MAJALAH ILMIAH JOURNAL
LPPM Universitas Putra Indonesia YPTK Padang
Jl. Raya Lubuk Begalung, Padang, West Sumatera, Indonesia, Zip Code: 25221
Volume: 32, Issue: 2, Page: 125 - 131, 28/12/2025, e-ISSN: 1412-5854
Available online at website: https://jmi-upiyptk.org/ojs/index.php/jmi/index

Technology-Based Community Service: Application of Oil Palm Midrib Stick Shaving Machine to Empower Local Creative Economy in Tebing Linggahara Village

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Abstract

Craftsmen producing goods from oil palm midribs often face slow production rates and significant physical strain. To tackle these core inefficiencies, this community service program introduced a crucial intervention: a stick shaving machine, paired with intensive training and mentoring, designed to minimize physical effort and significantly boost capacity. We employed field observations, interviews, and hands-on practice sessions that allowed participants to directly compare the machine's output with traditional manual work. The results were immediate and impactful: daily production capacity increased by over 50%, processing time shortened dramatically, and physical fatigue was minimized. This success further led to the establishment of more consistent marketing channels via local agents. Ultimately, this technology-based initiative proved effective in harnessing the village's agroindustrial potential, strengthening the local creative economy, and establishing a sustainable, practical model for community empowerment.

Keywords: Productivity Improvement, Oil palm midrib, Stick Shaving Machine, Creative Economy, Community-Empowerment

1. Introduction

Agroindustry based on oil palm waste has considerable potential to support the rural creative economy, especially in palm-producing regions of Indonesia [12]. Oil palm midribs, which are often treated as agricultural waste, can in fact be processed into broomsticks with high market demand both locally and regionally [13]. The community of Tebing Linggahara Village has long relied on producing broomsticks from oil palm midribs as an additional source of household income, representing a form of creative economy rooted in local resources [1]. However, the production process is still carried out manually using simple tools such as knives and machetes, taking between 30 to 120 minutes per bundle, which is highly labor-intensive and yields limited daily output [1]. The problem becomes more severe during the rainy season, when oil palm midribs are difficult to dry, reducing both productivity and product quality [1]. This situation highlights a critical problem that the absence of appropriate technology that can be practically adopted to increase the productivity of broomstick craftsmen in rural areas [1] [2].

At the same time, efforts to introduce innovation in rural industries often face the problem ofsustainability. Many programs only provide equipment without ensuring the readiness and capacity of the community to utilize and maintain it [3]. As a result, the tools provided are often underutilized or abandoned. On the other hand, empowerment programs that focus solely on capacity building without providing technological support also fail to achieve significant improvements in productivity and income [4]. This demonstrates the need for an integrated model that combines technology introduction with community empowerment.Reviews on appropriate technology stress the importance of tools that are affordable, simple, and locally adaptable, making them more sustainable for village-scale application [8]. In the context of palm broom production, innovations such as integrated peeling-tethering machines have demonstrated significant improvements in efficiency and productivity [9]. However, these technological innovations remain underutilized in Indonesia, particularly in small-scale rural communities [10]. This reveals a gap between advanced technological solutions and their practical application in local community empowerment initiatives [11,14].

This study bridges that gap by introducing an appropriate oil palm midrib stick-making machine

Accepted: 20-10-2025 | Revision: 01-11-2025 | Publication: 30-11-2025 | doi: 10.35134

integrated with community training and mentoring in Tebing Linggahara Village. The novelty lies in this integrated approach: combining technical innovation and capacity building to provide a holistic and practical model for strengthening rural agroindustry, unlike previous works that often focused on technology or empowerment in isolation.

2. Methods

This project applied a participatory approach through four stages: baseline survey, socialization, demonstration, and evaluation. The approach was based on appropriate technology principles, emphasizing simple, affordable, and locally adaptable solutions. The project specifically involved 30 local craftsmen as participants and was conducted over a period of 12 weeks.

