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Application of Technological Automation and Digitalization of Promotional Efforts in the Home Industry of Wickerwork in Jombang Regency: PAR Method

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Abstract

The wickerwork home industry in Jombang Regency, which utilizes screw pine and bamboo, plays an important role in local employment. However, its development remains constrained by manual production processes and limited marketing strategies. This study aims to examine the implementation of technological automation and the digitalization of promotional efforts in wickerwork home industries using a Participatory Action Research (PAR) approach, consisting of identification, planning, action, observation, and evaluation stages. The program involved two home industries, including owners and employees, in adopting simple automation technologies and digital marketing practices. The results indicate that the application of automation technology improved production efficiency and enabled businesses to better meet customer demand. In addition, digital promotion training covering product photography, content creation, and the use of AI tools enhanced marketing reach through social media, contributing to increased national-level demand. This study highlights that integrating automation and digital marketing can strengthen the competitiveness of small-scale industries. However, sustained mentoring and multi-stakeholder support are essential to ensure long-term impact, expand employment opportunities, and promote business sustainability.

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INTRODUCTION

Small-scale industry or home industry, also known as MSMEs, has become a central point where local people develop their creativity and empower their environment (Mukherjee, 2018; Nursini, 2020; Suminah et al., 2022). It has helped prolong the survival of some regions by stimulating

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their economy (Maksum et al., 2020; Satpathy et al., 2025; Steinerowska-Streb et al., 2022). Moreover, it was once the backbone of the economy back in 1998, when a severe economic crisis erupted (Tambunan, 2020), and in 2020-2022 following the outbreak of the Covid-19 pandemic (Bansilan & Rabajante, 2024). Given these experiences, this all suggests its importance in the growth of local economy.

Jombang Regency, located in East Java Province, represents one of the regions with a substantial concentration of home industries, totaling 4,432 business units (Faizin & Anoraga, 2022). This high concentration is closely associated with the region's abundant natural resources, particularly thorny-pandan leaves and bamboo, which serve as the main raw materials for wickerwork production (Zahro et al., 2024). The availability of these resources has not only enabled the development of wickerwork as a regional flagship product but has also shaped a localized production system rooted in traditional craftsmanship. Furthermore, the wickerwork home industry plays a strategic role in absorbing local labor and sustaining community livelihoods, thereby contributing significantly to regional economic stability. However, despite its potential and socio-economic importance, the sustainability and scalability of this sector remain dependent on its capacity to adapt to evolving production and market demands.

Despite its economic potential, the wickerwork home industry in Jombang Regency faces several structural and operational challenges that hinder its development. The production process remains largely manual, relying on traditional tools and techniques, which limits production capacity, consistency, and efficiency (Tambunan, 2020; World Bank, 2020). In addition, the lack of product diversification and the absence of structured product catalogs constrain the ability of these enterprises to respond to dynamic market demands. From a marketing perspective, promotional activities are still conducted through conventional methods, resulting in limited market reach and low visibility (Taiminen & Karjaluoto, 2015; Ainin et al., 2015). These constraints are further exacerbated by limited knowledge of product development and digital marketing strategies among business actors. As a consequence, many home industries are unable to scale their operations or meet increasing customer demand, and in some cases are forced to decline orders due to production limitations. This condition indicates a critical need for the integration of technological automation and digital-based marketing strategies to enhance both operational performance and market competitiveness.

Previous studies have emphasized the important role of technological advancement in improving production efficiency and product quality, particularly in small and medium-sized enterprises (SMEs) (Chaudhuri et al., 2017; Katz et al., 2023; Nugraheni et al., 2025; Soomro et al., 2024). In parallel, the adoption of digital marketing has been widely recognized as an effective strategy to expand market reach and enhance business performance through online platforms and social media (Bruce et al., 2023; Dwivedi et al., 2021; Fraccastoro et al., 2021; Yuwono et al., 2024). However, existing studies tend to examine technological improvement in production processes and digital marketing as separate domains, with limited attention to their integrated implementation, particularly in traditional craft-based home industries. Moreover, prior research predominantly adopts a technology-driven perspective, with insufficient emphasis on participatory approaches that actively involve business actors in identifying problems and co-developing context-based solutions. This gap is especially evident in the context of wickerwork home industries, where production processes remain closely tied to manual craftsmanship and local knowledge. Therefore, this study offers a novel contribution by integrating technology-based production enhancement and the digitalization of promotional efforts within a Participatory Action Research (PAR) framework, enabling a more adaptive and context-sensitive approach to improving both production performance and market competitiveness. This study aims to analyze the implementation of technology-based production enhancement and the digitalization of promotional efforts in wickerwork home industries in Jombang Regency using a Participatory Action Research (PAR) approach, with a focus on improving production performance and expanding market reach.

