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Empowering Creative Economic Centers in Gebyok Crafts for The Conservation of Local Culture, A Superior Product in Kudus Regency

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ABSTRACT

Kudus Gebyok crafts, a significant intangible cultural heritage, face threats from artisan regeneration issues, traditional production inefficiencies, and limited market reach. This study aims to empower the Gebyok Creative Economy Center by integrating technological innovation and digitalization to ensure cultural conservation. A participatory action research approach was employed with two artisan partners, involving the modernization of production tools, training in digital motif design, registration of Intellectual Property Rights (IPR), and development of digital marketing strategies. The results demonstrated significant improvements, with the adoption of modern machinery increasing production efficiency by up to 81.56%. Additionally, five distinctive motifs were successfully digitized and legally protected through IPR registration, and market access was expanded through the creation of social media channels and an e-catalog. In conclusion, the strategic implementation of technology and digitalization proved effective in enhancing production capacity while safeguarding cultural assets. This research contributes a replicable empowerment model for other heritage-based creative industries, demonstrating a viable pathway to synergize cultural preservation with economic sustainability in the modern era.

ARTICLE INFORMATION

Keywords:
creative economy; cultural conservation; digitalization approach; gebyok crafts; technological innovation

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INTRODUCTION

Preserving intangible cultural heritage amidst globalization and modernization is a complex challenge that requires a multidisciplinary approach (Wang & Xiao, 2021). As a multicultural nation rich in culture, Indonesia places great value on culture and must be consistently preserved (Purbasari et al., 2023). One manifestation of this cultural richness is Gebyok Kudus art, a woodcarving craft that serves not only as an architectural element but also reflects the noble philosophy of life of the local community (Suharson et al., 2021). The carvings on gebyok doors have architectural elements that symbolize various aspects of life and the universe. For instance, motifs such as flowers and leaves often symbolize growth, prosperity, and harmony with nature (Haryanto et al., 2022). However, the sustainability of this craft industry faces various obstacles that could potentially threaten its existence.

Conditions on the ground suggest that gebyok artisans face significant challenges in regenerating this craft, as younger generations show little interest in continuing it (Mahardika et al., 2024). This phenomenon can be attributed to the fact that the production process of traditional regional art products in Indonesia continues to depend predominantly on conventional methods (Purwaningrum et al., 2021). The manual and repetitive drawing of motifs, along with the use of conventional construction tools, impacts time efficiency, quality consistency, and production scalability. On the other hand, as with traditional industries in Indonesia in general, the marketing

reach remains limited to the local sphere, and word-of-mouth promotion has underdeveloped the economic potential of this craft (Ciadi & Putra, 2025; Ferricha & Fauzan, 2020; Purnomo et al., 2018). Furthermore, the richness of Kudus's distinctive Gebyok motifs has not been formally managed and protected, making them vulnerable to claims and loss of authenticity (Haryanto & Prameswari, 2022).

A recent study shows that although numerous empowerment efforts for craft MSMEs (Micro, Small, and Medium Enterprises) have been undertaken, most programs are partial (Nugroho et al., 2025; Surti et al., 2024). For example, some research and empowerment programs in batik crafts focus more on motif digitalization and online marketing without addressing the modernization of production equipment (Gondoputranto & Dibia, 2022; Prijono et al., 2024; Suprihono et al., 2022). On the other hand, interventions in other crafts may focus solely on increasing production capacity, without being balanced with strategies to protect cultural assets and ensure adequate digital market access (Yang, 2024). The absence of an integrated, holistic empowerment model that simultaneously addresses production modernization, intellectual property (IP) protection, and digital marketing transformation, particularly for high-value, complex crafts like Gebyok.

To address these challenges, an approach through the creative economy framework is relevant. The creative economy offers a model in which cultural heritage can be capitalized on to create high-value products without sacrificing its noble values (Ciampa, 2023; Thipwong et al., 2018). The key to this transformation lies in integrated innovation (Borissova, 2018). This theoretical approach leads to the hypothesis that adopting appropriate technology and digital strategies can bridge the gap between preserving tradition and meeting the demands of the modern market. Recent research also shows that technology integration is not intended to replace artisans' manual skill but rather to strengthen capacity, increase precision, and expand market access (Chen et al., 2022; Yang, 2024).

