

## Modernizing Traditional Weaving Tools Through Ergonomic And Environmentally Friendly Design

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### Abstract

Mandar weaving is a cultural heritage that has important economic and social value for the people of Onang Village, Majene Regency, West Sulawesi Province. However, the yarn winding process that still uses traditional tools causes various problems, such as low work comfort, physical complaints due to non-ergonomic working positions, and low production process efficiency. This community service activity aims to improve the understanding and skills of weavers in applying ergonomic principles and the use of more environmentally friendly yarn winding tools. The method of implementation of the activity is carried out through the stages of preparation, socialization, training, demonstration, mentoring, and evaluation. The activity involved the Mandar Weaving artisan group in Onang Village as the main partner. The results of the activity showed an increase in participants' understanding of the importance of ergonomics in weaving activities, the ability to operate modified yarn winding tools, and increased awareness of the use of environmentally friendly materials. In addition, the application of ergonomic yarn winding tools provides benefits in the form of increased work comfort and efficiency of the yarn winding process. This activity is expected to support increased productivity of artisans while maintaining the sustainability of the Mandar Weaving culture and environmental sustainability in Onang Village.

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## 1. INTRODUCTION

Indonesia is a country rich in cultural heritage, one of which is traditional weaving. In West Sulawesi, particularly in Onang Village, Sendana District, Majene Regency, West Sulawesi Province, Mandar weaving (mostly known as Lipa Sa'be) is not just an economic commodity but also a symbol of cultural identity passed down through generations. Home industry (*home industry*) Weaving in this region plays a crucial role in supporting the family economy and preserving the existence of local wisdom. (Nardia.N, 2018)

Traditional woven fabric is one of Indonesia's cultural treasures whose aesthetic and philosophical values have been recognized globally. In addition to being a symbol of regional identity, the traditional weaving industry, which is mostly driven by Micro, Small, and Medium Enterprises (MSMEs), has a strategic role in supporting the local economy and creating employment

opportunities, especially for women in remote areas. (Bahrum, S., & Anwar, D., 2009) In order to survive amidst the onslaught of modern factory-made textiles, the traditional weaving industry is required to increase its production capacity and work efficiency without eliminating the noble value of craft art. However, amidst the current of modernization and market demand that demands higher efficiency and production quantity, the Mandar Weaving process still faces significant technical obstacles. One of the crucial stages in weaving is the warping process, which is the process of arranging and arranging the strands of warp threads in a parallel manner before being installed on the loom.

This process is crucial for the neatness, pattern, and final quality of the woven fabric. Currently, most artisans in Onang Village still use traditional sewing tools, which have several fundamental weaknesses. The current sewing tool design forces artisans to work in unnatural positions, such as bending over, overreaching, or sitting without adequate support for long periods. This causes the weavers, mostly middle-aged women, to frequently experience physical complaints, including Musculoskeletal Disorders (MSDs), such as back pain, shoulder pain, and extreme fatigue. (Maksuk et al., 2021)

This situation directly reduces productivity and threatens the sustainability of the weaving profession for the younger generation. The winding and thread-arranging mechanisms on traditional tools are still very manual and slow, requiring significant time and energy to prepare just one skein of warp. The manufacture and renovation of traditional weaving tools often fail to consider the sustainability of the material, both in terms of its life cycle and the efficient use of workspace (Lubis et al. 2024).

Given these issues, the modernization of traditional sewing tools is necessary. Modernization here does not mean replacing cultural processes with fully automated machines that would eliminate their authentic value, but rather redesigning tools based on ergonomic and environmentally friendly design. An ergonomic approach is applied by adjusting tool dimensions based on local craftsmen's anthropometric data to minimize injuries and increase work comfort. Meanwhile, environmentally friendly principles are integrated through the use of renewable, durable local materials and a production process that minimizes waste. (Muslim, NI. 2018)

The challenges faced by weavers in Onang Village require empowerment efforts that focus not only on increasing productivity but also on occupational health and environmental sustainability. One possible solution is through community service activities, including outreach, training, and mentoring in the implementation of ergonomically designed and environmentally friendly weaving tools.

The tools used by most craftsmen today are still traditional and have not undergone adequate design updates. This condition gives rise to several major problems, namely: (1) ergonomic and health problems due to unnatural working positions, which trigger complaints. musculoskeletal disorders (MSDs) such as back pain, muscle fatigue, and joint disorders; (2) low work efficiency because the process of winding and arranging thread is still done manually so that it requires a relatively large amount of time and energy; and (3) the issue of material sustainability because some tools are made from less durable materials and do not pay attention to environmentally friendly principles.

This community service activity was carried out to provide assistance to weavers in implementing more ergonomic and environmentally friendly sewing tools as an effort to increase

work comfort, production process efficiency, and support the preservation of Mandar Weaving culture, which is the identity of the Onang Village community, Majene Regency.

