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Sustainability Strategies and Women's Empowerment in Sidingkat Weaving: Economic, Social, and Environmental Impacts Analysis

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Abstract—This study aims to analyze the economic, social, and environmental impacts of the Sidingkat weaving business run by female artisans in Sidingkat Village, Padang Lawas Utara Regency. Additionally, this research formulates strategies that can support the sustainability of the weaving business and enhance the empowerment of women within the local community. The study employs a qualitative case study approach with data analysis following Miles et al.'s (2018) model through four stages: data collection, data reduction, data presentation, and conclusion drawing. Data were collected through in-depth interviews using structured questionnaires, direct field observations using observation checklists, and documentation review. The research involved 11 female weavers (100% of active weavers in the village), key stakeholders including local government officials and weaving entrepreneurs, and 30 customers of woven products. The findings show that 81.8% of weavers rely on the business as their primary income source, with 72.7% reporting increased income since joining. In terms of social impact, 100% of weavers experienced increased community recognition, and 81.8% reported greater social involvement. Regarding environmental practices, 63.6% of weavers have adopted eco-friendly materials, while 54.5% implement proper waste management. Customer satisfaction data reveals that 40% rate product quality as excellent, though only 33.3% consider the designs unique. Based on the analysis, several sustainability strategies are proposed, with 100% of weavers identifying access to capital as crucial, 81.8% emphasizing product innovation, and 63.6% highlighting the need for skills training. The study concludes that the Sidingkat weaving business has substantial growth potential if supported by appropriate policies and community backing, while contributing to women's empowerment and SME development in the traditional craft sector.

Keywords: Sustainability of the Business; Women's Empowerment; Sidingkat Weaving, Economic Impact; Development Strategy, SMEs.

1. INTRODUCTION

The traditional weaving industry is an integral part of Indonesia's cultural heritage and plays a crucial role in supporting local economies across various regions. In many areas, weaving serves not only as a cultural product but also as the primary source of income for the artisans' families. A prominent example is Sidingkat Village in the Padang Lawas Utara Regency (Paluta), where 11 female weavers sustain the local economy, relying on weaving as their primary livelihood. Sidingkat weaving is distinguished by its unique color choices and patterns, particularly its signature green color which symbolizes fertility and holds spiritual significance in Islamic culture (Indrarini, 2011). However, despite its cultural richness, the industry faces significant challenges in marketing and product competitiveness. Interviews with local weavers revealed that although Sidingkat woven products have been showcased at the North Sumatra Fair (PRSU), they have not yet attracted significant consumer demand (Ulfa, br Sinulingga, & Sinulingga, 2023)

Recent studies have explored various aspects of traditional weaving and women's empowerment in Indonesia, revealing both opportunities and challenges in this sector. Bondyra et al. (2023) examined women's entrepreneurship in rural craft industries, finding that traditional crafts contribute significantly to women's economic independence, though market access remains a persistent challenge. In a similar vein (Habib & Sutopo, 2024; Surbakti, Hasibuan, & Arjuna, 2024; Winarsih, Adipurwa, Puspitasari, Harmono, & Astrada, 2024) studied women-led SMEs in tourist areas, revealing that while digital marketing enhanced business growth, many craftswomen still lack adequate training in business management and marketing skills. Research by Winarsih et al. (2024) on women's MSME education programs highlighted the importance of comprehensive management training, though their study focused primarily on urban areas.

The complexity of challenges facing traditional textile crafts has been well-documented in recent literature. Zebua et al. (2024) analyzed product innovation and marketing strategies in local industries, finding that while product innovation significantly impacts consumer purchasing decisions, many traditional craft businesses struggle to balance innovation with cultural preservation. This challenge is further complicated by limited access to capital, as demonstrated by (Surbakti et al., 2024), who found that while structured training programs improved business performance by 45%, financial constraints continued to impede growth. The challenges extend beyond economic factors to include limited access to skill development opportunities and environmental concerns regarding production practices. The traditional techniques often employ materials that may harm the environment, necessitating improvements in sustainable production methods (Rahaman, Pranta, Repon, Ahmed, & Islam, 2024).



The environmental sustainability of traditional crafts has also emerged as a crucial concern in recent literature. Rahaman et al. (2024) conducted a comprehensive study of green production practices in textile industries, finding that traditional artisans often face significant barriers in adopting eco-friendly materials due to cost and availability issues. This aligns with research by Bakri and Hasyim (2024), who discovered that while 78% of traditional craft producers expressed interest in sustainable practices, only 23% had successfully implemented them due to financial constraints. In the Sidingkat weaving, addressing these environmental challenges while maintaining economic viability becomes particularly important.

The role of women in traditional craft industries has gained increased attention in recent development studies. Mardikaningsih and Darmawan (2023) examined the relationship between women's empowerment and business innovation, finding that enterprises led by women were more likely to maintain cultural authenticity while adapting to market demands. This finding is particularly relevant for the Sidingkat weaving community, where women are the primary custodians of both technical skills and cultural knowledge. Supporting research by Tambunan et al. (2022) revealed that women-led traditional businesses showed greater resilience during economic downturns, primarily due to their strong community networks and adaptive management strategies.