The solutions implemented in this community service program are strategic interventions focused on three main pillars: modernizing production processes, digitizing cultural assets, and strengthening marketing capacity (Andryashina et al., 2020; Ji et al., 2022; Mavlioutov et al., 2020). Modernization is achieved through the introduction of more efficient and safer production machinery, such as planers and construction drills, designed to increase productivity and workplace safety (Dowsett et al., 2022). Asset digitization is realized by transforming traditional motifs into digital formats that can be replicated with precision and registered as Intellectual Property Rights (IPR) for legal protection. Meanwhile, marketing is strengthened by building a digital presence through social media and developing an e-catalog to reach a wider audience.

Therefore, this article makes a novel contribution by presenting a comprehensive and replicable empowerment framework for cultural heritage-based creative industries. The main novelty of this research lies in the integrated empowerment model approach that integrates three vital aspects simultaneously: 1) production technology innovation for efficiency; 2) cultural asset conservation through digitalization and IPR protection; and 3) marketing transformation in the digital era. Furthermore, this article aims to 1) analyze the impact of the application of digital innovation and production technology on increasing the effectiveness and efficiency of the work of Gebyok Kudus artisans; 2) describe the partner empowerment process as a model for local cultural conservation in the digital era; and 3) present an empowerment framework that can be replicated for other cultural heritage-based creative industries.

METHOD

This community service program adopts a qualitative approach, using a participatory action research (PAR) design. This approach was chosen to ensure that the interventions are collaborative, relevant to the partners' actual needs, and encourage ownership of the program by the target community. Within the PAR framework adapted from Kemmis et al. (2014), the community service

team acts not only as experts but also as facilitators, working with partners in a continuous cycle of problem identification, action planning, acting, observing, and reflecting to achieve self-reliant, sustainable empowerment. The PAR stages are explained in detail in Figure 1. Ensure the work can be repeated as per the provided details. It clearly and concisely presents technical information about the study. Therefore, readers can conduct research based on the techniques presented. Materials and equipment specifications are necessary. Approaches or procedures for the study, together with the data analysis methods, must be presented.

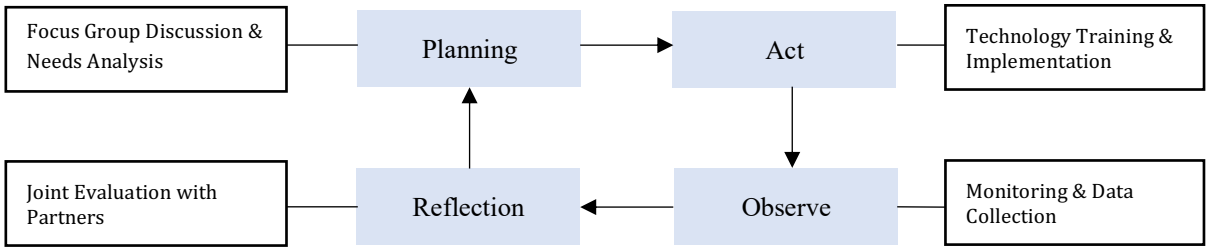


Figure 1. PAR framework adapted from (Kemmis et al., 2014)

This community service activity focuses on the Gebyok Craft Industry Center in Sidorekso Village, Kaliwungu District, Kudus Regency, Central Java. The location was selected for its potential as a Gebyok production center, which has historical and economic value for the region. Partners involved in this program were selected purposively based on their track record, development potential, and willingness to collaborate. The two main partners empowered are: 1) *Partner 1 (Avian Antique): A* business that has been operating for 35 years and is considered one of the pioneers of the Gebyok industry in Kudus. The main problems faced were limitations in design techniques (reliance on manual drawings) and the need to modernize production equipment to improve efficiency and safety, including planers and wood presses; *Partner 2 (Arjuna Antique):* A 17-year-old business focused on contemporary products. Challenges include the need for greater precision in joint construction (replacing manual chiseling with modern chiseling machines), maintaining work area cleanliness, and utilizing unproductive wood waste.