The baseline survey involved field observation and interviews with broomstick craftsmen to identify production practices, challenges, and marketing systems, ensuring the intervention matched real community needs. The socialization stage introduced the program's objectives and benefits, building awareness and community commitment.

The demonstration stage consisted of hands on training with the stick making machine, covering operation, maintenance, and direct practice. This participatory training strengthened skills and independence, supported by relevant technical references. Finally, the evaluation compared manual and mechanized production, measuring daily output, time efficiency, labor needs, and physical fatigue, while also gathering participant feedback. Mixed-methods analysis enhanced the validity and reliability of the results.

3. Results and Discussions

3.1. Baseline Survey For Craftsmen

Before start with socialization and make community engagement, baseline survey needed to recorded. Summary of interview with 10 broomstick t found restricted market strategies hinder the growth of rural creative industries.

From an economic perspective, most craftsmen consider broomstick production as additional income, although a small portion rely on it as the main source of livelihood. This resonates with [20] that agro based household industries typically function as secondary rather than primary income sources. Importantly, the expectations expressed by respondents showed on Figure 1 that efficiency, increased production, and craftsmen in Tebing Linggahara vilalagee showed on Table 1.

The production time for a single bundle ranges from 15 minutes to 2 hours, leading to varied production capacities from 10 kg per day to 100 kg per week. These findings align with research showing that the absence of mechanization is a major constraint to productivity in small-scale agricultural industries [17].

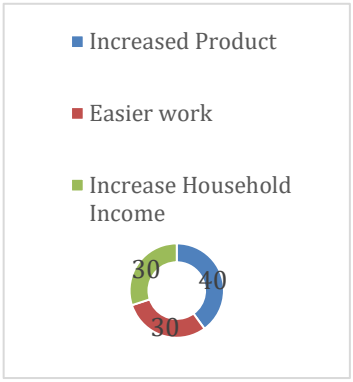

Figure 1. Respondents' Expectations for the New Machine

Figure 2. Interview from broomstick craftsmen

The main constraints identified were injury risks from manual tools, raw materials that could not be dried properly, and dependence on weather conditions. This is in line with [18] which emphasize that environmental factors and safety issues remain critical challenges for household agro-industry. In addition, marketing is still dominated by agents who come directly to the village, while only a few craftsmen utilize social media. This demonstrates limited access to modern market channels, consistent with [19] tha

reduced workload reflect their awareness of the necessity of appropriate technology.

Therefore, the results of this baseline survey strongly indicate the need for socialization prior to equipment distribution. As argued by [21], empowerment programs are only effective when communities are adequately informed, trained, and prepared for technological adoption. Thus, socialization plays a crucial role in building awareness and readiness, while demonstration and evaluation will ensure sustainability of the intervention.

3.2. Socialization and Community Engagement

Following the baseline survey, a socialization activity was conducted in Tebing Linggahara Village, attended by representatives of broomstick craftsmen (penyerut lidi) from each hamlet. The purpose of this activity was to disseminate the results of the initial survey, provide knowledge about the importance of mechanization, and prepare the community for the introduction of the palm midrib broomstick machine.

The socialization process, as shown in Figure 3, was carried out interactively, where participants actively shared their experiences regarding production constraints, particularly injuries from manual tools and difficulties in drying raw materials. This confirms the findings of the baseline survey, where safety and raw material conditions were the main challenges for craftsmen. The presence of craftsmen from different hamlets also provided a more comprehensive picture of the diversity of problems and expectations across the village.

Importantly, this activity served as an entry point for community empowerment. By involving broomstick craftsmen directly, the socialization not only informed them about the upcoming intervention but also encouraged collective awareness of the need to transition from manual processes to more efficient and safer mechanization. This aligns with previous studies that emphasize the role of participatory approaches in ensuring community acceptance of new technologies [22].

