



Assessing Environmental Sustainability and Market Potential of Jamdani Loom Industry: A Baseline Study in Rupganj and Sonargaon Upazilas, Narayanganj District

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Abstract

The loom industry, the largest and most significant cottage industry in Bangladesh, holds a venerable position in the country's cultural and economic landscape. Among its various products, Jamdani stands out as a symbol of national heritage and cultural continuity, unmatched globally. Originally flourishing in the Dhaka district, areas like Sonargaon, Dhamrai, and Rupganj were renowned for their muslin production. This study investigates the current state of the Jamdani sub-sector in Rupganj and Sonargaon upazilas, Narayanganj district, focusing on promoting Jamdani products for premium markets through environmentally sustainable practices. The study employs a comprehensive methodology including literature review, desk research, individual interviews with targeted stakeholders, Focus Group Discussions (FGDs) in the communities, and Key Informant Interviews (KIIs) in Rupganj and Sonargaon. Data was collected from 200 micro-entrepreneurs (MEs). Findings reveal that while both male and female workers participate in this sector, males dominate the workforce. Educational levels among workers are generally low. The primary air pollutants in the area include dust, CO, NO_x, SO_x, and VOCs, stemming mainly from brick industries, road dust, construction activities, chemical and food processing industries, and motor vehicle emissions. However, field observations indicate that the Jamdani MEs are not major contributors to air pollution. Notably, Sonargaon boasts better air quality compared to Rupganj. Noise pollution is generally not a significant issue, though some concerns were noted in Rupganj. A SWOT analysis highlights the Jamdani industry's considerable growth potential and its positive socio-economic impact. However, significant environmental and public health challenges persist, primarily due to the sector's neglect of environmental compliance and health safety standards. For the Jamdani industry to achieve sustainability and align with national and international policies, it must address these environmental and health concerns. Promoting Jamdani products in premium markets requires integrating environmentally friendly practices, ensuring the preservation of this cultural heritage while fostering economic growth.

Keywords: Jamdani products, Environmental practices, Weavers, Loom industry, Promotion, Craft

Background

The loom industry has been considered an ancient and the largest and most significant cottage industry in Bangladesh (Bangladesh Handloom Board, 2019). This industry possess a lot of prospects and is also responsible for a very high percentage of the nation's economy (World

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Bank, 2021). About more than 1.5 million people are involved in this industry directly or indirectly (Rahman M, 2013). It has also been considered the biggest handicrafts industry in Bangladesh. But compared to other handloom fabrics, jamdani is one of the most popular and top-selling handloom products since its origin. The loom industry is the second-highest source of rural employment after agriculture. Dhakai Jamdani or widely known as 'Jamdani', has been produced for centuries In Bangladesh. Jamdani is well known all over the world for its refined texture and delicate embroidery. Due to the geographical uniqueness of the Jamdani saree, it was included in GI (Geographical Indication) in 2016 (World Bank, 2021).

Originally, muslin flourished in Dhaka district. Sonargaon, Dhamrai and Rupganj in Dhaka were famous for muslin (Bangladesh Handloom Board, 2019). However, all the famous and unforgettable designs and weaves of Jamdani sarees are now almost extinct (Haque & Rahman, 2015). The present scenario of handloom weaving is disputed and the number of weavers of the industry is decreasing in an alarming rate as a lot of internal and external factors have a direct impact on the handloom industry of ours (Liton et.al., 2016). According to Sharmin and Hossain (2020), the study identified several causes contributing to the decline in the value of handloom products. These include a shortage of space for production and display, the absence of contemporary technology-based marketing strategies for increased production and advertising, a lack of preservation skills, and the artisans' limited direct access to local and international markets. Consequently, weavers are experiencing reduced profits, leading to a decline in interest among future generations to carry on the traditional craftsmanship of their ancestors.

Artisans can enhance their skills and become part of the community, so concessions should offer them essential amenities to cultivate a conducive learning atmosphere. Certain characteristics of this could encompass factors that will propel the growth of the industry (Hasan, 2021).

The baseline study was crafted with the overarching goal of conducting a thorough evaluation of the prevailing business, economic, and environmental circumstances within the micro-entrepreneurial landscape of the Jamdani weaving sector. It was meticulously structured to establish foundational data concerning a spectrum of pivotal variables such as sales, profitability, employment rates, asset generation, environmental implications, and health and safety standards across the spectrum of project participants. The insights garnered from this survey are poised to serve as a cornerstone for assessing the efficacy of endeavours directed towards the advancement of Jamdani products into premium markets, all while upholding stringent environmental standards and practices.