The intersection of cultural preservation and economic development presents unique challenges and opportunities. Liantifa (2023)'s research similarly found that business capital significantly contributes to the growth of UMKM Batik Tulis Giriloya. Similarly, research by (Alichia, Khoirunnisa, Al-Madani, Hidayat, & Ikaningtyas, 2024; Mardikaningsih & Darmawan, 2023) demonstrated that consumers are increasingly willing to pay premium prices for traditional crafts that maintain authentic cultural elements while meeting contemporary quality standards.

Global market trends also indicate growing opportunities for traditional craft industries. According to recent studies by Zebua et al. (2024) point out, accessing these markets requires significant improvements in product quality, standardization, and marketing capabilities - areas where many traditional craft communities, including Sidingkat weavers, still need substantial support. The theoretical framework for this research draws on recent developments in sustainable development studies. Surbakti et al. (2024) propose an integrated approach to traditional craft development that considers economic viability, social equity, and environmental sustainability as equally important components. This framework aligns well with the objectives of the current study and provides a structured approach for analyzing the complex challenges facing the Sidingkat weaving community.

A notable research gap exists in understanding the holistic impact of traditional weaving businesses on women artisans' lives. While previous studies have examined either economic aspects or social empowerment (Prasetyo, 2023), few have investigated the intersection of economic, social, and environmental impacts within the same community. Additionally, existing research has not adequately addressed how traditional weaving businesses can adapt sustainable practices while maintaining cultural authenticity and economic viability.

This research therefore aims to conduct a comprehensive analysis of the economic, social, and environmental impacts of the Sidingkat weaving business on female artisans and their community. It seeks to identify specific challenges in maintaining business sustainability while preserving cultural heritage, particularly focusing on the unique characteristics of Sidingkat weaving. Furthermore, the study aims to formulate evidence-based strategies for empowering female weavers through skill enhancement, market access expansion, and sustainable production practices. These objectives align with several Sustainable Development Goals (SDGs), including gender equality (SDG 5), decent work and economic growth (SDG 8), and responsible consumption and production (SDG 12), making this research particularly relevant to both local development and global sustainability initiatives.

2. RESEARCH METHODS

This research adopts a qualitative approach based on the model developed by Miles et al. (2018) to analyze the economic, social, and environmental impacts of the Sidingkat weaving industry, operated by female artisans in Sidingkat Village, Padang Lawas Utara Regency. A qualitative approach was chosen to delve into and understand the meanings, experiences, and perspectives of the artisans and other related parties. The research involves 11 female weavers and other key informants, including weaving entrepreneurs and 30 customers of woven products.

This study examines three main variables in analyzing the impact of the Sidingkat weaving business: economic impact, social impact, and environmental impact, along with business sustainability as a supporting variable. Each variable has been operationally defined with specific measurable indicators to ensure systematic data collection and analysis, following the framework developed by Surbakti et al. (2024) for analyzing traditional craft enterprises.

The economic impact is operationalized as measurable changes in financial conditions and economic well-being of female weavers and their families resulting from participation in the weaving business. Drawing from research by Tambunan et al. (2022) on small enterprise development, this includes tracking monthly income increases, evaluating the contribution of weaving income to total family income, assessing economic stability through the ability to meet daily needs, measuring business growth through changes in production volume and sales, and analyzing marketing performance through market reach and customer base expansion.

Social impact is defined operationally as the changes in social status, community engagement, and family dynamics experienced by female weavers due to their involvement in the weaving business. Following the social impact assessment framework proposed by Winarsih et al. (2024), this encompasses multiple dimensions: the level of



recognition and respect received from the community, the extent of participation in community activities, changes in family decision-making roles, access to and participation in empowerment programs, and the development of both business and social networks within and beyond the community.

Environmental impact focuses on the effects of weaving production practices on environmental sustainability and the adoption of eco-friendly methods. Based on recent research by Rahaman et al. (2024) on sustainable textile production, the operational measurement includes analyzing the types and percentages of eco-friendly materials used in production, evaluating waste management practices, assessing environmental awareness among weavers, documenting sustainable production initiatives, and measuring resource efficiency in the production process.

Business sustainability, as a supporting variable, is operationalized following the framework developed by Mardikaningsih & Darmawan (2023) as the capacity of the weaving business to maintain operations while balancing economic viability, social responsibility, and environmental protection. This includes examining business continuity strategies, evaluating innovation practices in product development and marketing (Zebua et al., 2024), assessing market adaptation capabilities, measuring technology adoption rates, and analyzing access to various resources and support systems.

These operational definitions guide the development of research instruments, including interview guides, questionnaires, and observation checklists, following methodological approaches validated by Puspatriani, Budiman, & Rahman (2022) in their study of traditional craft enterprises. The definitions also inform the data analysis process, providing clear parameters for evaluating the impacts and relationships between variables in the Sidingkat weaving business (Yansahrita, Fauzi, & Irviani, 2023).