The instruments used in this program consisted of observation sheets, interview guidelines, productivity measurement forms, and documentation tools. Observation sheets were employed to record partner participation, workflow changes, and workplace safety during technology implementation. Semi-structured interview guidelines were designed to explore perceptions and challenges related to production, motif digitization, and marketing. Productivity measurement forms captured quantitative data such as working hours, machine capacity, and actual output to calculate efficiency and effectiveness. Meanwhile, photos, videos, and field notes served as documentation to support reflection and dissemination. Academic experts reviewed instrument validity, while reliability was ensured by consistently applying the same formats across both partners.

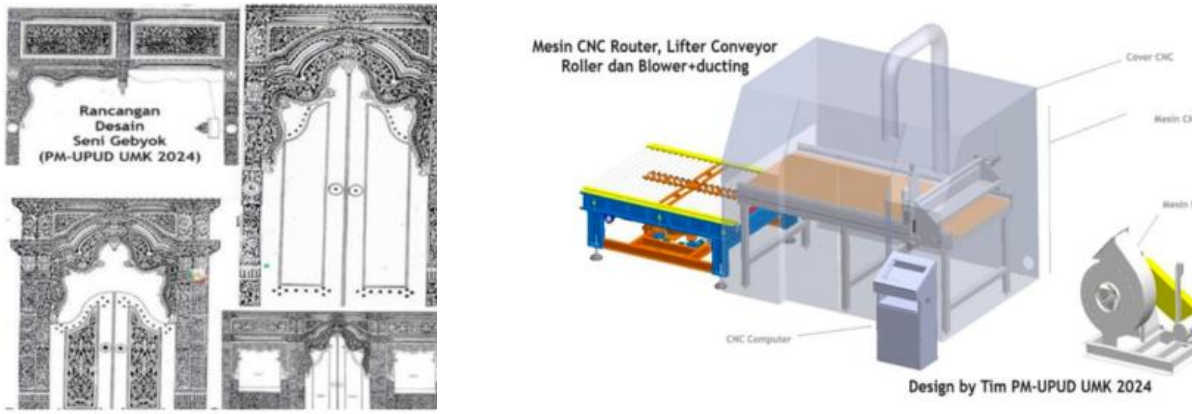
This program involved two partners: Avian Antique and Arjuna Antique. The participants were selected purposively to gain in-depth insight. For the in-depth interview session, three individuals from each partner were involved: the business owner and two senior artisans. Subsequently, a focus group discussion (FGD) was conducted with 10 participants, divided into two groups of five, representing each partner, to explore broader perspectives and facilitate group dynamics. The program is implemented through five main, systematic, and interrelated stages, designed to ensure effective transfer of knowledge and technology: 1) *Socialization and Planning Stage:* The initial stage involved focus group discussions (FGDs) and in-depth interviews with both partners to map out the problems, needs, and expectations in detail. The outcome of this stage was the formulation of a joint action plan encompassing three intervention focuses: (a) product and design digitalization, (b)

production machine innovation, and (c) digital marketing strategy; 2) *Training and Capacity Building Stage:* Based on the action plan, a series of structured trainings are held, covering; 3) *Motif Digitization Training:* Partners are trained to use a smartphone camera-scanning app to digitize sketches, which are then further processed in graphic design software. The goal is to create digital assets for documentation, intellectual property rights, and precise design replication; 4) *Digital Marketing Training:* Partners are guided to create and manage business social media accounts and are introduced to the concept of e-catalogs as a promotional tool to reach a broader market; 5) *Machine Operation and K3 Training:* Technical training is provided for operating new machines, with a strong emphasis on Occupational Safety and Health (K3) aspects to minimize the risk of work-related accidents; 6) *Technology Implementation Phase:* This phase involves the handover and installation of appropriate technologies identified during the planning phase. These include construction demolition machines, wood planers, waste management presses, and industrial vacuum cleaners for cleaning production areas; 7) *Mentoring and Evaluation Phase:* The community service team provides regular mentoring to ensure the new technology is well integrated into the partner's workflow. The evaluation process is conducted in a participatory manner to measure the program's impact and identify challenges that arise during implementation.

To measure the program's success, data were collected using a mixed-methods approach. Qualitative data were collected through direct observation at the work sites, visual documentation (including photos and videos), and field notes during the mentoring process. This data was analyzed thematically to understand changes in work processes, partner perceptions, and the program's social impact. Meanwhile, quantitative data were gathered to measure productivity improvements. Specifically, the effectiveness and efficiency of the construction mortising machine and the wood planer were measured. Data, including actual working hours, actual output (in m^3), and machine capacity, were recorded and analyzed using descriptive statistics to calculate the percentage increase in efficiency. In calculating effectiveness, we assess how well we utilize available time, and efficiency is determined by how well the tool performs when working.