Selection of Sample Area

The selection of sample areas for the present study primarily focuses on 200 Jamdani loom Microentrepreneurs (MEs) situated in Rupganj and Sonargaon Upazilas within the Narayanganj District. Narayanganj District, renowned for its concentration of loom and handloom industries, serves as a hub for the production and circulation of Jamdani sarees throughout Bangladesh (Rabby M F, 2012). The historical significance of the loom industry in this region, coupled with numerous weaving families, underscores the rationale behind selecting these areas as sample locations.

Furthermore, these areas were chosen due to their proximity and easy accessibility from Dhaka city, facilitating logistical convenience for data collection and research activities. Therefore, the selection of Rupganj and Sonargaon Upazilas in the Narayanganj District as sample areas aligns with the study's objectives, providing a representative sample of Jamdani loom MEs while ensuring practicality in conducting the research.

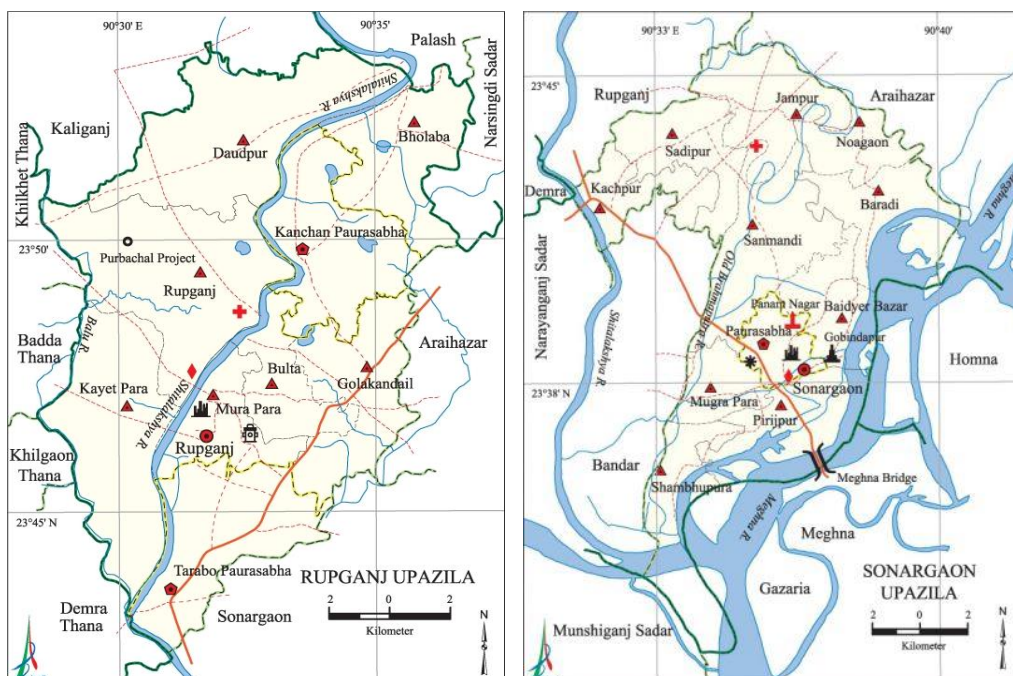


Figure 1: Location map of Rupganj Upazila and Sonargaon Upazila

Methodology

For this research, data was gathered from both primary and secondary sources. Primary data was collected through a questionnaire survey designed specifically for this study. The questionnaire was developed to gather insights from various stakeholders, including micro-enterprises (MEs), key individuals associated with the industry, and Jamdani users. Participants were asked to respond to the questionnaire, enabling us to obtain firsthand information directly related to the research objectives. Additionally, secondary sources such as literature reviews and existing studies were consulted to complement the primary data and provide further context to the research findings. This multi-faceted approach to data collection allowed for a comprehensive analysis of the Jamdani loom industry and its associated practices.

The detailed approach and methodology, as well as the work tasks, were depicted in the following flowchart (Figure 2).