The data collection techniques in this study were carried out using several methods. In-depth interviews were conducted with female weavers to gather detailed information about their experiences in the weaving industry, including the challenges and opportunities they encountered. These interviews were designed to capture the qualitative perspectives of the artisans. Direct observations were also conducted at the weaving sites, allowing the researcher to observe the production process, social interactions among the weavers, and the environmental conditions related to the industry. In addition to these methods, relevant documents such as production records and reports on weaving industry activities were collected to further support and complement the data gathered from interviews and observations.

The study utilized various instruments to gather data from different perspectives, including weavers, entrepreneurs, and customers. The following tables outline the data collection instruments used:

Table 1. Interview Instrument for Weaving Entrepreneurs

No	Aspect	Indicator	Number of Questions
1	Business Background	Reasons for starting the business, Business duration, Vision	3
2	Economic Impact	Contribution to personal economy, Business growth, Economic stability, Marketing challenges	4
3	Social Impact	Community relations, Role of women, Empowerment programs	3
4	Environmental Impact	Efforts to protect the environment, Use of eco-friendly materials, Initiatives to reduce environmental impact	3
5	Sustainability Strategy	Strategies for sustainability, Challenges, Development plans, Role of technology	4
6	Women's Empowerment	Women's role in the business, Empowerment programs, Contribution to women's well-being	3
7	Stakeholder Involvement	Involvement of external parties (government, NGOs, community), Support from government/organizations, Collaboration with institutions	3
8	Challenges and Solutions	Major challenges, Problem-solving methods, Support needed for small businesses	3
Total Questions			26

Table 2. Questionnaire Instrument for Female Weavers

No	Aspect	Indicator	Number of Questions
1	Demographic Information	Age, Education level, Participation duration, Family economic status	4
2	Economic Impact	Income increase, Contribution to family income, Meeting daily needs, Income stability	4
3	Social Impact	Social engagement in the community, Role in the family, Community recognition, Empowerment programs	4



No	Aspect	Indicator	Number of Questions
4	Environmental Impact	Production's environmental impact, Use of eco-friendly materials, Awareness of sustainable practices, Waste reduction initiatives	4
5	Sustainability & Empowerment	Challenges in the business, Sustainability strategies, Role of government/organizations, Women's empowerment	4
6	In-depth Interviews	Business history, Benefits of involvement, Impact on family and community, Sustainability strategies, Eco-friendly practices	5
7	Observation Checklist	Production processes, Environmental conditions, Social interactions, Facilities and infrastructure, Environmental initiatives	5
Total Questions			30

Table 3. Survey Instrument for Weaving Customers

No	Aspect	Indicator	Number of Questions
1	Demographic Information	Age, Gender, Occupation, Monthly income	4
2	Purchase Experience	Purchase frequency, Information source, Primary reason for purchase, Type of woven product purchased	4
3	Customer Satisfaction	Evaluation of product quality, design, price, and service	4
4	Preferences & Suggestions	Repurchase intentions, Factors increasing interest, Product suitability for foreign markets, Suggestions for improvement	4
Total Questions			16

The data analysis in this study follows the qualitative model developed by Miles et al., (2018), which involves four main stages. The first stage, data collection, involves gathering information through interviews, observations, and documentation. All relevant field data is processed and stored for further analysis. In the second stage, data reduction, the researcher simplifies, focuses, and selects the most relevant data that aligns with the research objectives. This step is crucial in summarizing essential information from the raw field data. The third stage is data presentation, where the reduced data is organized into structured formats such as matrices, flowcharts, or narratives, allowing the researcher to understand relationships between variables and to draw conclusions. Finally, in the conclusion drawing and verification stage, the researcher interprets the presented data, formulating tentative conclusions based on emerging patterns and themes. These conclusions are verified through data triangulation or by revisiting the field to ensure their validity and reliability.

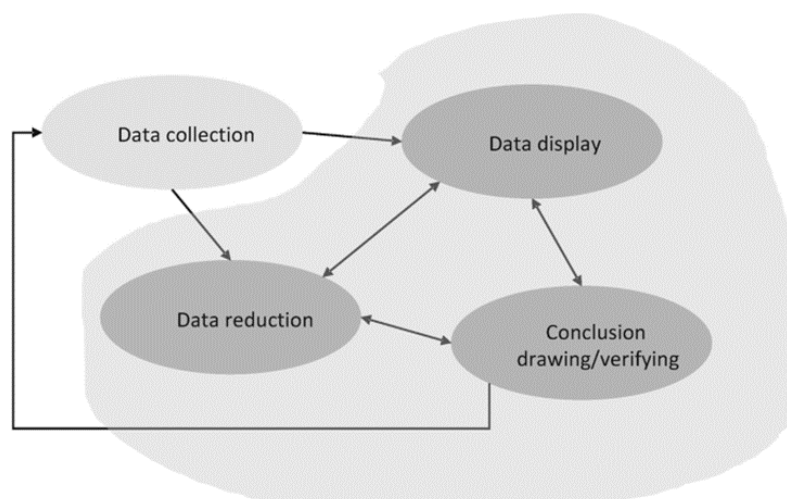


Figure 1. Huberman and Miles' model of qualitative data analysis (in Recker, 2021)

3. RESULTS AND DISCUSSION

3.1 Economic Impact of the Sidingkat Weaving Business

The Sidingkat weaving business plays a significant role in improving the economic well-being of the female artisans in Desa Sidingkat. Based on the results of a questionnaire conducted with 11 female weavers, the business serves as the primary source of income for the majority of the artisans and their families.