RESULTS AND DISCUSSION

The empowerment program has produced measurable outcomes, including increased production capacity, cultural conservation, and expanded market access. These findings are presented and analyzed in an integrated manner across the following four main pillars. The primary intervention in this program is modernizing work equipment to address inefficiencies in traditional production processes. As Aikin (2021) argues, equipment upgrades can also reduce downtime and maintenance costs, thereby improving quality metrics and reducing waste levels. By increasing the efficiency of the design process in Gebyok craft making, computerization can simplify drawing, drafting, and screening for the production of Kudus gebyok art. New media art technologies, such as 3D printing, can simplify the creation of complex art forms, making traditional crafts like gebyok more accessible and less labor-intensive (Mubarak et al., 2023; Pandey et al., 2022). The integration of these technologies can help preserve traditional arts while making them more adaptable to modern production methods (K & Srinivasan, 2023). The design is created in three stages, developed through 3D visuals and motif modifications that can be applied to wood as a production material—innovation in the development of CNC machines for the production of Kudus gebyok art (Sneineh et al., 2025; Tung et al., 2025). The motif design in Kudus gebyok art is expected to be applied to CNC (Computer Numerical Control) router machines in the production design. According to Daniel et al. (2020) and Wu et al. (2022), CNC enables the production of precise, consistent images over an extended period, demonstrating the machine's ability to perform repetitive artistic tasks with high accuracy. The CNC Rother production machine is shown in Figure 2.



(a) (b)

Figure 2. Visualization of the (a) Art Motif Design and (b) CNC Router Machine Components for the Production of Gebyok Kudus Works

The use of construction weight machines and planing machines accelerated the production of panels for the Kudus gebyok artwork. The implementation results showed a significant increase in productivity, as detailed in the machine design and productivity observation data in Figure 3 and Table 1.

Table 1. Productivity Test Results of New Production Machines

Machine Type	Observation	Available Hours (hours)	Actual Hours (hours)	Actual Output (m^3)	Machine Capacity (m^3)	Effectiveness (%)	Efficiency (%)
Construction	1	10	9	126.44	355.03	90	35.61
Mortising	2	10	9	151.41	355.03	90	42.64
Machine	3	10	9	166.29	355.03	90	46.84
	Average	10	9	148.04	355.03	90	41.70
Wood Planer	1	10	9	10.64	14.34	90	74.20
	2	10	9	10.63	14.34	90	74.13
	3	10	9	13.82	14.34	90	96.37
	Average	10	9	11.67	14.34	90	81.56



(a) (b)

Figure 3. Wood Mortising Machine and Wood Planing Machine

Unlike previous research that primarily examined technology adoption in modern industries, this study demonstrates a different way of applying production innovations, such as mortising and planing machines, within a traditional craft context. This integration shows that modernization does not diminish cultural value but instead supports artisans in focusing on creativity. Scientifically, the results contribute to craft engineering and cultural studies by providing empirical evidence that efficiency and heritage preservation can coexist, offering a replicable model for other heritage industries facing similar challenges.

The data in Table 1 shows that technology adoption has a clear quantitative impact. With an average efficiency of 81.56%, wood planing machines drastically reduced the time required to smooth wood surfaces. Meanwhile, construction planning machines, with an average efficiency of 41.70%, significantly improved hole-making speed and precision compared to manual methods. These increased efficiencies not only accelerated the overall workflow but also allowed artisans to devote more time to the artistic aspect of the carving process (Hamzaoğlu et al., 2022; Mazur-Włodarczyk et al., 2024). As explained by Tung et al. (2025), CNC machines can produce wood carvings with high precision. Socio-economically, although long-term income data are not collected in this program, these efficiency improvements have the potential to directly increase production capacity per craftsperson, thereby increasing income without requiring additional working hours. Thus, technology adoption served as a supporting tool, freeing artisans from repetitive and tedious work (Hirsch et al., 2023; Mahato & Kalita, 2022). Furthermore, the introduction of industrial vacuum cleaners to remove sawdust before finishing directly improved final product quality while creating a healthier, safer work environment.