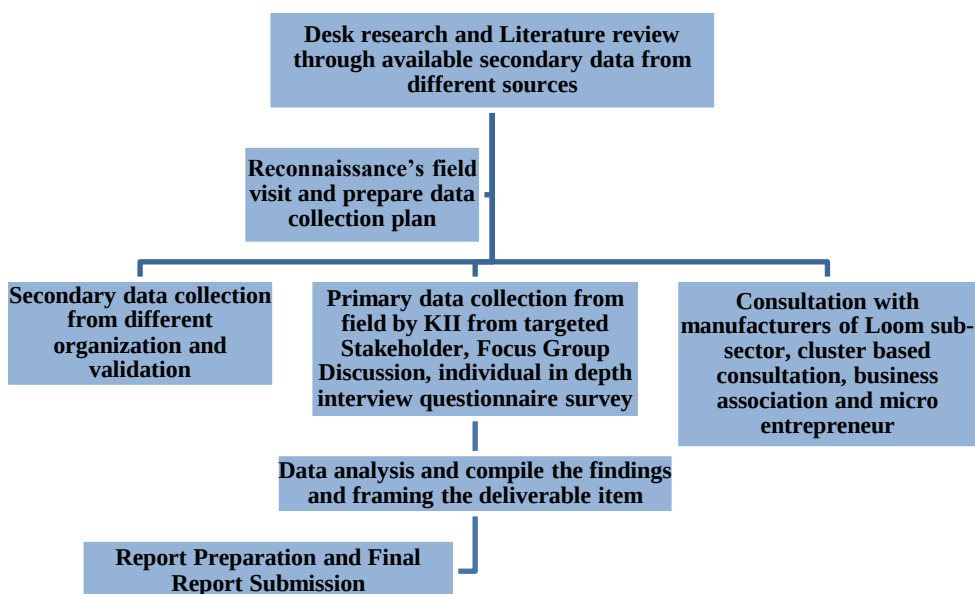


Figure 2: Showing flow chart of the study activity

Calculation of Sample Size: The minimum sample size was determined using the formula:

$$n = Z^2 \cdot p \cdot (1-p) / E^2$$

Where:

- n = sample size
- Z = Z-score corresponding to the desired confidence level (e.g., 95% confidence level)
- p = estimated proportion of the population with the characteristic of interest
- E = precision level (e.g., $\pm 5\%$)

Stratified sampling was employed under the probability sampling technique to collect questionnaire-based primary data for socio-economic analysis. The study areas (Upazila, Union, and Municipality) were stratified, and random sampling techniques were used to select loom micro-enterprises for the survey within each stratum.

Results and Discussion

To acquire fundamental insights into Micro-Enterprises (MEs) involved in loom Jamdani manufacturing and related business sectors, a baseline study was undertaken in the locales of Rupganj and Sonargaon Upazilas, situated within the Narayanganj District of Bangladesh.

The study focused on gathering essential information, encompassing the following key aspects:

Number of MEs age of experience and growth rate in loom jamdani business

The study surveyed 200 Micro-Enterprises (MEs) engaged in Jamdani product manufacturing within specific business clusters, but it did not encompass the entirety of similar businesses operating in and around the study area. Notably, the largest cluster of such enterprises is situated in Rupganj and Sonargaon Upazilas of Narayanganj district. According to the responses from MEs, approximately 750 small and medium-sized enterprises are active in Rupganj, while Sonargaon boasts a higher concentration, with an estimated 1600 MEs. It's worth mentioning that this business activity predominantly occurs within residential areas, primarily within the premises of individual ME houses, as outlined in Table 1.

Table-1: shows the number of MEs related to Loom Jamdani

Number of Surveyed MEs (Micro-enterprises) related to Loom- Jamdani			
	Rupganj Upazila	Sonargaon Upazila	Total
Number of Jamdani MEs (approx.)	750	1600	2350
Number of Studied MEs	74	126	200

Human Resources Engagement

In the surveyed Loom Jamdani enterprises, totaling 200, a workforce of 1401 employees were identified, comprising both male and female workers, with males being the predominant group. The participation rates were reported as 71.22% for male workers and 27.23% for female workers. Additionally, findings from the field survey revealed that 86.5% of respondents, equivalent to 173 MEs, acknowledged employing child workers in their enterprises. This indicates a substantial presence of child labor in the subsector, constituting approximately 24.7% of the total workforce.