Table 4. Economic Impact of the Sidingkat Weaving Business

No	Economic Indicator	Number of Respondents (Yes)	Percentage (%)
1	Increased income	8	72.7%
2	Weaving as the main source of income	9	81.8%
3	Weaving helps meet daily needs	11	100%

From Table 4, it is shown that 81.8% of the female artisans stated that the weaving business is their family's main source of income, while 72.7% reported that their income has increased since joining the business. Additionally, all respondents (100%) acknowledged that the weaving business helps meet their families' daily needs. However, since the onset of the Covid-19 pandemic, production has decreased from an average of 100-120 woven cloths per month to a lower number. Interviews with weaving entrepreneurs further highlighted that this business provides economic stability for the artisans and their families, helping them meet their basic daily needs.

3.2 Social Impact of the Sidingkat Weaving Business

The activities of the Sidingkat weaving business not only have economic implications but also play a crucial role in enhancing the social engagement of female artisans within the local community. Through their involvement in the production and marketing of woven fabrics, the women of Desa Sidingkat gain not only income but also an elevated status and more active participation in social and family life.

Table 5. Social Impact of the Sidingkat Weaving Business

No	Social Indicator	Number of Respondents (Yes)	Percentage (%)
1	Increased social involvement	9	81.8%
2	Increased recognition in the community	11	100%
3	Increased role in the family	8	72.7%

Based on the questionnaire results in Table 5, 100% of the female weavers felt that their involvement in the weaving business had increased the recognition they received from the community. This indicates that the weaving business not only provides economic benefits but also helps improve the social status of women in the village. Additionally, 81.8% of respondents stated that their participation in the business expanded their social engagement within the community, including through collaboration with the youth in various activities that support the sustainability of the business. Moreover, 72.7% of the weavers felt that their role within the family had increased, especially in decision-making related to household economics.

Interviews with weaving entrepreneurs also highlighted collaboration with the youth to support the sustainability of the business, strengthening social ties within the local community.

3.3 Environmental Impact of the Sidingkat Weaving Production Process

The environmental impact of the Sidingkat weaving production process has gained attention, particularly regarding the use of eco-friendly materials and waste management. The weaving process is traditionally conducted with minimal modern technology, but as awareness of environmental issues increases, most artisans have started to adopt more eco-friendly materials, although they still face challenges in fully implementing these practices.

Table 6. Environmental Impact of the Sidingkat Weaving Business

No	Eco-Friendly Practice	Number of Respondents (Yes)	Percentage (%)
1	Use of eco-friendly materials	7	63.6%
2	Proper waste management	6	54.5%

According to the questionnaire results, 63.6% of the weavers have started using eco-friendly materials, such as natural dyes made from plants, as an alternative to chemical dyes. The use of natural dyes not only reduces negative environmental impacts but also adds value to the woven fabric itself, as it is considered safer and healthier to use. Furthermore, 54.5% of the weavers reported having implemented proper waste management practices to minimize production waste. For instance, leftover fabric from production is often reused to make smaller products like bags or accessories, which not only helps reduce waste but also provides an additional source of income. Weaving entrepreneurs emphasized that the use of eco-friendly materials is essential for maintaining business sustainability and protecting the environment, though financial constraints remain a challenge in full implementation.

3.4 Strategies to Support the Sustainability of Sidingkat Weaving Business and Empower Female Artisans

Based on interviews, questionnaires, and surveys, several key strategies have been identified to maintain the sustainability of the Sidingkat weaving business and strengthen the empowerment of female artisans. These strategies include product innovation, increased access to capital, skill development, and business digitalization, all of which are considered essential by the artisans to address the challenges of sustaining the weaving business in the face of market demands.

**Table 7.** Strategies for the Sustainability of the Sidingkat Weaving Business

No	Strategy	Number of Respondents (Agree)	Percentage (%)
1	Product and design innovation	9	81.8%
2	Access to capital	11	100%
3	Skills and management training	7	63.6%

Table 7 shows that 100% of the weavers stated that limited access to capital is the biggest challenge in expanding their business. Financial support from the government or financial institutions is needed to expand the market and increase production capacity. Additionally, 81.8% of the weavers feel that product and design innovation is critical to ensuring business sustainability, especially to attract new markets and maintain competitiveness. Furthermore, 63.6% of the weavers also highlighted the importance of additional training in skills and business management. Weaving entrepreneurs also revealed that digitalizing production is a key step in expanding market reach and improving operational efficiency.

3.5 Customer Opinions and Preferences

A survey of 30 Sidingkat weaving product customers provided insights into customer perceptions and satisfaction regarding product quality, design, price, and service. While most customers were satisfied with the products they purchased, feedback was given on the need for more design variations and competitive pricing, which could help attract younger consumers.

