

Accelerating Women-Owned MSMEs Through Digital Financial Literacy, Bookkeeping Adoption, and E-Commerce

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ABSTRACT

Background: Women-owned MSMEs in Balaraja continue to face challenges in financial recording, digital financial management, and access to wider online markets. These limitations reduce their ability to manage cash flow, strengthen business credibility, and improve business sustainability.

Contribution: Development of an integrated empowerment acceleration model that combines financial literacy, digital bookkeeping adoption, and e-commerce utilization to strengthen the sustainability and competitiveness of women-owned MSMEs.

Method: This community service program implemented an integrated empowerment model through training, digital tool development, and structured mentoring. A total of 55 women-owned MSMEs participated in the training stage, while 22 selected MSMEs continued to the implementation and mentoring stage.

Results: The program significantly improved participants' knowledge, digital financial literacy, and digital business practices. Knowledge scores increased from 56% to 78% and from 60% to 85% across the two stages, while digital financial literacy scores rose from 64% to 76% and from 66% to 82%. Online market expansion improved from 20% to 50%, the Empowerment Index increased by 22.57%, and average turnover rose by 12%.

Conclusion: The findings indicate that women-owned MSME empowerment becomes more effective when digital financial literacy is integrated with bookkeeping tools, e-commerce facilities, and continuous mentoring.

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1. Introduction

Digitalization has transformed accounting and financial management practices by shifting the process of recording, controlling, and reporting from paper-based manual routines to a more integrated, data-driven, and increasingly real-time system [1]. This change is particularly relevant for micro and small businesses because the quality of accounting information affects planning, liquidity management, access to financing, and business resilience when facing shocks [2]. In the context of community empowerment, digital transformation should not only be understood as technology adoption, but also as a way to strengthen economic inclusion and business capacity [3], [4].

In the context of women's MSMEs, digital transformation is important to expand market access, financial services, and business growth opportunities [3], [4]. In Balaraja District, Tangerang Regency, female MSMEs have strong potential, dominated by the food sector (65.3%), basic necessities (22.7%), fashion (4%), handicrafts (4%), beverages (2.7%), and services (1.3%). However, the majority still rely on local markets, conventional marketing (80%), and cash transactions, while the understanding of e-commerce and digital financial management is also low. This shows that the business growth potential has not been fully supported by the adequate use of digital technology.

Previous literature emphasizes that increasing digital literacy and financial capabilities can improve business performance when actors face barriers to market access and financial access. Digital financial literacy proves important for the financial inclusion of women entrepreneurs [5], while digital financial inclusion can support women's entrepreneurship by reducing financing and information constraints [6]. In terms of trade, the adoption of e-commerce in developing countries still faces issues of trust, payment security, and ecosystem readiness [7]. The TOE perspective also shows that resources, organizational readiness, and local support are critical to the success of e-commerce adoption [8]. In addition, the benefits of digital accounting systems are highly dependent on continuous use, user competence, and organizational readiness [9].

In the context of Balaraja, these challenges intersect with various studies that highlight the limited market access and technology utilization in MSMEs [10], the need to strengthen digital literacy and financial literacy [11]–[13], and the limited use of e-commerce and digital marketing platforms for women MSMEs [14]–[17]. Thus, women MSMEs in Balaraja face double barriers, namely low financial literacy, especially in the disciplines of cash flow, bookkeeping, debt management, and capital planning [2], [9], [18], as well as limited digital literacy and e-commerce utilization which causes conventional marketing and wider market access to be limited [14], [15]. The priority problems faced by MSMEs in Balaraja are presented in [Figure 1](#).

Based on the empirical conditions and literature findings, this community service program designed an integrated acceleration path that connects digital financial literacy, concrete financial accounting practices, and the use of e-commerce for market expansion. This approach is in line with the view that the value of accounting digitization arises when technology is truly

integrated into organizational processes and routines, rather than simply installed as a tool [1]. Operationally, the solution is realized through financial literacy, digital literacy, and e-commerce training; the preparation of technology-integrated financial accounting and reporting systems; development of digital platforms; as well as assistance in the use of bookkeeping systems and online sales channels so that adoption becomes a work habit [5]–[9]. This strengthening is also supported by evidence that digital transformation can improve the efficiency of financial management and expand market access [19], as well as by previous service studies and research on technological innovation and the importance of accounting information systems for MSMEs [20].