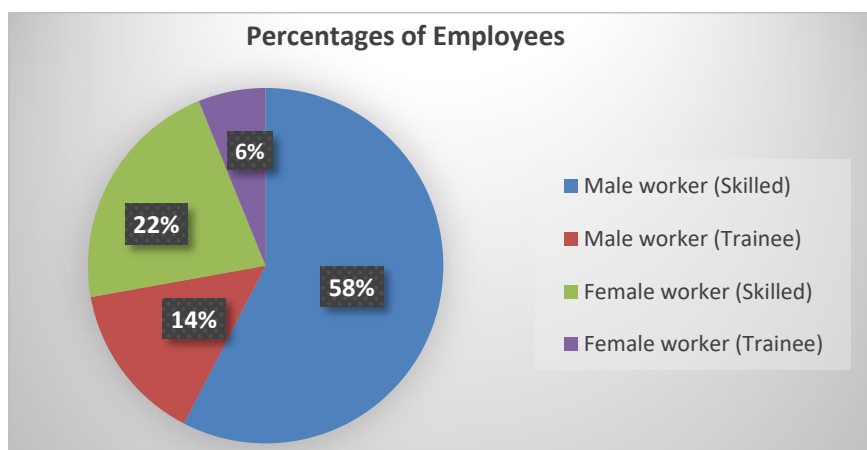


Figure 3: Types of employees as per gender

Educational Qualification of Micro-enterprises:

Table 2 illustrates the educational qualifications and training status of micro-entrepreneurs (MEs) in the surveyed area. It reveals a varied educational background among MEs, with 12% being uneducated, 28% able to sign or write, 43% having completed primary education, and 16% having attained education up to high school or Madrasa level. Only a small fraction had advanced educational qualifications, with negligible representation at the SSC level or higher. Additionally, the table highlights the prevalence of business-related training opportunities, as 78% of MEs reported access to training facilities, particularly for loom operation and capacity building, while 66.5% received skill development-related training. Almost all MEs, accounting for 98.5%, had undergone training specifically related to loom operation. These findings emphasize both the educational diversity within the ME community and the concerted efforts to provide training for skill enhancement, particularly in the context of the loom industry.

Table 2: Survey result of Educational Qualification and Training of Micro-entrepreneurs

Level of Education	MEs respondent	
	Population (N)	Percentage (%)
Uneducated	24	12
Able to sign/write	56	28
Primary	86	43
High School/Madrasa	32	16
SSC Pass/Vocational	2	1
HSC Pass	0	0
Degree	0	0
Graduate	0	0
Business-related Training information		
Having the facility of Training (Loom operation and capacity building)	156	78
Skill Development related training received	133	66.5
Loom operation related training received	197	98.5

Type of Business Structures

Based on the survey responses, three types of infrastructures were identified among the surveyed micro enterprises (MEs): Tin-shed, Semi Pucca (tin shed brick building), and Paka (Brick or RCC building structure).

The most common type of structure in the Sonargaon area was Tin-shed houses, accounting for 52.5% of the respondents. In contrast, Semi Pucca structures were more prevalent in the Rupganj area, with approximately 38.5% of MEs residing in such buildings. Only a small proportion, around 9% of MEs, reported living in Buildings (Brick or RCC building structures).

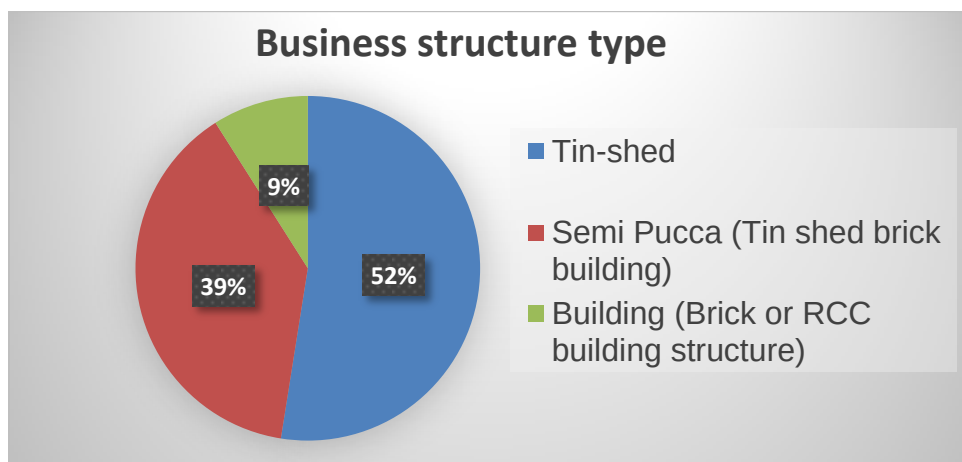


Figure 4: Business structure type in the study area

Business or factory Ownership of MEs

Based on the survey results, three distinct types of business ownership models were identified: rental business units, self-owned business units, and shared ownership.

Among the 200 surveyed micro enterprises (MEs), the majority (86%) established their factories on owned properties, indicating self-owned business units. A smaller percentage of MEs (5.5%) opted for establishing their factories or business units in rental spaces, indicating rental business units. Additionally, 9.5% of the surveyed MEs reported shared ownership, suggesting that multiple individuals or entities collectively owned these business units.