METHOD

Considering the aforementioned problems faced by home industries manufacturing wickerwork made from thorny-pandan leaves and bamboo, the research employed the PAR

(Participatory Action Research) method. According to Baum et al. (2006) and McGrath et al. (2025), PAR is a research method that involves local people directly in the research process for the purpose of overcoming their problems and improving their living conditions. Through this method, the owners of home industries manufacturing wickerwork made from thorny-pandan leaves and bamboo played an active role in solving their own problems, even in every single stage of the research. Here are some stages in the application of the PAR method.

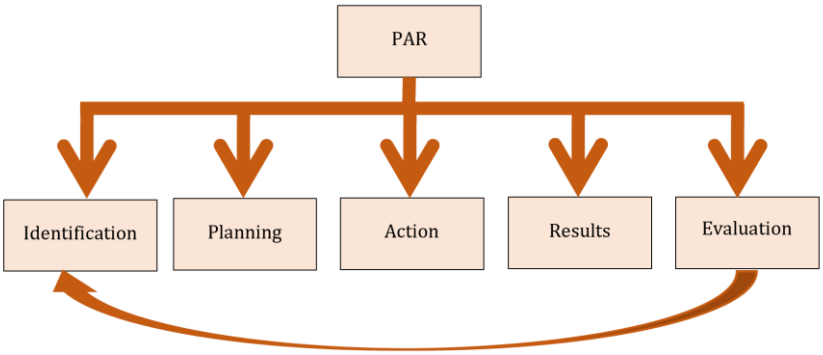

Figure 1. The stages of the PAR method

The first stage of the PAR method is problem identification (Figure 1). Problem identification was made to comprehensively know the problems facing the two home industries whose products are the flagship products of Jombang Regency. The process of identification involved interviews and observation (see Table 1). An open-ended interview was used to collect more detailed data about the problems. The results of the interviews and observation were then analyzed and discussed with the two home industries. The analysis results were subsequently processed in the next stage of research, namely the stage of planning.

Table 1. Guidelines for interviews and observations

Research Purpose	Indicators	Sub Indicators	Interview Questions	Observation
The application of technological automation and digitalization of promotional efforts in wickerwork home industries in Jombang Regency	Technological Automation	Production	– What obstacle is facing your industry nowadays? – How do you resume your production? – How do you surmount the obstacle?	Making observations on production rooms and the use of available technology
	Promotional Digitalization	Products	– What type of products have you manufactured? – What are you planning to develop your products? – Do your products raise the sales revenue of your industry? Please explain.	Making observations on the types of products that have been manufactured and the product classification at your industrial display room
		Management	– How do you classify product types of your industry? – How do consumers order your products?	Reviewing documentation of products used in the home industries
		Marketing	– Which areas have been the target markets for your industrial sales so far? Why? – What marketing strategy have you implemented? – What challenges are you facing with your marketing campaign?	mapping out industrial marketing target areas

Planning, the second stage of the research, was done collaboratively with the owners of Wickerwork Home Industries to determine the next steps. In this stage, which is actually the follow-up stage of the results of interviews and observation in the stage of problem identification, the owners were invited to decide what action takes priority over others and what solution to adopt. Additionally, the timeline and the outcome to be achieved were also set in this stage to know whether the planning done collaboratively can meet its objective.

The next stage involved implementing the plan, where actions were carried out based on the agreements reached during the Focus Group Discussion (FGD) in the stage of planning. All activities that had been planned and agreed upon were carried out jointly with both pandan leaf and bamboo wickerwork home industries, involving employees from both. This stage was then followed by the stage of results, in which the impacts of the implemented plans were felt and experienced by the two home industries.