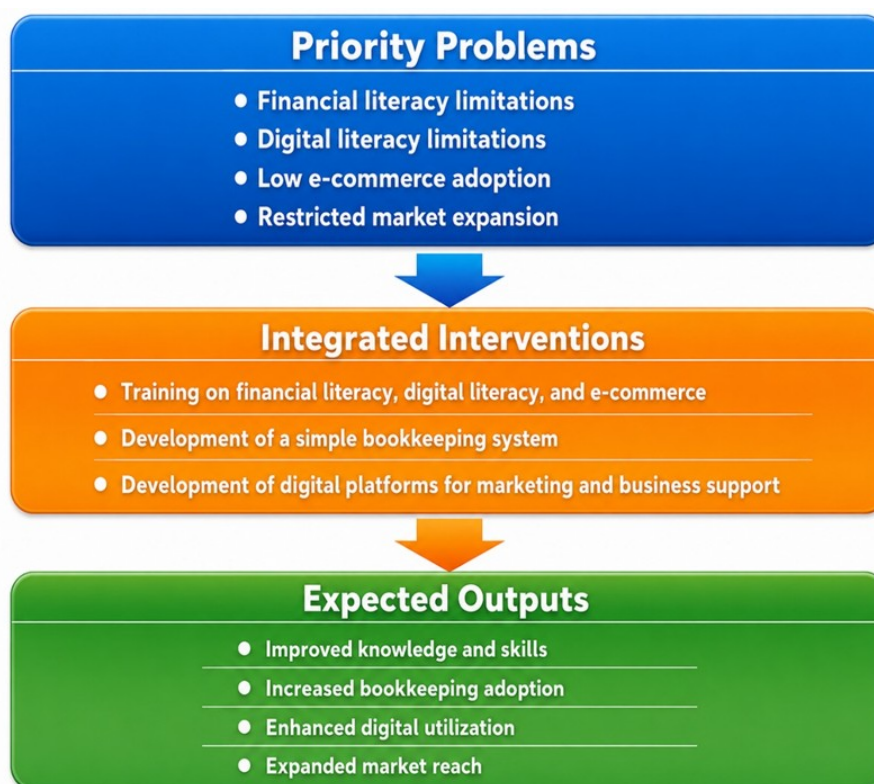


Figure 1. Priority problems and integrated intervention framework for Women-owned MSMEs in Balaraja district

Despite the growing number of studies on digital financial literacy, e-commerce adoption, digital bookkeeping, and MSME empowerment, previous studies have generally examined these issues in separate streams of literature [21]. Studies on digital financial literacy have mainly emphasized financial knowledge, financial inclusion, and access to formal financial services among women entrepreneurs, showing that digital financial literacy improves women's engagement with formal banking and digital financial services [5], [22]. Similarly, studies on e-commerce adoption in MSMEs have mostly focused on technology adoption, digital platform readiness, marketing performance, customer reach, brand recognition, and transaction-related systems, particularly in relation to business performance and financial inclusion outcomes [16], [17], [23]. Meanwhile, studies on digital bookkeeping and digital accounting systems have largely concentrated on accounting technology adoption,

continuance intention, perceived usefulness, system quality, and organizational performance, without directly linking these systems to market expansion and women's economic empowerment [9], [24], [25]. This indicates an important research and practice gap: limited empirical evidence is available on how digital financial literacy, bookkeeping adoption, and e-commerce utilization can be integrated into a single community-based empowerment model, especially for women-owned MSMEs in local Indonesian contexts such as Balaraja.

The novelty of this program lies in the development and evaluation of an integrated acceleration model that combines digital financial literacy, digital bookkeeping adoption, and e-commerce utilization within a single intervention pathway. Unlike stand-alone training programs that only focus on knowledge transfer, this model connects capacity building with operational digital tools and structured mentoring. Participants were not only introduced to digital financial and marketing concepts, but were also guided to apply them through SiBatik bookkeeping, e-commerce utilization, website-based branding, and online market expansion [1], [7], [9]. Therefore, this article contributes to community empowerment literature by offering a practical and measurable model for strengthening women-owned MSMEs through integrated digital transformation. The model also provides empirical evidence that financial recording capacity, digital market access, and online business visibility can reinforce one another in supporting MSME sustainability [2], [5], [6].

2. Method

This community service program applies a community-based empowerment approach through a combination of training, digital platform development, and implementation assistance to increase financial literacy and the use of e-commerce as a strategy for expanding the women's MSME market in Balaraja District. The work stages are designed sequentially so that (i) needs and root causes are identified early on, (ii) the chosen solutions are relevant to the partner context, and (iii) the adoption of new practices can be measured through baseline and endline indicators.

The program was implemented in five phases: inception, focus group discussion (FGD), socialization and training, construction, and transition. During the inception phase, the team conducted field observations and collected preliminary data with the head of the MSME Corner and women-owned MSME actors in Balaraja District to map existing conditions and design the intervention. During the FGD phase, group discussions were conducted to gather specific information, build trust and openness, and explore participants' perceptions, attitudes, and experiences. The results of the FGD were then used to identify solution options and determine the socialization and training agenda required by the participants. These phases were translated into the sequence of activities presented in [Figure 2](#).