Table 3: Survey result of business or factory of MEs Ownership

Type of infrastructure	MEs respondent	
	Population (N)	Percentage
Self-owned business unit	172	86
Rental business unit	11	5.5
Joined ownership	17	9.5

Product types and quantity

From the survey conducted among 200 micro enterprises (MEs), it was found that the majority, comprising 197 MEs, were engaged in the production of Jamdani Sharees. The production quantity varied from 2 to 44 Sharees per month per ME, depending on factors such as design complexity and labor availability. On average, each ME produced approximately 12.37 Jamdani Sharees per month.

Additionally, two Jamdani Sharee business owners reported selling 85 pieces of Sharees monthly in their retail shops. Furthermore, one surveyed ME was involved in dyeing 200 kg of yarn every month.

The study revealed that the production distribution among the MEs was as follows: the majority (97 MEs) produced 1-10 Sharees per month, followed by 78 MEs producing 11-20 Sharees per month. Only a small number of MEs (7) produced more than 40 Sharees per month.

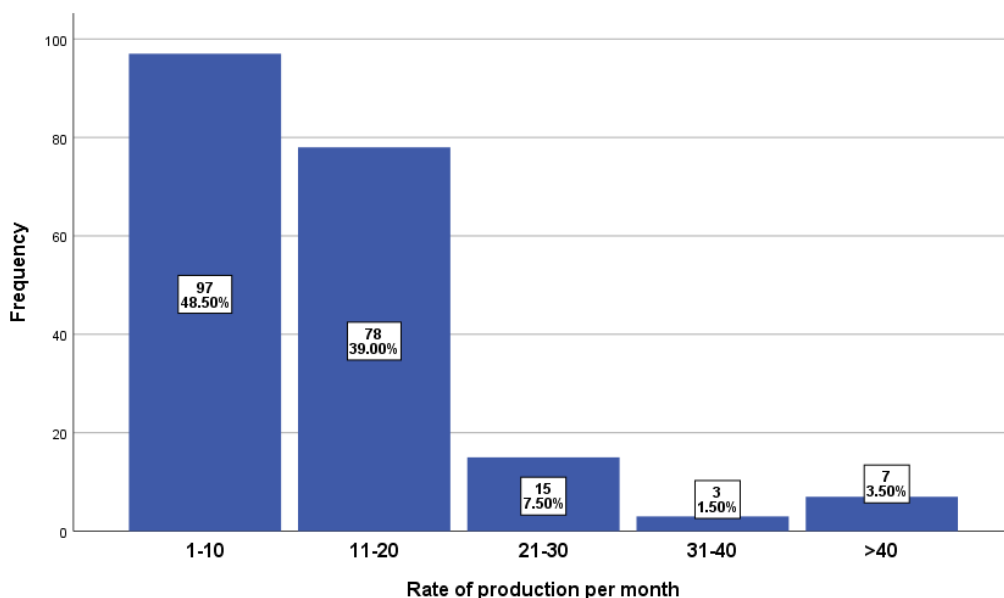


Figure 5: Rate of production per month

Common Support Services:

According to FGD survey result, common support service is not available in the study area, most of the MEs are doing their business individually in isolated place or houses. But they have demand to provide product design center, worker training center for skilled development or for awareness building on HSE, health care center, safe storage or warehouse, product display and trade center, public toilet, modern fire safety system with nearby fire station etc.

Environmental condition of the study area

Soil Condition: The study area comprises two main soil types according to the soil map of Bangladesh (SRDI): Deep Red Brown Terrace soils and Noncalcareous Grey Floodplain Soils (non-saline).

Deep Red Brown Terrace soils occur extensively in the northeastern Barind Tract, on the Madhupur Tract and on the Akhaura Terrace. These soils are well to moderately well drained, reddish brown to yellow-brown, strongly to extremely acidic, friable clay soils over deeply weathered, red-mottled, Madhupur Clay. They are mainly Ferric Alisols.

Non-calcareous Grey Floodplain soils Generally comprise a grey topsoil and a cambic B-horizon in the subsoil with a grey matrix or grey gleans. They extensively occupy Tista,

Karatoya-Bangali, Jamuna, middle Meghna, and eastern Surma-Kushiyara floodplains. However, there are considerable regional differences in the proportions occupied by individual soil textures. Silt loam texture is dominant in the Tista meander floodplain whereas silty clays are predominant in the Ganges tidal floodplain and in the Surma-Kushiyara floodplain. But the Jamuna floodplain has a more even distribution of silt loam, silty clay loam and silty clays. Most of these soils have been included in Eutric Gleysols.