The final stage was aimed at evaluating the experienced impacts of the plans in order to determine and perform more appropriate actions. This stage involved using the Kirkpatrick model of evaluation, which comprises four levels of evaluation: reaction, learning, behaviour, and results. Unfortunately, due to time constraints for research conduction (eight months of activities), this research took only two of the four levels the Kirkpatrick model of evaluation, namely reaction and learning. In the evaluation stage, observations will be conducted on the reaction level, which will be assessed from socialization, training, mentoring, and technology adoption. Meanwhile, on the learning level, observation and unstructured interviews were conducted to notice any change occurring after the training, mentoring, and technology adoption. Only then could the measurable impact of the adoption of the digitalization process be examined.

To streamline the process of data analysis, all the data collected were coded. The code WWC was used for the results of interviews, while the code OBS was for the results of observation. The data collected from the owners of the two pandan leaf and bamboo wickerwork home industries were marked respectively under the codes HI_1 and HI_2. The codes HI_1_1 to HI_1_5 represented employees producing wickerwork from thorny pandan leaves, while the codes HI_2_1 to HI_2_5 stood for employees producing wickerwork from bamboo. In this way, the code HI_2_4_WWC_07072025 can be understood as the result of an interview with Employee 4, producing wickerwork from bamboo, which was conducted on July 7, 2025. The use of the codes also simplified data interpretation. The results of the data analysis lead to the solution to the problems facing the two pandan leaf and bamboo wickerwork home industries.

RESULTS AND DISCUSSION

The results and discussion section provides a detailed explanation based on the research questions, as follows.

Problem Identification

Problem identification was conducted to have more detailed information about the problems of each home industry. The process of identification involved both the owners and employees of the pandan leaf and bamboo wickerwork home industries. Through interviews and observation at the home industries, the researcher noted four keywords often mentioned by both the owners and employees of the home industries (see Figure 2).

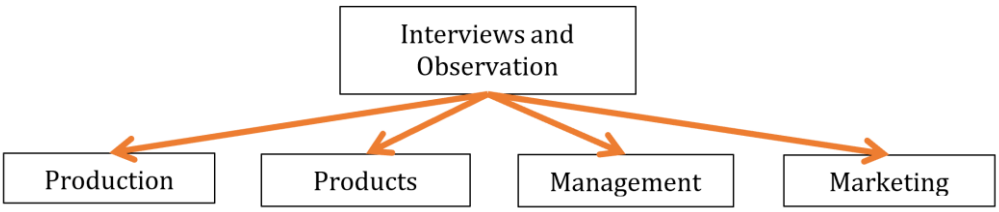

Figure 2. Key Themes from interviews and observations

The researcher recorded from the interviews that:

"The problem of the thorny-pandan leaf wickerwork home industry lies in its production tools. To date, the production process uses a sewing machine for sewing clothes, which, when working with thick weaving materials, produces wickerworks of poor quality. As is known, this type of sewing machines is designed for materials of certain thickness. Employees of the home industry mentioned that the production process of sewing wickerwork into finished products often results in product defects due to the sewing machines' limitations with materials of certain thickness. They added that it takes longer time to remedy product defects (HI_1_1, HI_1_3, and HI_1_5). Another problem is related to customer service. They have to encounter a language barrier, especially when they are dealing with foreign customers. Even after suggesting consumers to view the social media of the home industry, they have difficulty answering the costumers' further questions. This results from the fact that they have not published a catalog of their products, while as a matter of facts, some costumers request it. Such poor marketing strategy and management indeed need improving to intensify the home industry's marketing campaign (HI_1)."

As for the bamboo wickerwork home industry, the researcher recorded that:

"The current constraints are related to processing the bamboo. The longest processes are waiting for the bamboo to dry, splitting the bamboo, bending the bamboo, and shaping it into a round form. This production process is lengthy due to its reliance on weather and manual labor (HI_2). On the other hand, employees who weave sometimes lack materials due to the lengthy and manual process. Other employees explained that the most challenging part is manually cutting the bamboo strips with knives. Additionally, the bending process is still manual, relying on their feet to shape the bamboo. Similar constraints exist in marketing, such as the lack of product specifications in the catalog. The industry focuses on producing products, so marketing efforts are not yet maximized (HI_2_1, HI_2_2, HI_2_3, HI_2_4, and HI_2_5)."