Figure 4. Application of the Gebyok Art Product Machine

Cultural conservation efforts are a significant achievement of this program. Five distinctive Gebyok Kudus design motifs were successfully documented and digitally transformed using a CamScanner application and graphic design software. Various motif designs, such as the Bandar Atas Motif Design Sketch, Ceplok Soko Motif Design, and Kalaran Motif Design, have been registered as intellectual property rights. Registering IPR gives artisans the legal tools to take action against parties who infringe their designs (Mohanty & Pradhan, 2019). This can include preventing third parties from copying, producing, or adopting features of their designs without permission (Fasi, 2023). Dhar and Tikhak (2024), Samsonova et al. (2020, and Sudarmayana et al. (2022) share the same argument and believe that traditional knowledge and cultural expressions are an important part of cultural heritage. Registering these as IPR helps preserve them from loss or misuse, ensuring that they remain within the community and are passed down from one generation to the next. This process culminated in the registration of these five motifs as Intellectual Property Rights (IPR) in the names of the artisans.

This step has a dual strategic value. First, IPR registration provides legal protection and formal recognition of the authenticity of the artisans' work (Triadi et al., 2025). Second, the digitization of the motifs creates a precise, easily replicable digital archive for future product development (Alami et al.,

2024). Digital archives make traditional art motifs accessible to a broader audience, ensuring their preservation for future generations. These archives can be used by contemporary artists, researchers, and designers to reference and creatively reuse historical materials (Desmond, 2021). However, ensuring the authenticity of digital heritage data is crucial (Larin & Surovtseva, 2021). The digitization process must be carefully managed to avoid altering or misrepresenting the original design (Zabulis et al., 2022). Legal and ethical considerations, such as copyright protection, play a crucial role in maintaining the integrity of digital archives. This contrasts with many other traditional crafts in Indonesia, which are vulnerable to imitation due to a lack of IPR protection, as implied by a study by Sudarmayana et al. (2022). This digitization process also creates a precise digital archive, ensuring that this cultural heritage knowledge is not lost and remains accessible to future generations, in line with the importance of data authenticity in digital preservation emphasized by Nwabueze (017). However, it must be acknowledged that IPR registration is only the first step. Further challenges, which limit the program's results, include monitoring and law enforcement against IPR violations and developing business models for licensing these motifs.

Furthermore, as part of the dissemination and education efforts, a draft book entitled "The Art of Gebyok Kudus as the Identity of Indonesian Heritage Works" has been prepared, as seen in Figure 5. This book is expected to serve as a reference source for disseminating knowledge about the philosophical and aesthetic values of Gebyok Kudus to the broader community. This is crucial for instilling a sense of appreciation for traditional arts in the community. As explained by Wulandari et al. (2024), educational materials that incorporate traditional content can effectively enhance children's appreciation of the arts in Kudus Regency.



Figure 5. Preservation of Local Cultural Motifs in Gebyok Kudus Art and the Gebyok Kudus Art Book

This program successfully transformed the partner marketing approach from a conventional, passive model to a more active and modern one. Partners are now equipped with digital marketing assets and skills. This is crucial for partners because, according to Suprihono et al. (2022), digital marketing plays a crucial role in promoting traditional art forms. The rise of digital platforms,

including websites and social media, has transformed the way contemporary art is sold and consumed (Piancatelli et al., 2020). These platforms provide greater accessibility and efficiency, overcoming geographical and psychological barriers associated with physical galleries (Jurėnienė, 2020). For example, streaming technology and social media platforms are used for sharing and monetization, although their impact on consumer participation and value can vary (Arum et al., 2023; Fathurrahman, 2024). Specifically, a business social media account (Instagram) has been created and optimized, and an e-catalog has been integrated into the website (gebyok.co.id), as shown in Figure 6.