At the socialization and training stage, the program began with Training 1, held on August 12, 2025, and attended by 55 women-owned MSMEs. This activity served as the initial intervention stage to provide basic capacity building for all target participants. The training materials covered digital financial literacy, digital literacy, and e-commerce, with the aim of

strengthening participants' understanding of digital-based business management while opening opportunities for market expansion. In addition to serving as an initial capacity-building activity, Training 1 also functioned as a mapping stage to identify the condition, potential, and readiness of each MSME to participate in the advanced stages of the program.



Figure 2. Stages of the community service program

After Training 1, the team curated participants based on product feasibility, operational readiness, and the potential for sustained use of digital technology. The curation results showed that 22 MSMEs met the criteria to proceed to the implementation stage. Therefore, Training 2, held on September 27, 2025, was attended only by these 22 MSMEs. In the next stage, the program continued with the development of digital support facilities during the construction phase, including the e-commerce platform, the SiBatik bookkeeping application, and the Balaniaga website. This stage was then reinforced through intensive assistance during the transition phase from October 1 to October 30, 2025. Thus, the curation process formed part of the program strategy to focus implementation on MSMEs that were considered the readiest.

The reduction in the number of participants from 55 in Training 1 to 22 in Training 2 was not treated as ordinary participant attrition, but as part of a purposive curation process. This curation was conducted because the second stage required participants to actively use the digital tools developed by the program, including the e-commerce platform, SiBatik bookkeeping application, and Balaniaga website. The curation process considered three main criteria: product feasibility, operational readiness, and the potential for sustained use of digital technology. Product feasibility referred to whether the MSME products were ready to be promoted through digital channels. Operational readiness referred to the ability of the business owners to participate in mentoring and apply digital tools in their daily business activities. The potential for sustained digital adoption referred to the likelihood that participants would continue using the tools after the program ended.

However, this curation process also has methodological implications. The endline results represent the progress of MSMEs that had higher readiness to continue to the implementation stage, rather than the full initial group of 55 participants. Therefore, the baseline and endline results should be interpreted as developments across two intervention stages, not as a strict repeated measurement of exactly the same participant group. This limitation was considered in interpreting the results, especially in relation to selection bias and generalizability.

For evaluation purposes, this condition indicates that the baseline results reflect changes in the initial participant group, while the endline results represent the development of the curated group that proceeded to the implementation stage. Program achievements were measured as percentages so that baseline and endline results could be compared clearly. Measurements were conducted at two points: baseline before and after Training 1, and endline before and after Training 2 and mentoring. The evaluation employed three instruments: a 10-item pre-test/post-test to measure participants' knowledge, a 12-item Likert-scale questionnaire to assess digital financial literacy skills and attitudes, and a digital adoption observation rubric covering four main indicators, namely e-commerce utilization, website utilization, bookkeeping using SiBatik, and market expansion through online marketing.

To strengthen measurement rigor, the evaluation instruments were aligned with the objectives of the community service program and the competencies targeted in the intervention. The knowledge test was designed to assess participants' understanding of digital financial literacy, basic bookkeeping, and e-commerce concepts, reflecting the importance of measuring digital financial capability and financial literacy among entrepreneurs [5], [26]. The Likert-scale questionnaire measured participants' perceived skills and attitudes toward transaction security, financial recording habits, separation of business and personal finances, and the use of digital bookkeeping tools, consistent with prior studies on technology acceptance, perceived usefulness, and digital accounting system adoption in SMEs [24], [25]. In addition, the observation rubric was used to assess practical adoption during the mentoring stage, particularly in relation to e-commerce utilization, website-based business visibility, SiBatik bookkeeping, and online market expansion. This approach is relevant to previous research emphasizing that SME digital transformation should be evaluated not only through knowledge and perception, but also through actual adoption of e-commerce platforms, digital marketing tools, and operational systems [16], [17], [27]. Together, these instruments enabled the evaluation to capture participants' knowledge acquisition, perceived readiness, and practical application of digital tools in supporting MSME business transformation.