The results of observation also show that the production process in thorny-pandan leaf wickerwork home industry uses garment sewing machines with their intrinsic dimensional limitation. Even employees with field experience of sewing cannot prevent product defects when dealing with wickerwork with certain thickness. Besides, the industry's reliance on resellers and friends in marketing their products also poses another obstacle to its growth. Similarly, the production room of the bamboo wickerwork home industry looks to lack production tools, and almost all of their products are manufactured with manual skills. The room production of the industry seems to be filled with a number of product variants which are left without any classification. Moreover, the owner of the industry often overlooks documenting the industry's finished products because he is busy completing customers' bulk orders. The observation also reveals that this home industry has to deal with a lengthy waiting list of customers coming from many regions in Indonesia, which shows widespread interest to their products. Therefore, it only needs to improve its production process, management, and marketing campaign.

Based on the results of the interviews and observation, the two home industries share the same problems: inefficient production processes, inadequate product categorization, badly handled product management, and old-fashioned marketing strategies that lack technological integration.

Program Plan

Based on the results of problem identification in the previous stage, a focus group discussion (FGD) was held in this stage of planning. The FGD involved the project team and the owners of the two wickerwork home industries. The discussion began with presenting the result of problem identification, which discovered technical problems with production processes, products, management, and marketing strategies. The FGD then provided technical solutions to the prioritized problems of both home industries, as outlined in Table 2.

Table 2. Priority problems and solutions

Aspects	Problems	Solutions
Production	Some production processes continue to utilize manual tools.	Procuring appropriate technology that is suitable for the needs of both wickerwork home industries
Products	The products lack innovations.	Introducing innovations in products
Management	The storage and processing of product images continue to depend on mobile phones	Providing training sessions on utilizing AI tools to enhance the visual appearance of the products
Marketing	The marketplace has not been utilized to its maximum capacity	Providing training sessions on digital marketing

Table 2 outlines the problems facing the two wickerwork home industries and proposed solutions to the problems agreed upon through the FGD. Although both home industries face technical issues in four areas, this research concentrates on three key aspects: production, management, and marketing. Furthermore, the efforts to solve the problems in the three aspects are made in two programs, namely automation technology for the aspect of production and promotional digitalization for the aspects of management and marketing.

Program Action

Based on the results of planning and the order of priority determined by the two home industries, the solution to the problems they are facing is focused on the implementation of two programs, which will be described in detail as follows.

Technological automation

Both the home industry producing thorny-leaf wickerworks and the one producing bamboo wickerworks have not adopted technology in their production processes. The program of technological automation is implemented through the procurement of appropriate technology to hasten production processes. The technology introduced is tailored to the unique needs of both thorny-leaf and bamboo wickerwork industries. Below is a detailed overview of how suitable technological automation is applied in each of the home industries.

The first step is the implementation of appropriate technology in the thorny-leaf wickerwork home industry. The thorny-leaf wickerwork home industry encounters a problem with introducing innovations in their products. In fact, many customers order thorny-leaf wickerwork which combines thorny-pandan leaves with some other materials like leather, synthetic leather, and fabrics.

After identifying the needs, the project team and the owner of the thorny-leaf wickerwork home industry agreed to procure high-speed sewing machines, specialized leather stitching machines, and embroidery/decorative machines (Figure 3).

(i) High-speed sewing machine (ii) Leather stitching machine (iii) Embroidery machines

Figure 3. Three technological automations in the thorny-leaf wickerwork home industry

Indeed, automation technology is implemented not only by procuring technology but also by providing training sessions on how to operate it. The training involved the industry owner and employees involved in production processes. It enabled some employees involved in manufacturing

sewn products to learn special sewing skills. Figure 4 illustrates the training session on the utilization of high-speed sewing machines, Leather stitching machines, and decorative sewing machines.