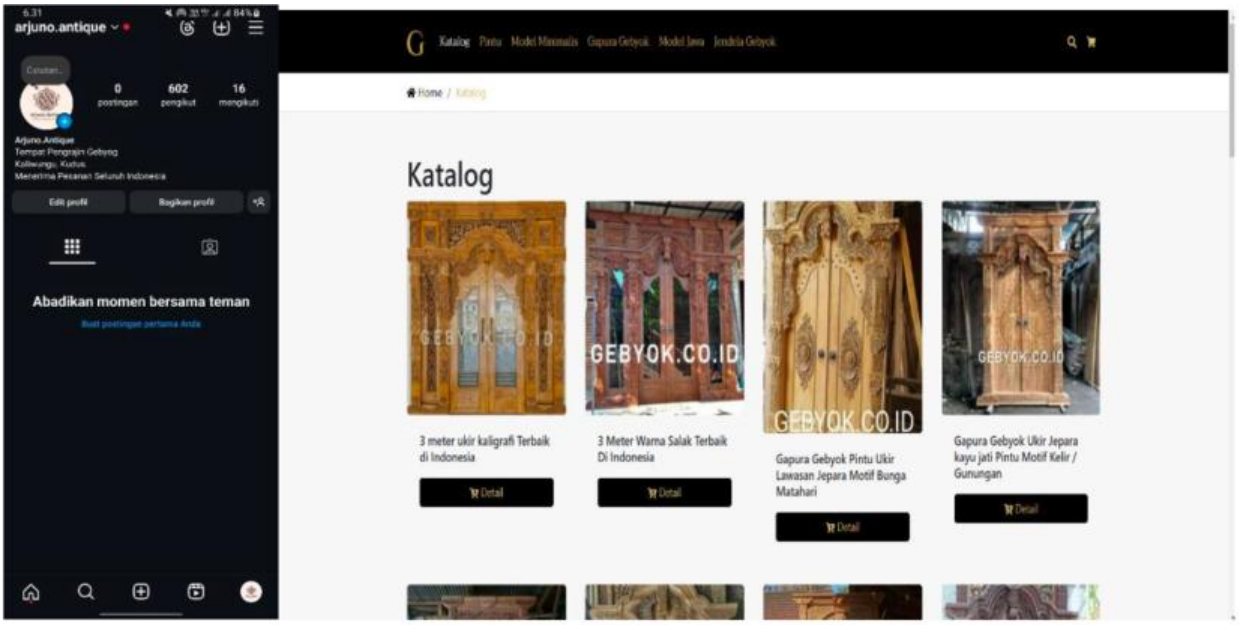


Figure 6. Digital Marketing Design of Gebyok Kudus Art

E-catalog platforms serve as effective channels for artists and entrepreneurs to sell their work directly online, bypassing the need for galleries and traditional intermediaries. This shift enables artists to maintain a greater proportion of sales revenue (Sirois, 2020). The e-catalog developed in this program includes a feature that enables gebyok entrepreneurs to showcase product designs and descriptions, thereby replacing conventional galleries. Additionally, this platform facilitates direct interaction between buyers and sellers via WhatsApp or the platform itself. The gebyok.co.id platform is distinguished by its provision of a multifaceted online payment method, a feature particularly salient given its integration with a diverse array of payment methods. This emerging trend necessitates a transformation within the gebyok industry. Many artists are adopting digital self-marketing strategies, acting as digital entrepreneurs to promote their work. This trend is evident among artists, as stated in Hodgkiss et al. (2019), who found that over 50% of surveyed artists indicated a need for further training in digital marketing. Zhong and Zhang (2025) also show that digital integration can reduce creation time and costs while significantly increasing audience engagement and interaction.

The presence of this digital platform fundamentally changes how partners interact with the market. They can proactively promote products and interact directly with potential consumers from various regions (Gelashvili, 2021). The e-catalog serves as a professional virtual storefront, enabling potential buyers to browse a wide range of products easily. This transformation not only has the potential to increase sales volume but also to build a more modern and trustworthy brand image. Sustainability is the ultimate focus of this program, utilizing a wood waste recycling machine to address the enormous environmental and economic problems caused by wasted production waste.

The often-overlooked problem of wood waste, as explained by Rusmini et al. (2024), can be a valuable resource if appropriately managed. Therefore, adequate management is necessary. This project is not merely management, but a proactive move to introduce a circular-economy approach to the traditional craft of Gebyok Kudus. The initiative's pioneering approach involves recycling sawdust and wood waste into economically sustainable products, thereby providing additional income to artisans and a more sustainable, robust business model.