The feedback during the session showed that craftsmen were enthusiastic about the innovation, with many expressing that the new equipment would reduce fatigue and allow them to increase production capacity. Thus, the socialization activity not only validated the survey findings but also reinforced the readiness of the community to adopt the broomstick-making machine as part of strengthening the local creative economy.

Figure 3. Socialization activity with broomstick craftsmen representatives in Tebing Linggahara Village

3.3. Broomstick Making Machine Demonstration

The demonstration of the palm midrib broomstick machine was conducted with direct participation of broomstick craftsmen in Tebing Linggahara Village (Figure 4). The machine was tested to evaluate its effectiveness compared to manual methods traditionally used by craftsmen. The machine performance showed on Table 2.

Table 1. Machine performance based on Demonstration

Parameters	Performance
Processing speed	The machine processed 1 kg of broomsticks in less than 3 minutes. In comparison, the manual method requires 15–20 minutes per bundle (±0.5 kg), or approximately 30–40 minutes per kg. This indicates that the machine is 10–12 times faster than manual labor
Fuel efficiency	The machine operated for 3 hours using 1 liter of fuel, producing approximately 40 kg of broomsticks. In contrast, manual methods are limited by physical endurance, with production ranging only between 10–20 kg per day per person.
Output Capacity	With the machine, production capacity reached 40 kg in 3 hours, whereas manually, craftsmen require almost a full day (6–8 hours) to reach similar results

The demonstration highlights a clear productivity leap from manual to mechanized processing and the effectiveness of the machine showed on Figure 4. These visuals clearly show that the machine is 10–12 times faster, 6–7 times more productive, and highly efficient compared to manual methods. While manual work is constrained by time and physical capacity, the machine enables continuous production with minimal fatigue, aligning with findings of [23] which argue that agricultural mechanization significantly enhances efficiency and reduces drudgery.

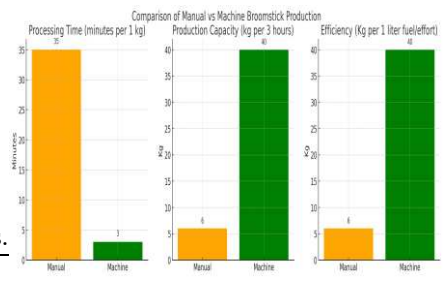

Figure 5. Comparison of Manual vs Machine Broomstick Production

Furthermore, fuel efficiency data show that 1 liter of fuel produces 40 kg of broomsticks, representing a cost-effective solution compared to manual labor. This performance demonstrates not only improved economic value but also reduced dependency on human energy, which is often a limiting factor in rural-based industries. Previous studies have emphasized that mechanization in smallholder agricultural processing can reduce operational costs significantly while increasing labor productivity [24]. In addition, mechanized processing reduces the risk of occupational hazards, especially cuts and injuries from knives, which are commonly reported in manual broomstick production [25]. Beyond the direct benefits of efficiency and safety, the adoption of locally appropriate machines also supports the long-term sustainability of rural creative industries by enabling craftsmen to expand production capacity and access wider markets [26]. This reinforces the potential of the broomstick machine not only to increase income but also to strengthen occupational safety and rural livelihood resilience.

The enthusiastic response of craftsmen during the demonstration confirms their readiness to adopt the technology, especially as the intervention directly addresses key constraints identified in the baseline survey: low efficiency, high physical workload, and weather dependency.

3.4. Evaluation Survey

The evaluation survey conducted after the demonstration phase showed that the majority of craftsmen preferred the broomstick processing machine over manual methods. Out of ten respondents, eight respondents (80%) chose to adopt the machine, while only two respondents (20%) preferred to continue manually (Figure 6). The main reason for choosing the machine was its ability to process broomsticks more quickly, increase production, and provide additional income for household economies.