Table 8. Customer Preferences and Satisfaction

No	Strategy	Number of Respondents (Agree)	Percentage (%)
1	Product quality is excellent	12	40%
2	Product design is very unique	10	33.3%
3	Price matches the quality	15	50%
4	Service is highly satisfactory	9	30%

Based on Table 8, there are 40% of customers stated that the product quality is excellent, and 50% felt that the price corresponds with the quality offered. Additionally, 33.3% of customers found the product design to be unique, but some suggested the inclusion of more modern design variations and more competitive pricing to attract a broader range of younger consumers. Customers also recommended more aggressive social media promotion to raise public awareness of Sidingkat weaving products.

3.6 Discussion

The Sidingkat weaving business has had a significant economic impact on both workers and entrepreneurs. Based on the questionnaire results in Table 4, 72.7% of the weavers reported an increase in income since joining the business, and 81.8% stated that the weaving business is the primary source of income for their families.

As a small-scale home industry, the Sidingkat weaving business plays a crucial role in the family economies of rural areas. Entrepreneurs like Mr. Asrul Hidayah, who employs 11 workers, emphasized that this business not only provides income for the workers but also creates economic stability for the weavers' families, enabling them to endure economic uncertainties, particularly during the Covid-19 pandemic. However, during the pandemic, production levels dropped from an average of 100-120 woven fabrics per month to a significantly lower amount.

As noted by Hazani et al. (2019), women's participation in economic activities like weaving is a manifestation of their dynamic role in improving family welfare, as seen in their status and position within the social system. Similar to the weavers in Desa Gumanano, the women artisans in Desa Sidingkat also work to supplement family income and meet essential needs. The weaving activity not only helps fulfill daily necessities such as food, clothing, and education but also provides essential economic stability for their families (Dwi Artih & Susilawati, 2019).

Moreover, the income generated from weaving is often used to meet the primary needs of the family, and any surplus is set aside as savings for future emergencies. These savings can also be reinvested as capital for continuing the weaving production, ensuring the long-term sustainability of their business (Hazani et al., 2019). This demonstrates the importance of the weaving industry in providing financial security for the families of weavers in Desa Sidingkat.

Sidingkat's traditional Paluta textiles have been exhibited at the Sumatra Utara Fair (PRSU) in Medan since 2015, but market demand has yet to meet the expected targets. The marketing challenges, both locally and nationally, remain a significant economic barrier that needs to be addressed.

According to previous research Bondyra et al. (2023) on the impact of the craft industry on local economies, small-scale crafts such as weaving play a crucial role in reducing poverty in rural areas. Tinker et al. (1976) also noted that crafts utilizing traditional skills often provide stable employment opportunities, especially for women. This aligns with the findings of this study, where female weavers reported gaining reliable income stability from the Sidingkat weaving business.

Additionally, Schumacher's economic theory, as cited by Zarif et al. (2018) in *Small is Beautiful*, supports the importance of small enterprises in fostering local economic sustainability. According to this theory, small businesses like Sidingkat weaving have the potential to improve local well-being by creating a more sustainable and community-



centered economic system. Workers not only benefit directly from economic gains but also contribute to strengthening a more independent and sustainable local economy.

Despite the significant contributions of this industry to the local economy, several challenges remain for weavers and weaving entrepreneurs. In interviews with entrepreneurs, one of the main challenges highlighted was the lack of access to wider markets. Currently, the marketing of Sidingkat textiles is confined to the Padang Lawas Utara region and nearby areas, such as Padangsidempuan, limiting the opportunity for expansion into national or international markets.

Entrepreneurs also mentioned that while government support in the form of training and technical assistance has helped improve the skills of weavers, this support has not adequately addressed access to capital or broader marketing infrastructure. Istinganah & Widiyanto (2020) indicated that one of the keys to the success of craft enterprises lies in adequate access to capital and broader marketing networks, which are essential for enhancing the competitiveness of traditional craft products in larger markets. Liantifa (2023)'s research similarly found that business capital significantly contributes to the growth of UMKM Batik Tulis Giriloya. These findings align with Riyanto, (2012), which states that business capital significantly influences the development of small and medium-sized enterprises (SMEs), as it represents the assets or wealth used by business owners to expand their ventures.

Since the Covid-19 pandemic, the production of Sidingkat woven fabrics has significantly declined. Previously capable of producing 100-120 woven pieces per month, production has drastically decreased due to a drop in demand and imposed restrictions. According to reports from the entrepreneurs, this production decline has also affected workers' incomes, although most workers have remained in the business as it is their sole source of livelihood.

The pandemic has highlighted the vulnerability of small businesses like Sidingkat weaving to external economic shocks. Xheneti et al. (2021)'s research on the impact of the pandemic on the craft industry shows that small businesses that are not diversified and rely on local markets are more susceptible to global economic crises. Yang & Zhang (2020) emphasizes the importance of market diversification and strengthening access to digital platforms to ensure the sustainability of businesses in the future.