Water Quality: Water quality, both surface and groundwater sources, has deteriorated due to various natural and man-made factors. Tube wells are the primary source of drinking water (94.29%), with arsenic detected in shallow tube well water in Sonargaon. While micro-enterprises (MEs) mostly use groundwater for domestic purposes, they do not produce effluents in their business related to loom production.

Air Quality: MEs in the Rupganj area have expressed concerns about air quality, attributed to various industrial activities. Main air pollutants include dust, CO, NO_x, SO_x, and VOCs, originating from brick industries, road and construction dust, and motor vehicle emissions. Weaving processes in loom production also contribute small particulate matter, posing health risks to workers. Mitigation measures such as ventilation systems and personal protective equipment (PPE) are recommended.

Noise Pollution: Noise pollution is a significant concern reported by MEs in Rupganj due to machinery and loudspeaker noise. Average noise levels range from 70 to 75 decibels near sources, posing occupational health hazards. Awareness and measures to mitigate noise pollution are lacking among MEs.

Waste and Waste Management:

Liquid waste and its management:

Micro-enterprises (MEs) primarily utilize groundwater for domestic purposes, with wastewater being directly discharged into the open environment through drains. In the production processes of Jamdani sarees, water is predominantly used for yarn dyeing, leading to the production of effluent. Among the surveyed MEs, 5% are involved in yarn dyeing, generating a substantial amount of effluent. Particularly in the BISIC area of Rupganj, 10 respondents were identified as producers of effluent, discharging significant quantities into nearby drains without treatment. This untreated wastewater ultimately flows into nearby open water bodies, exacerbating water pollution.

On average, MEs discharge approximately 97.5 tons of liquid waste per month, equating to a minimum of 9,750 liters of effluent per ME. The disposal of such large volumes of effluent into the environment occurs with minimal concern for environmental impact. Furthermore, there is a notable absence of effluent treatment plants (ETPs) at both individual and community levels, indicating a lack of measures to mitigate water pollution at the source.

These findings underscore the urgent need for interventions to address the issue of wastewater management within the Jamdani loom industry. Efforts towards the implementation of effective wastewater treatment technologies and regulatory frameworks are imperative to mitigate the adverse environmental consequences of untreated effluent discharge.

Solid waste and its management:

From field observations and survey results, it was found that 100% of micro-enterprises (MEs) in this sector generate solid waste, primarily consisting of yarn wastage. The solid waste generated during the production process of Sharee is predominantly non-recyclable yarn, which is disposed of in nearby garbage places or incinerated using stoves, often during cooking activities. Specifically, out of 200 MEs surveyed, 157 reported disposing of solid waste in the open environment.

Moreover, it was observed that only 5.5% of MEs have organized dedicated waste bins or pits available in their factories or business premises, while the majority of MEs dispose of their waste haphazardly into the environment. In terms of cleaning practices, only 12.5% of MEs claimed to clean or sweep their factories or business premises daily, with 84.5% opting for weekly cleaning, and a small percentage conducting cleaning every three days.

These findings highlight the prevalent challenges regarding solid waste management practices among MEs in the Jamdani loom industry. Efforts to improve waste disposal methods and promote regular cleaning practices are essential to mitigate environmental pollution and enhance sustainability within the sector.

Table 4: Survey results on Waste and Waste management

Item or activity	Respondent of MEs	
	Number	%
Effluent or Liquid waste	10	5
Average amount of liquid waste by MEs	97.5 Ton/month	
Information on Solid waste		
Solid waste available	200	100
Recyclable solid waste	0	0
Non-recyclable solid waste	200	100
Dedicated waste Bin/bag available	11	5.5
Collected solid waste is incinerated	43	100
Collected solid waste dispose in the open environment	157	78.5
Information about cleaning practices		
Cleaning/swiping activities of the factory in daily practice	25	12.5
Cleaning/swiping activities of the factory in weekly practice	169	84.5
Cleaning/swiping activities of the factory in three days interval cleaning	6	3