The recycling of wood waste presents a viable approach towards a circular economy (Haryudiniarti et al., 2025), shifting from the conventional linear "make, use, dispose" model to one of repair, reuse, and recycling. For Gebyok artisans, this means that what was once worthless material is now used as input for new products. This can range from a variety of derivative products, including but not limited to souvenirs, home furnishings, keychains, and composite wood panels for small furniture pieces. The manufacture of these value-added products has been noted to diversify artisans' income sources, thereby reducing their dependence on single, large-scale commissions and making them more resilient to market fluctuations. As established by Elginoz et al. (2024) and Khakimova et al. (2024), wood waste recycling has resulted in the manufacture of economically viable artifacts that are both functional and aesthetically attractive. This exercise can help generate additional income with improved environmental sustainability.

Looking long-term, the combination of waste recycling and the successful creation of derivative products from waste could lead to a significant increase in enthusiasm towards the Gebyok craft industry among younger generations. The opportunity to do something that traditional craftspeople have historically done and to improve the perception of innovation, eco-friendliness, and financial sustainability was enough to encourage interest in countering the perception that the trade is antiquated. This is supported by changes in the attitudes of the youth market, as expressed by Supriyono et al. (2024), indicating that the younger generation tends to choose products that have a positive impact on the environment and society, as well as those of good quality. Therefore, creating an opportunity for artisans to regenerate will ensure the noble trade of Kudus Gebyok continues through sustainable practices. Evidence from studies of other wood-based industries, such as Lukman et al. (2022) and Prasetyo et al. (2023), indicates that environmental benefits will not only provide economic benefits but also contribute to community empowerment and local skill development. Adding the circular-economy aspect to the occupation of Gebyok Kudus artisans means recognizing that they can both update and honor the cultural trade and carry it forward.

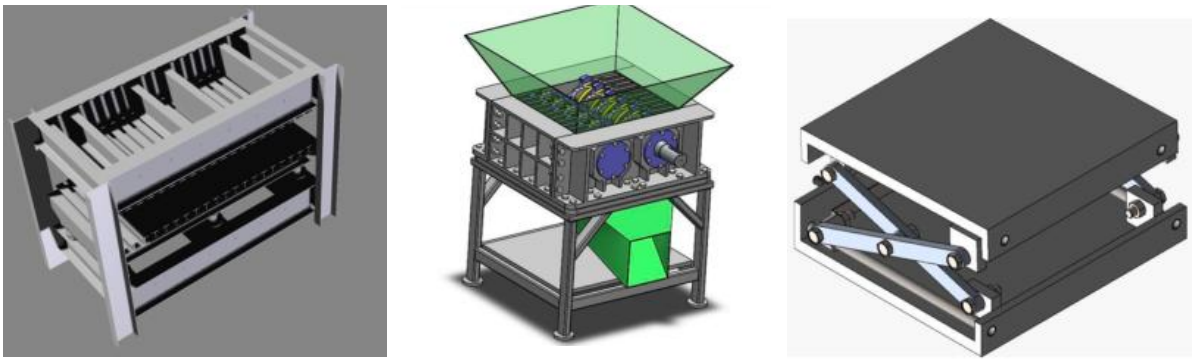


Figure 7. Wood waste processing machine

CONCLUSION

This community empowerment program at the Gebyok Creative Economy Center in Kudus illustrates how the application of technological innovation and digital strategy can improve production efficiency and contribute to the preservation of culture. Theoretically, this study

contributes an integrated empowerment framework for appropriate technology adoption to improve production efficiency, digital asset management for cultural preservation and legal protection (IPR), and digital market integration to enhance artisans' economic capacity. Modern tools like mortising machines and plan machines increased efficiency by 41.70% and 81.56%, respectively, allowing craftsmen-in-charge to pay more attention to the artistic quality of the work. On the other hand, intellectual property rights (IPR) for five different motifs were combined with systems that provided legal protection and maintained cultural integrity, while digital marketing platforms helped promote them in the market and enhance entrepreneurs' capabilities. The implications of these findings are two-fold: first, they demonstrate that modernization and tradition can live side by side without eroding cultural values, and second, they offer a replicable model for other heritage-based creative industries in need of sustainability. In more general terms, this paper provides substantial evidence that cultural heritage industries can be competitive in the digital age without losing their role as tradition-keepers. This program suggests that local governments and development agencies should support heritage industries by facilitating access to technology, IPR registration, and digital literacy training.

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