Figure 4. Training in sewing machine technologies in the thorny-leaf wickerwork home industry

The second is the implementation of appropriate technology in the bamboo wickerwork home industry. This home industry is the second home industry mentored by the team to address its challenges. It is faced with problems with the use of manual tools to split bamboo into strips, dry bamboo, and shape bamboo into rounded forms. In its production processes, the industry uses knives for splitting, the sun for drying (the drying process will take a longer time in the rainy season), and parts of employees' bodies for curving bamboo into circular forms (see Figure 5).

Figure 5. Bamboo processing using manual tools and solar drying

Following the identification of the problems, automation technology is implemented by procuring appropriate technology in the form of bamboo drying oven, bamboo roller, and bamboo splitting machine (Figure 6). The availability of the technology helps streamline the production process that requires rapid drying, bamboo thinning for weaving, and bamboo rounding for circular-shaped products. As a result, the technology helps the home industry meet the demands of consumers rightly on time.

(i) Bamboo drying oven (ii) Bamboo roller (iii) Bamboo splitting machine

Figure 6. Three technological types in the bamboo wickerwork home industry

By way of more detailed explanation, the bamboo drying oven is used for drying bamboo strips for weaving and drying finished products, while the bamboo roller is used for curving bamboo into a round shape for circular-shaped products. Meanwhile, the bamboo splitting machine is for tearing bamboo into thin strips.

The procured technology was fabricated in a specialized industrial equipment workshop in which the technology can be created in accordance with the unique characteristics of bamboo. The equipment has undergone a trial process so as to damage the bamboo fiber. Just as the case in the thorny-leaf wickerwork home industry, the project team also conducted training sessions for the industry's employees to upgrade their technical skills of utilizing the technology (see Figure 7).

Figure 7. Training on bamboo wickerwork technology for home industries

Promotional digitalization

Both thorny-pandan leaf and bamboo wickerwork home industries have not implemented digitalization of promotion in their marketing campaigns. As illustrated in Figure 8, the project team conducted training sessions on generating product images, creating contents using product images, and using Artificial Intelligence (AI) to enhance product images and facilitate the implementation of digital promotion. The team conducted the training, taking into consideration the fact that visuals of the products are highly necessary for the sales and marketing campaign of the thorny-pandan leaf and bamboo wickerwork home industries. In addition to attracting consumers' interest, product visuals are also instrumental in educating consumers about the benefits of products made from natural materials.

Figure 8. Training sessions on promotional. digitalization

The training was held for two consecutive days and involved 17 participants and 5 keynote speakers. It stimulated in-depth discussions of subject matters and facilitated practical implementation of them. On day 1. The training focused on practices of generating product images, which covered both indoor and outdoor settings, and on content creation using a certain application to produce high-quality product images with excellent market value. On Day 2, participants learned to give a final touch to the product images created the previous day. To achieve this, the trainer introduced an application for creating motion graphics or animated visuals. These contents also stated by Gunawan et al. (2022), Ratnadianti et al. (2020), and Sari et al. (2025).

Program Results

The programs collaboratively agreed upon and implemented to solve the problems facing the two home industries have proved to be effective and created powerful impacts. The most noticeable

of these impacts is that the technology training enabled both home industries to acquire technological equipment which adequately fulfils each of the home industries' needs. Now, the industries have technological devices in the list of their assets. Additionally, the programs resulted in improved production efficiency, particularly in bamboo strip processing. Unlike manual processing with knives, splitting machines can help split bamboo into strips with a consistent level of thinnes. Likewise, the embroidery or decorative machine, a new item in the asset list of the thorny-pandan leaf wickerwork home industry, has made it possible for the industry to prevent product defects in the manufacture of any bag, despite the thickness level of the materials.

Another training session focusing on product image generation, content creation, AI application, and digital marketing has also delivered satisfactory result, namely products images with higher market values than the ones produced before the training. The leverage of technology can enhance the quality of product images and add immense value to the product (Figure 9).

Figure 9. The results of product digitalization for marketing improvement

What is more, thanks to the training and mentoring programs, periodically conducted both online and offline, the two home industries are among the Top 15 High-Performing SMEs of 2025 in the Province of East Java in the category of fashion and craft. This is the best achievement of the two home industries and the real impact of the training and mentoring programs to implement and improve digitalization in the home industries, manufacturing the flagship products of Jombang Regency. These impacts are relevant with previous studies (Boffa & Maffei, 2024; Widodo & Putranto, 2024).