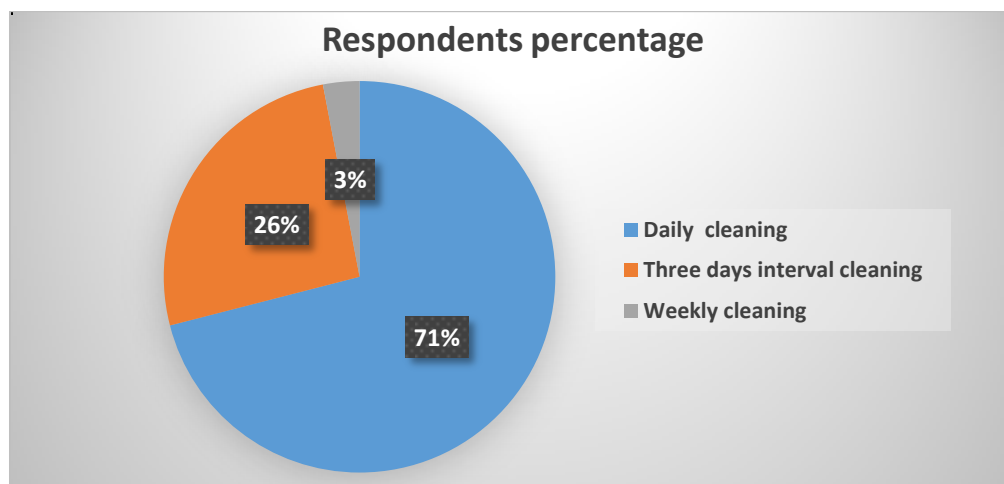


Figure 6: MEs percentage in cleaning their business area.

Key Challenges of the Business

According to the study, the Jamdani weaving sector faces numerous challenges, which can be categorised into three main areas: financial/economic, technological, social, and environmental. These challenges are summarised as follows:

Financial/Economic Challenges:

- The micro-entrepreneurs (MEs) lack sufficient capital to expand their business operations.
- Many respondents highlighted the issue of low loan amounts coupled with high interest rates, which are not conducive to large-scale or long-term investments.

Technological Challenges:

- There is a significant shortage of educated and technically skilled workers with modern knowledge.
- The unavailability of new product designs hinders innovation within the industry.

Social and Environmental Challenges:

- Maintaining environmental compliance to ensure a pollution-free environment remains a significant hurdle.
- The sector faces intense market competition from low-cost, machine-made Jamdani products.
- There is an increasing tendency among MEs to shift to other businesses, such as grocery shops or transport services, due to the lack of trained apprentices known as "Sagret."

- Legal regulations regarding business operations and environmental standards impose additional constraints.
- The business areas are often inadequate to accommodate all MEs, leading to congested and unhygienic conditions that can exacerbate health issues such as mosquito and flea infestations.
- Many MEs operate their factories in residential areas, which is illegal and leads to conflicts with local government authorities and law enforcement agencies.

SWOT Analysis

Strengths

Strategic Location: The proximity of the Jamdani weaving sites to the Dhaka city bypass, particularly in the Narayanganj area, provides easy accessibility and logistical advantages for production and distribution.

Cultural Significance: Jamdani weaving holds a significant place in the cultural heritage of Bangladesh, contributing to its rich textile tradition.

Innovative Potential: The presence of water bodies near the weaving sites fosters creativity and innovation in the production process, allowing for the development of new ideas and techniques.

Weaknesses

Lack of Urban Infrastructure: Despite being located in a township, the Jamdani weaving areas lack sufficient urban amenities and features, which hinders the overall quality of life for residents and workers.

Industrial Environment: The industrial surroundings around the weaving sites pose challenges in achieving architectural goals and maintaining aesthetic appeal, potentially impacting the attractiveness of the area.

Opportunities

Market Expansion: With growing global interest in sustainable and artisanal products, there is an opportunity to position Jamdani products in premium markets both domestically and internationally, leveraging its cultural significance and craftsmanship.

Innovation and Modernization: There is potential for innovation and modernization in the Jamdani loom industry, incorporating sustainable practices and adopting new technologies to enhance productivity and product quality.

Strategic Location: Located in a recently developed and sparsely populated area, the site possesses the capacity to manage the expansion of metropolitan areas, representing a novel perspective (Tsang-De Lyster, 2021).

Threats

Environmental Degradation: The industrial activities surrounding the weaving sites may contribute to environmental degradation, posing threats to the ecosystem and sustainability of the area.

Competition from Mass Production: Increased competition from mass-produced textiles may pose a threat to the market demand for Jamdani products, especially if not adequately differentiated or positioned in the market.

This SWOT analysis highlights the strengths, weaknesses, opportunities, and threats facing the Jamdani loom industry in Rupganj and Sonargaon Upazilas, Narayanganj District, providing insights into its environmental sustainability and market potential.