Craftsmen engaged in downstream processing, such as broomstick making, were particularly enthusiastic about adopting the machine because the benefits directly translated into higher economic returns. This enthusiasm reflects the principle that mechanization has the greatest impact when applied to value-added processing stages, where efficiency directly affects profitability. Respondents also emphasized that when broomstick collection was carried out collectively or supported by hired collectors, the machine became more profitable due to the larger supply of raw materials. This aligns with the findings of previous studies which highlight that collective action and economies of scale are critical factors in ensuring the economic viability of rural mechanization programs [27].

In contrast, the two respondents who chose manual methods were small-scale collectors who only gathered a limited number of palm midribs, making manual processing sufficient for their needs. This reflects the heterogeneity of technology adoption, where smallholders often delay mechanization until production reaches a threshold that justifies investment [28]. However, these respondents also acknowledged that if raw material availability increased, using the machine would be strongly recommended to maximize efficiency. Such conditional acceptance indicates that the adoption of appropriate technology is not only influenced by economic returns, but also by the capacity to secure consistent raw material supply and the community's ability to manage the technology collectively [29].

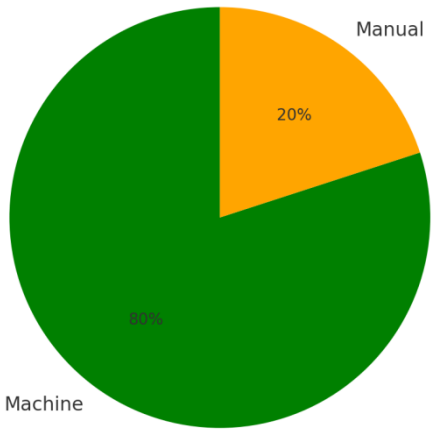

Figure 6. Respondents Preference After Demonstration

The evaluation also identified several impacts of mechanization. On the positive side, the machine offered faster processing and increased income. On the other hand, it required regular maintenance, fuel preparation, and the use of fresh midribs to avoid breakage. These findings highlight the trade-offs of mechanization: while it reduces drudgery and improves productivity, it also introduces new responsibilities for machine management. Overall, the evaluation confirmed that the introduction of the machine was well-received by the majority of broomstick craftsmen and has strong potential to

strengthen the local creative economy. To ensure sustainability, supporting activities such as training on machine operation, maintenance, and raw material preparation will be essential.

3. Conclusions

The adoption of the machine increased daily production capacity by more than 50%, shortened processing time, and minimized fatigue. Furthermore, the community experienced more consistent marketing through local agents, creating a stronger link between production and distribution. The introduction of the oil palm midrib stick-making machine proved effective in optimizing the village's agroindustrial potential and achieved the program's objective of strengthening the creative economy. This initiative not only improved household income but also provided a practical and sustainable model of community empowerment based on local agricultural resources.

For sustained long-term impact, the program emphasizes a clear follow-up plan. Institutional strengthening is ensured as the PPK Tebing Linggahara manages the equipment and formally hands over maintenance responsibilities to selected groups of local craftsmen. In terms of economic resilience, the groups continue to maximize digital marketing potential through platforms like Shopee and FB Marketplace. Crucially, the program is moving towards product diversification, with efforts currently underway to develop innovative derivative products, such as plates made from oil palm midribs. These steps will ensure the program's benefits are maximized, promoting a more resilient and sustainable creative economy in the village.

Acknowledgements

The authors would like to express their sincere gratitude to the Directorate of Research, Technology, and Community Service (DPPM-DIKTISAINTEK) 2025 for providing support through the Community Empowerment-Based Program Scheme (Skema Pemberdayaan Berbasis Masyarakat). Special appreciation is also extended to the Institute for Research and Community Service (LPPM) for facilitating and bridging the implementation of this community engagement program. Finally, the authors convey their deepest thanks to the partner institution, Tebing Linggahara Village, for their active collaboration, participation, and commitment, which greatly contributed to the success of this project.

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