From this analysis, it can be concluded that the Sidingkat weaving business has had a positive economic impact on the artisans and their families. However, challenges related to market access, marketing, and the effects of the pandemic are factors that need to be addressed in long-term sustainability strategies. Efforts to improve access to capital and expand marketing networks, including through digitalization, are crucial to ensuring that this business can survive and grow further.

Table 8. Economic Challenges and Solutions for Sidingkat Weaving Business

No	Challenge	Proposed Solution
1	Limited market access	Market diversification and enhanced marketing through digital platforms
2	Limited capital	Support from the government or financial institutions through loans and capital assistance
3	Impact of the pandemic on production	Development of crisis mitigation strategies, including training and product innovation

From a social perspective, the Sidingkat weaving business has made a positive contribution to women's involvement in the community. Based on the questionnaire in Table 5, 81.8% of weaving workers felt that this business had increased their social engagement within the community, and 100% of workers felt more appreciated by society. This business has also strengthened the role of women in family economic decision-making, as acknowledged by 72.7% of respondents.

Participation in the weaving business provides women with the opportunity to interact more broadly with the community. For example, weaving entrepreneur Mr. Asrul Hidayah mentioned that this business has involved various elements of society, including young people who assist in product marketing and development. Through this social engagement, female weavers in Desa Sidingkat are no longer seen solely as homemakers but as drivers of the local economy.

Research by Mayoux (2006) on gender and micro-enterprise shows that small businesses involving women can be a crucial tool for enhancing social engagement and women's empowerment. This is further supported by Prasetyo, (2023)'s study, which found that women's empowerment initiatives, whether in small businesses or farming groups, have been proven to improve the economic and social welfare of families and create better conditions for women in rural areas. In the Sidingkat weaving business, it provides a platform for women to become more socially and economically empowered. The increased recognition from the community, as reflected in the data, shows that women are not only gaining access to income but also receiving acknowledgment for their role in building the local economy.

Furthermore, studies on community-based enterprises by Bridger et al. (2011) found that community-based businesses, such as weaving, have the potential to strengthen social ties and increase solidarity among community members. In this case, women's involvement in weaving not only enhances their social engagement but also strengthens social cohesion in Desa Sidingkat, where women are involved not only in production but also in other community activities that support business sustainability.

The questionnaire results in Table 5 also show that 72.7% of respondents feel that their role in the family has increased, especially in terms of economic decision-making. Before engaging in the weaving business, women in this



village were likely limited to traditional domestic roles, but their involvement in the production and marketing of woven fabrics has given them economic power, which in turn strengthens their position within the family. The theory of power and decision-making within families by Blood and Wolfe, as cited in Wong & Daminger (2024), states that the greater an individual's economic contribution, the more influence they have in family decision-making. The findings from this research align with that theory, as women working in the weaving business now play a more significant role in family economic management. Previous studies (Kusmayadi, 2017) also support this concept, stating that more women are working to help their husbands improve the family's welfare, particularly as the cost of living increases. Kusmayadi highlights how women are also expected to manage family finances effectively given the unstable economic conditions, which often make the husband's income insufficient to meet family needs (Kusmayadi, 2017). Therefore, women's role in working outside the home has become increasingly important, not only to support the family economy but also in creating a fairer and more equitable family decision-making process.

Additionally, Sen (2014) argues that women's economic empowerment through participation in productive work allows them greater freedom in making decisions that affect family welfare. In Desa Sidingkat, the weaving business has opened doors for women to not only contribute to the family income but also become agents of change within their households.

The social role of the weaving business is also evident through collaboration between artisans and youth groups in the village, which helps expand the product marketing network and supports the promotion of woven fabrics at various local events. According to the weaving entrepreneur, this collaboration not only strengthens social solidarity but also helps introduce Sidingkat woven fabrics to a wider audience, including through local exhibitions such as the Pekan Raya Sumatra Utara (PRSU).

Research by Putnam, as cited in Siisiainen (2003), on social capital highlights that strong social networks within a community play a crucial role in the success of small businesses and local crafts. This is consistent with the findings of Sujoko (2015), which showed that innovation in the craft and culinary industries in Banyuwangi mostly originates from the producers themselves, despite limited social networks, with family and close friends being the primary sources of information and innovation. However, the study also found that components of social networks, such as closeness with business partners and other association members, can positively impact innovation. In this research in Desa Sidingkat, the collaboration between female artisans and local youth not only strengthens social capital but also helps expand marketing networks and improve product competitiveness in the market. This demonstrates that social capital within the community can be a valuable resource for the success of craft businesses, especially in facing challenges related to innovation and marketing in broader markets.

From the analysis of social impacts in this research, the Sidingkat weaving business has created opportunities for women's empowerment in the region through their involvement in the weaving production process, providing them with income and enhancing their skills. However, specific training or empowerment programs for workers remain limited and need to be expanded to further enhance women's capacity to manage the business independently.