Conclusions & Recommendations

Conclusions

The present study underscores the significance of the Jamdani loom industry as a major cottage industry in Bangladesh with substantial future prospects for the nation's economy. The Loom-Jamdani manufacturing enterprises, a traditional sector among marginalized populations, have a rich history and play a crucial role in the economy and society by creating jobs and producing esteemed female attire. The study focuses on the largest clusters located in Rupganj and Sonargaon Upazilas in the Narayanganj district, where numerous small and medium-sized micro-entrepreneurs (MEs) operate.

Jamdani manufacturing activities are situated in both urban and rural areas of mixed land use. The workforce comprises both male and female workers, with males dominating the sector. Notably, child labor is prevalent, accounting for approximately 24.7% of the total workforce. While ME owners are not highly educated, they possess basic literacy skills. Workers have not received formal training but have acquired their expertise informally from previous generations. Environmentally, the Jamdani subsector is less harmful compared to other textile industries. Water is not used extensively in production, except for yarn dyeing. However, ten MEs produce 97.5 tons of effluent per month, with 5% of yarn dyers in Rupganj's BSCIC area discharging untreated effluent into the environment. Solid waste generated is primarily non-recyclable yarn, disposed of in nearby garbage sites or incinerated. Only 5.5% of MEs have organized waste disposal systems, with the majority disposing of waste haphazardly. The subsector does not produce significant noise or air pollutants, except for Suspended Particulate Matter (SPM) as an indoor air pollutant. These environmental challenges are manageable with proper mitigation measures.

The study reveals a lack of adequate common support services, with most MEs operating individually. MEs have expressed a need for collective waste management systems, effluent treatment plants, product design centers, worker training centers for skill development and HSE awareness, healthcare centers, safe storage facilities, product display and trade centers, daycare centers, public toilets, modern fire safety systems, and nearby fire stations. Financially, MEs face significant challenges in operating their businesses. They are gradually losing working capital and skilled workers, leading to difficulties in repaying loans on time.

The SWOT analysis indicates that while the Jamdani business has significant growth potential and a positive socio-economic impact, it faces considerable environmental and public health drawbacks. The industry largely ignores environmental and health safety compliance, which undermines its sustainability according to national and international standards.

In conclusion, the Jamdani subsector requires support from international donors, development partners, local governments, NGOs, private organizations, and financial institutions for sustainable development and business enhancement. Addressing these challenges through coordinated efforts will ensure the longevity and prosperity of this culturally significant industry.

Recommendations

Environmental and Technological Interventions:

- **Regulatory Compliance:** Enforce standard protocols related to factory environmental management systems and occupational health and safety management to ensure Micro-Entrepreneurs (MEs) adhere to environmental standards and provide safe working conditions.
- **Digital Design System:** Implement digital design systems to facilitate innovative designs and enhance the competitiveness of MEs in the market.

Improving Brand of the MEs:

- **Collaborative Partnerships:** Foster partnerships with design centers, major brands/buying houses, universities for research and development (R&D), importers, testing laboratories, third-party audit firms, business associations, Department of Environment (DoE), City Corporations or Municipalities, and audit firms (quality, environmental, and social) to enhance the brand image of MEs.
- **Product Certifications:** Obtain product certifications as per market requirements to improve market access and credibility.

Good Practices of MEs:

- **Ventilation Systems:** Introduce exhaust ventilation systems or local ventilation systems in factories to mitigate indoor air pollution and improve air quality for workers.
- **Waste Management:** Implement waste management systems based on the principles of recycling, reusing, and reducing. MEs should transition from chemical dyes to natural dyes, repurpose waste materials (such as cutting threads) for other productions, and utilize water from liquid waste through Effluent Treatment Plants (ETPs).
- **Worker Safety:** Ensure worker safety by providing protective gear (such as aprons and masks) and maintaining hygienic working environments, including clean and accessible toilets and first aid facilities.

- **Fire Safety:** Regularly monitor and maintain fire safety protocols and equipment, conduct periodic firefighting drills, and ensure routine maintenance of electrical and mechanical equipment to minimize fire hazards and noise levels.
- **Workplace Safety Measures:** Implement safety measures such as temperature indicators, humidity measurement devices, fire detectors with alarm systems, fire extinguishers, etc., to create a safe working environment for all personnel.
- **Awareness Programs:** Conduct regular awareness programs on occupational health and safety, proper use of Personal Protective Equipment (PPEs), first aid procedures, building safety, fire safety, and firefighting protocols to promote a culture of safety within MEs.

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