## 2. IMPLEMENTATION METHOD

This community service activity was carried out in Onang Village, Majene Regency, West Sulawesi Province, targeting Mandar weaving artisans who still use traditional sewing tools in their production process. The implementation method was designed in a participatory manner, actively involving partners in every stage of the activity, from problem identification to evaluation of program results. This approach aims to ensure that the solutions provided are in accordance with the actual needs and conditions faced by the artisans, with the following stages:

1. The preparation phase is the initial step taken to obtain an overview of the partners' conditions and the problems they face in weaving activities. Activities at this stage include field surveys, observations of the thread-winding process, and interviews with weavers and village officials. Through these activities, information is obtained regarding the condition of the sewing tools used, the craftsmen's work patterns, and various complaints arising from the use of less ergonomic tools. In addition, the community service team identifies the partners' needs to determine the form of solutions to be provided. Next, coordination is carried out with the village government and craftsmen's groups to develop a schedule of activities, determine participants, and prepare the necessary facilities and infrastructure. At this stage, socialization and training materials are also prepared, focusing on aspects of work ergonomics, the use of more efficient sewing tools, and the use of environmentally friendly materials.
2. The socialization phase was conducted to increase participants' understanding of the importance of applying ergonomic principles in weaving activities. The material presented covered the relationship between work position and the health of craftspeople, the impact of using inappropriate work tools on the emergence of musculoskeletal disorders, and the importance of creating a safe and comfortable work environment. Furthermore, participants were introduced to the concept of modernizing weaving tools through ergonomic and environmentally friendly designs. In this session, the community service team explained the benefits of using tools designed according to the user's body characteristics, thereby reducing work fatigue and increasing production efficiency. The socialization activity was conducted interactively through discussions, questions, and answers so that participants could share their experiences and challenges they have faced.
3. After gaining theoretical understanding, participants participated in training and demonstrations on the use of the modified circular saw. At this stage, the community service team introduced the ergonomic circular saw design and its supporting components. The demonstrations included showing how to use the tool, setting the correct working position, and operating techniques that are more effective than conventional methods. Participants were then allowed to practice using the tool directly, accompanied by the community service team. This practical activity aimed to enable participants to understand the function of each component of the tool and gain hands-on experience in applying more ergonomic work techniques.
4. The mentoring phase is carried out to ensure that participants are able to apply the knowledge and skills they have acquired during the training. Direct mentoring is provided during the artisans'

thread-shearing and weaving activities. During this phase, the community service team provides guidance on how to operate the modified sewing machine, adjust the sitting position and ergonomic working range, and how to maintain the machine to ensure optimal function. Furthermore, participants are provided with an understanding of the use of environmentally friendly materials and the sustainable utilization of local resources to support weaving production activities.

5. Activity evaluation was conducted to determine the success of the community service program. The evaluation involved direct observation of participants' use of the Sekir tool, interviews to obtain feedback on the program's benefits, and the distribution of participant satisfaction questionnaires. Furthermore, changes in participants' understanding and skills were assessed before and after the program. The evaluation results served as a basis for measuring the program's effectiveness and as recommendations for further mentoring activities to support the sustainability of the Sekir Weaving Tool Modernization Program in Onang Village.

### 3. RESULTS AND DISCUSSION

#### Overview of Community Service Locations

Onang Village, located in Majene Regency, West Sulawesi Province, is known as a center for the development of Mandar weaving. Weaving has become an integral part of the local community's social and cultural life and has been passed down from generation to generation. Besides its cultural significance, weaving also serves as the primary source of income for most families in the village.



Based on field observations, there are approximately 85 active weavers in Onang Village, most of whom are women. Weaving production is carried out on a household scale, utilizing traditional skills passed down from the ancestors of the Mandar people. This home-based weaving industry makes a significant contribution to the local economy and plays a role in preserving the region's cultural heritage.

The weaving production process still faces various challenges, particularly during the thread winding stage, which still uses traditional tools with relatively low levels of efficiency and comfort. Therefore, this community service activity focuses on modernizing the winding tools through ergonomic and environmentally friendly approaches to support improved work quality for artisans.

### Initial Conditions of Partners

Observations and discussions with the artisan group revealed that most participants still use conventional saws that have not been designed with ergonomic principles in mind. Using these tools requires artisans to work in uncomfortable positions, such as bending over for extended periods, reaching too far, and using chairs that lack adequate back support.



These conditions cause various physical complaints experienced by the craftsmen. (Tiara et al., 2020) Based on the results of the initial identification, the most common complaints were back pain (85%), shoulder and neck pain (75%), wrist fatigue (70%), and lower back pain (80%). These complaints indicate that thread-winding activities have the potential to cause musculoskeletal disorders if carried out continuously without the support of appropriate work equipment.

Besides impacting health, the use of traditional yarn-shearing tools also impacts work productivity. The yarn-shearing process takes a relatively long time because all stages are still performed manually and lack efficient work mechanisms. This situation is one of the factors hampering the increase in production capacity of weavers in Onang Village.