Program Evaluation

The active involvement of owners and employees of both home industries has a favorable impact on each stage of the program, which can be seen at every end of training and mentoring sessions. The evaluation of the program was made by adapting Kirkpatrick's model of evaluation to assess participants' satisfaction (reaction level) and their knowledge and skill gain (learning level). The reaction level was assessed through interviews, while the learning level was measured through observation. The evaluation was aimed at digging in-depth data on and directly overseeing the process of addressing challenges confronting both home industries. Furthermore, to monitor the real impact of the overall activities agreed upon during the program, this evaluation was periodically made immediately after the training and two or three months after the training.

The results of the evaluation of automation technology through interviews and observation show that:

"The sewing machine specifically designed for materials with certain thickness brings ease to the production processes. The machine helps reduce the number of product defects and prevents employees from remedy product defects, mostly because of being too thick. Additionally, the

availability of the machine makes it possible the produce innovative products demanded by customers. Fabricated using the latest technology, the machine also allows employees to learn new technology (HI_1_2, HI_1_4, and HI_1_5).

"The procured technologies are enormously helpful to employees and shorten the prolonged duration of bamboo processing before production. Notably, the bamboo drying oven speeds up bamboo drying process, which used to take several days to dry bamboo and relied on weather conditions. The bamboo roller frees employees from manual processes of curving bamboo, saving much time for other activities. Employees of weaving division feel greatly assisted by the adequate stock of bamboo strips prepared by using the bamboo splitting machine, in place of knives, which need much longer time (HI_2_1, HI_2_2, HI_2_3, HI_2_4, and HI_2_5)."

Furthermore, an evaluation was also made to assess the implementation of training in product images, content creation, the leverage of AI, and digital marketing. The results of the interviews recorded that:

"The employees have actually attended this kind of training before, but they have never put what they have learned into practice yet. As a matter of fact, product image training, even with simple tools available in the industry, offers valuable experience if followed by hands-on implementation. Content creation training utilizing digital platforms yields optimal results, producing more engaging and visually appealing content. Moreover, the training in the leverage of AI in which animated product images add a touch of life to the products. However, the most important training is utilizing marketplaces to support products and increase sales (HI_1 and HI_2)."

After two months of technology training, observations reveal that employees are noticeably more enthusiastic and engaged in their work. Technology adoption has brought an ease of job processes and encourages owners of both home industries to introduce innovations in their products. The training, which emphasizes hands-on practice, has significantly boosted creativity in each of the home industries. The observations were conducted not only in the mentoring sessions but also through visiting the social media of both industries.

Based on the aforementioned discussion and exploration, the application of automation technology and promotional digitalization, supported by periodically-conducted mentoring sessions, greatly contributes to the growth and development of the two home industries. This success can be attributed to the active involvement and participation of both industries and their commitment to put into operation the plans that were collaboratively agreed upon by way of overcoming any obstacle in the way of their industries' development (Dostie et al., 2025; Leixnering et al., 2025).

CONCLUSION

The program of the application of technological automation and promotional digitalization in the thorny-pandan leaf and bamboo wickerwork home industries in Jombang Regency contributes to the growth and development of both home industries. The success of the program reflects great credit on both home industries for being actively involved in every stage of the program and completely committed to overcoming their problems by adopting solutions that they developed through a collaborative process. The application of technological automation helps increase the productivity of both industries in their effort to satisfy customers' demand. Similarly, the application of promotional digitalization contributes to the improvement of their marketing strategy through social media, increasing the number of demands from all over the country. However, due to the low budget allocated by the government, the application of technological automation and promotional digitalization has limitations, especially in the number of industries involved. The automation technology program involved only one thorny-pandan leaf wickerwork home industry and one bamboo wickerwork home industry in Jombang Regency, while the promotion digitalization program involved only one home industry. Moreover, the improvement of technological automation and promotional digitalization needs sustainable mentoring programs supported by any related stakeholders to create employment opportunities for local workers and increase the competitiveness of home industries at the national and international levels.

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