Table 9. Social Challenges and Proposed Solutions for Sidingkat Weaving Business

No	Challenge	Proposed Solution
1	Limited market access for the promotion of woven cloth	Expand marketing networks by involving youth groups in product promotion and increasing the use of digital platforms for online marketing.
2	Lack of business management skills among artisans	Provide management and marketing skills training for female weavers, as well as collaborate with local governments for intensive training programs.
3	Low product competitiveness in the national market	Innovate woven fabric designs and diversify products to attract a wider range of consumers, as well as participate in national exhibitions like the North Sumatra Fair (PRSU).
4	Limited social recognition before involvement in the weaving business	Strengthen the role of female artisans by increasing their involvement in community activities and fostering social collaboration to enhance social capital in the village.
5	Traditional role of women in the family	Enhance the role of women in family economic decision-making by providing household financial management training and increasing economic capacity through productive ventures such as weaving.
6	Minimal intergenerational collaboration within the community	Encourage closer collaboration between female artisans and youth groups in marketing, innovation, and product promotion through joint activities that support business sustainability.

In terms of environmental impact, Sidingkat weaving still utilizes traditional methods with manual looms, which are more eco-friendly compared to mass production technologies. However, challenges remain regarding the use of environmentally friendly materials. In Table 6, 63.6% of workers reported using natural dyes, but financial constraints have led 36.4% to continue using chemical dyes.

Moreover, weaving entrepreneurs also reported efforts to reduce negative environmental impacts by managing production waste more effectively, though such initiatives could still be improved. Full adoption of eco-friendly



practices remains a challenge for many artisans in Desa Sidingkat. Financial limitations are the main factor preventing consistent use of natural materials. Natural dyes, while more environmentally friendly, are often more expensive and involve a more complex production process than chemical dyes. Weaving entrepreneur Mr. Asrul Hidayah emphasized that although there is a strong awareness of the importance of using eco-friendly materials, financial constraints remain the biggest obstacle to fully adopting sustainable practices.

Like many traditional craft industries, Sidingkat weaving faces challenges in adopting sustainable technology and practices. Most weavers still use traditional techniques focused on cost efficiency. Ljungberg (2007) states that financial and technological limitations are the main barriers to adopting sustainable practices in the craft sector. He also highlights various methods for developing products with minimal environmental impact through material selection, design, usage, and recycling.

Additionally, Bebbington's study, cited in Bakri & Hasyim (2024), on traditional crafts and environmental impact underscores the importance of ongoing training for artisans to understand how eco-friendly practices can be integrated into production without significantly increasing costs. In the case of Sidingkat weaving, the local government's efforts to provide technical training to artisans have been an important first step, but further efforts are needed to ensure artisans can access natural materials at more affordable prices.

From the perspective of sustainability theory, small businesses like Sidingkat weaving are at a critical juncture, where environmentally friendly practices must be balanced with cost affordability. The triple bottom line theory by Elkington, as discussed in Putri et al. (2023), emphasizes that sustainability in a business must consider three elements: economic, social, and environmental. In this research, the Sidingkat weaving business faces challenges in simultaneously meeting both economic and environmental aspects. The artisans aim to keep production costs low to maintain profitability, but at the same time, they recognize the importance of protecting the environment by reducing the use of chemicals and better managing waste.

Previous research (Rahaman et al., 2024) highlights that the adoption of environmentally friendly practices in small industries like weaving can be enhanced through easier access to natural materials and incentives from the government or non-governmental organizations (Pearce, 1992). In the Sidingkat weaving business, providing subsidies or capital assistance for procuring eco-friendly materials would significantly help artisans fully transition to sustainable practices.

Environmental sustainability must be an integral part of small business development strategies, including in the craft industry. Implementing eco-friendly practices such as better waste management and using natural dyes can help artisans maintain a healthy environment while still retaining economic profitability. Initiatives such as environmental certification programs can be used to ensure that these weaving businesses operate according to eco-friendly principles, which in turn can increase the competitiveness of their products in the market.

Overall, although the Sidingkat weaving business has demonstrated a commitment to adopting environmentally friendly practices, the challenges related to costs and access to natural materials remain major obstacles. With support from the government and NGOs to provide broader access to eco-friendly materials, as well as further training on waste management, this weaving business can become more sustainable and environmentally friendly in the future.

Table 10. Challenges in Implementing Eco-Friendly Practices and Proposed Solutions

No	Challenge	Proposed Solution
1	Limited access to eco-friendly materials	Provision of subsidies and affordable access to natural materials through government programs
2	High costs of using natural dyes	Capital assistance and training to improve efficiency in the use of natural materials
3	Suboptimal waste management	Further training on waste management and recycling to reduce environmental impact

Based on the research findings in Table 7, access to capital is a top priority in the sustainability strategy for the weaving business. A total of 100% of artisans agreed that access to capital is essential to overcoming the challenges of developing their business. Tambunan et al. (2022) underscores the importance of capital for small businesses to maintain business continuity, and in this study, support from the government or financial institutions is highly necessary.

Additionally, 81.8% of female weavers emphasized the importance of product and design innovation. Innovation is key to attracting new consumers, particularly from younger generations who are more interested in products with contemporary designs. This aligns with Zebua et al. (2024), which highlights that product innovation is crucial for maintaining competitiveness in the market. Without innovation, traditional products like Sidingkat weaving could lose relevance in rapidly changing markets.