### Implementation of Community Service Activities

The community service activities were carried out through several stages, including outreach, training, demonstrations, and mentoring on the use of modified weaving tools. The activities began with a presentation on the importance of applying ergonomic principles in weaving activities and the impact of using inappropriate work tools on the health of the craftspeople. (Helga et al., 2024)



Next, participants were introduced to the concept of an ergonomically designed and environmentally friendly saw. The community service team explained the function of each component and the benefits of implementing a design that better suits user needs. The event continued with a demonstration of the tool's use and hands-on practice involving all participants.



Throughout the activity, participants demonstrated high levels of enthusiasm. This was evident in their active involvement in discussion sessions, practical use of tools, and the provision of various inputs related to their needs in the field. The high level of participation demonstrated that the innovations introduced were considered relevant and appropriate to the problems they faced.

### **Implementation of Ergonomic Design in Circular Tools**

The modernization of the weaving tool was carried out by implementing several ergonomic aspects aimed at improving craftsmen's comfort and work efficiency. One innovation implemented was the use of a frame that can be adjusted to suit the user's posture. (Rima et al., 2022) This feature allows craftsmen to adjust the tool's height as needed, thereby reducing the risk of unnatural working positions. Furthermore, the weaving tool is equipped with an ergonomic chair with a backrest and seat cushion to provide better support during the work process. The presence of an ergonomic chair is expected to reduce pressure on the spine and reduce fatigue levels during weaving activities.

Improvements were also made to the thread-pulling system through the use of a lighter, easier-to-operate mechanism. This system helps reduce the physical workload experienced by craftspeople during the weaving process. To further enhance comfort, the tool is also equipped with a footrest that allows users to maintain a more stable and ergonomic sitting position while working. The implementation of these various components demonstrates that ergonomic principles can be integrated into traditional work tools without eliminating the primary function or cultural values inherent in the traditional weaving production process.

### **Utilization of Environmentally Friendly Materials**

In addition to considering ergonomics, the modernization of the wheelbarrow also prioritizes the use of environmentally friendly materials that are readily available in the surrounding community. The main materials used include laminated bamboo, recycled fiber, local rattan, and natural finishing materials that are safer for health and the environment. Laminated bamboo was chosen for its good strength, relatively light weight, and faster growth rate than wood. The use of recycled fiber in several tool components also serves as an effort to reduce waste and supports the principles of a circular economy.



The use of local rattan adds value by increasing the utilization of locally available resources within the community. The use of natural finishing materials also reduces the use of hazardous chemicals that can potentially pollute the environment. Thus, modernizing the rattan tool not only provides productivity benefits but also supports more sustainable production practices.

#### **Impact of Community Service Activities**

The implementation of community service activities has had various positive impacts on the weaving artisan group in Onang Village. From a knowledge aspect, participants gained a better understanding of the importance of ergonomics in weaving activities and the relationship between work positions and body health. (Siti AP and Yoyon S, 2019) This knowledge is an important provision for artisans to implement safer and more comfortable work patterns.

In terms of skills, participants were able to understand how to use the modified threading tool and operate it independently. This ability demonstrates that the simple technology introduced was well-received and implemented by the target community. In terms of productivity, participants felt that the threading process was easier and more efficient compared to using conventional tools. Although the impact of increased production requires long-term measurement, observations during the activity indicate the potential for increased work effectiveness through the use of more ergonomic tools.

In terms of the environment, participants gained an understanding of the importance of using environmentally friendly materials in the production process. This awareness is expected to encourage artisans to pay greater attention to sustainability in all production activities. Overall, this community service activity demonstrated that modernizing weaving tools through an ergonomic and environmentally friendly approach can be a solution to improving the quality of work of weavers while supporting the preservation of Mandar weaving culture in Onang Village.

#### **4. CONCLUSION**

Community service activities carried out in Onang Village, Majene Regency, successfully increased the understanding and skills of Mandar weaving artisans in applying ergonomic principles and using more environmentally friendly sewing tools. Through outreach, training, demonstrations, and mentoring, partners gained knowledge about the importance of ergonomic work positions, the use of sustainable materials, and more efficient sewing tool operating techniques. The application of modified sewing tools provides benefits in the form of increased work comfort, reduced potential for

physical complaints, and supports efforts to preserve traditional weaving culture and the development of a more sustainable weaving industry.

## 5. SUGGESTION

To ensure the sustainability of the activity's results, continued mentoring and support from local governments, universities, and other stakeholders are needed in the development and implementation of ergonomic sewing tools for weaving artisan groups. Furthermore, similar programs need to be expanded by integrating training in business management, product marketing, and the use of appropriate technology to further enhance the competitiveness of Mandar weaving. The use of environmentally friendly materials also needs to be continuously encouraged as part of efforts to create a productive, sustainable craft industry that maintains the local cultural values that are the identity of the Onang Village community.

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