Another suggested strategy by the artisans is skills and management training. A total of 63.6% of artisans agreed that further training is necessary to enhance their capacity in managing their businesses and expanding their marketing networks. Several studies (Habib & Sutopo, 2024; Surbakti et al., 2024; Winarsih et al., 2024) highlight the importance of training in empowering women and ensuring the sustainability of small businesses. Trained artisans are better equipped to face challenges in business management and innovate according to market demands.



Weaving entrepreneur Mr. Asrul Hidayah emphasized that the digitalization of production and marketing is a crucial step in expanding the market and improving operational efficiency. Currently, the marketing of Sidingkat weaving is mostly limited to the local area, such as North Padang Lawas Regency and Padangsidempuan. However, with the adoption of digital technology, these woven products have the potential to be marketed to a broader audience, including national and international markets.

Female weavers and weaving entrepreneurs are aware that marketing through social media and digital platforms can help expand their consumer networks, both locally and nationally. Research by Puspatriani et al. (2022) and Yansahrita et al. (2023) showed that digital marketing can increase visibility and access to a wider range of consumers at a lower marketing cost.

In addition, customer preferences data revealed that 40% of customers stated that the quality of Sidingkat woven products is excellent. This shows that Sidingkat weaving has a recognized quality among consumers. The perceived high product quality reflects the artisans' success in maintaining product standards, even while using traditional production methods. Product quality is one of the most important factors in building customer loyalty (Kusuma, Suyadi, & Abdillah, 2014). Satisfied consumers tend to return for repeat purchases, making quality a key element in retaining and attracting customers.

However, only 33.3% of customers felt that the product designs were very unique. While many customers appreciate the traditional characteristics of Sidingkat woven designs that use the green color, they also suggested more modern design variations to attract younger consumers. This is consistent with previous research (Alichia et al., 2024; Mardikaningsih & Darmawan, 2023) on the importance of product innovation in maintaining relevance and competitiveness in rapidly changing markets. Design innovation, especially to meet the tastes of modern consumers, can help attract more customers, particularly from younger generations who may be more drawn to contemporary designs.

In terms of pricing, 50% of customers felt that the product price was appropriate for the quality offered. While this is a positive indicator, some customers suggested lowering the price or providing products at more affordable price points. Customer service also emerged as an important aspect highlighted by respondents. Only 30% of customers felt very satisfied with the service they received, while others believed there was room for improvement. Enhancing customer service, such as by improving responsiveness or offering a more personalized shopping experience, could increase consumer satisfaction levels.

Most customers mentioned that they liked the uniqueness of Sidingkat woven designs, but they also suggested increasing design variations to attract more consumers, especially younger audiences. Modern design variations could include adding more contemporary style elements, such as geometric patterns or the use of brighter colors in addition to the signature green of Paluta. Stylios (2008) shows that innovation in textile design can increase product appeal, especially in markets sensitive to fashion trends.

Additionally, customers suggested that social media promotion be enhanced. Social media is an effective marketing tool for small businesses like Sidingkat weaving, which is still focused on local marketing. By using platforms like Instagram, Facebook, and online marketplaces, artisans can expand their market reach and attract consumers beyond the Paluta region.

Based on the data obtained, it is clear that the Sidingkat weaving business has a significant impact on improving the economic, social, and environmental well-being of female artisans. However, several challenges need to be addressed, such as limited capital, product innovation, and the adoption of eco-friendly practices. With the right strategies, such as product innovation, access to capital, training, and digitalization, the Sidingkat weaving business can continue to grow and contribute more to women's empowerment and environmental sustainability in Desa Sidingkat.

4. CONCLUSION

The findings of this study demonstrate that the Sidingkat weaving business has significant impacts across economic, social, and environmental dimensions, with results showing that 81.8% of weavers rely on it as their primary income source and 100% report increased community recognition. While the business has successfully empowered female artisans and strengthened their role in both family and community settings, it faces several key challenges including limited capital access, market reach constraints, and barriers to implementing sustainable practices. To address these challenges and ensure business sustainability, this research recommends implementing integrated strategies focusing on design innovation, management skills development, digital marketing adoption, and increased access to eco-friendly materials through government support and institutional partnerships, ultimately contributing to the achievement of relevant Sustainable Development Goals while preserving cultural heritage. This study encountered several limitations that should be considered when interpreting the results. First, the sample size was relatively small, comprising only 11 female weavers and 30 customers, which may limit the generalizability of findings to larger weaving communities. Second, the research was geographically limited to Sidingkat Village in Padang Lawas Utara Regency, and the findings may not fully represent the challenges and opportunities faced by weaving businesses in other regions of Indonesia. Third, the reliance on self-reported data through interviews and questionnaires may introduce potential response bias, particularly regarding sensitive topics such as income levels and business



performance. Finally, while the study attempted to measure environmental impact, the lack of standardized metrics for sustainable practices in traditional weaving businesses made it difficult to quantitatively assess environmental improvements. Future research would benefit from larger sample sizes, longitudinal designs, and the development of more precise measurement tools for environmental impact assessment in traditional craft industries.

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