Content validity was ensured through expert review by the community service team and by aligning the evaluation instruments with the training materials, mentoring activities, and expected program outcomes, consistent with the view that content validity should consider the relevance, comprehensiveness, and comprehensibility of measurement instruments [28], [29]. Instrument clarity was also checked during implementation to ensure that the questions and observation indicators were understandable for MSME participants, following prior instrument-development practices that emphasize expert validation and pre-testing before

wider application [26]. Although formal statistical reliability testing was limited due to the community-based and practice-oriented nature of the program, evaluation rigor was strengthened through data triangulation. By combining knowledge test results, self-reported questionnaire responses, and observation-based adoption indicators, the evaluation provided a more comprehensive picture of participants' knowledge development, perceived readiness, and practical application of digital tools in digital financial literacy, bookkeeping adoption, and e-commerce utilization [27], [30]. As seen in Eq. (1), Eq. (2) and Eq. (3), to summarize the level of empowerment in a single composite score, the Empowerment Index (EI) was calculated as the average of the four practice indicators.

$$IK = (E + W + B + M) / 4 \quad (1)$$

$$\Delta IK = IK_{\text{endline}} - IK_{\text{baseline}} \quad (2)$$

$$\Delta IK (\%) = ((IK_{\text{endline}} - IK_{\text{baseline}}) / IK_{\text{baseline}}) \times 100\% \quad (3)$$

Description:

E = e-commerce utilization

W = website utilization

B = application of bookkeeping (SiBatik)

M = market expansion (online marketing)

The Empowerment Index was developed to summarize the practical digital empowerment outcomes targeted by the program. Its four indicators were selected because they represent the main dimensions of the integrated intervention: e-commerce utilization, website utilization, digital bookkeeping, and online market expansion. E-commerce utilization reflects participants' ability to use digital channels for product promotion and sales activities, consistent with studies showing that e-commerce adoption supports MSME performance, customer awareness, brand recognition, and financial inclusion [16], [23]. Website utilization captures participants' capacity to strengthen digital visibility, branding, and access to business information, which is central to how small businesses build brands and improve their presence in digital markets [31]. Bookkeeping using SiBatik represents the adoption of financial recording habits and the ability to manage business transactions more systematically, aligning with studies on digital accounting and cloud accounting adoption in SMEs [24], [25]. Meanwhile, market expansion through online marketing reflects participants' ability to reach broader customers beyond conventional local markets, as digital marketing and platform adoption can enhance SME performance, customer reach, and market expansion [32], [33].

Each indicator was given equal weight because the program was designed as an integrated empowerment model in which digital marketing, digital visibility, bookkeeping, and market expansion were considered equally important for strengthening MSME capacity. Equal weighting was also used to maintain simplicity and transparency in the evaluation process, making the index easier to communicate to MSME participants, local stakeholders, and community empowerment institutions.

3. Results and Discussion

3.1. Authors and Affiliations

This community service program was implemented as planned and generated both operational outputs and measurable outcomes. The program consisted of three main components: training preparation, training implementation, and evaluation. The preparation stage involved the development of teaching materials to support the training sessions. This included the preparation of training modules that could be accessed and studied by women-owned MSMEs in Balaraja District to strengthen their understanding of digital financial literacy, bookkeeping, and e-commerce. The training module was also registered as an intellectual property output of the community service team at the University of Muhammadiyah Tangerang.

The implementation results show in [Figure 3](#), that the planned activities were carried out successfully and produced measurable outcomes. The program began with socialization and Training 1 on August 12, 2025, attended by 55 women-owned MSMEs in Balaraja District. This activity was supported by key stakeholders, including the Head of Balaraja Subdistrict, Mr. Willy Patria, S.E., M.Si., and the Secretary of the Tangerang Regency Office of Cooperatives and Micro Enterprises, Mrs. Dra. Hj. Dhian Hartati, M.Si.



Figure 3. Training Sessions 1 and 2

After the initial stage, the program continued with the development of digital support facilities, including an e-commerce platform completed on August 7, 2025, the SiBatik bookkeeping application and its user manual completed on August 27, 2025, and the Balaniaga website together with its user guide completed on August 31, 2025. The availability of these three tools indicates that the program did not focus solely on knowledge enhancement through training, but also provided digital solutions that could be directly used by MSMEs in their business operations.

The next stage of the program was reinforced through Training 2, held on September 27, 2025, and attended by 22 MSMEs that had progressed to the implementation stage. This activity was attended by the Head of Balaraja Subdistrict, Mr. Randi Bachtiar, S.H., and again received support from the Secretary of the Tangerang Regency Office of Cooperatives and Micro Enterprises, Mrs. Dra. Hj. Dhian Hartati, M.Si. Overall, the major components of the

program were fully implemented, including the preparation of socialization materials and the provision of three digital channels developed in stages: an e-commerce platform for marketing and transactions, the SiBatik bookkeeping application for financial records, and the Balaniaga website for information dissemination and branding, each supported by a user manual in Figure 4. These results indicate that the intervention extended beyond training and provided operational facilities that could be directly utilized by MSMEs.

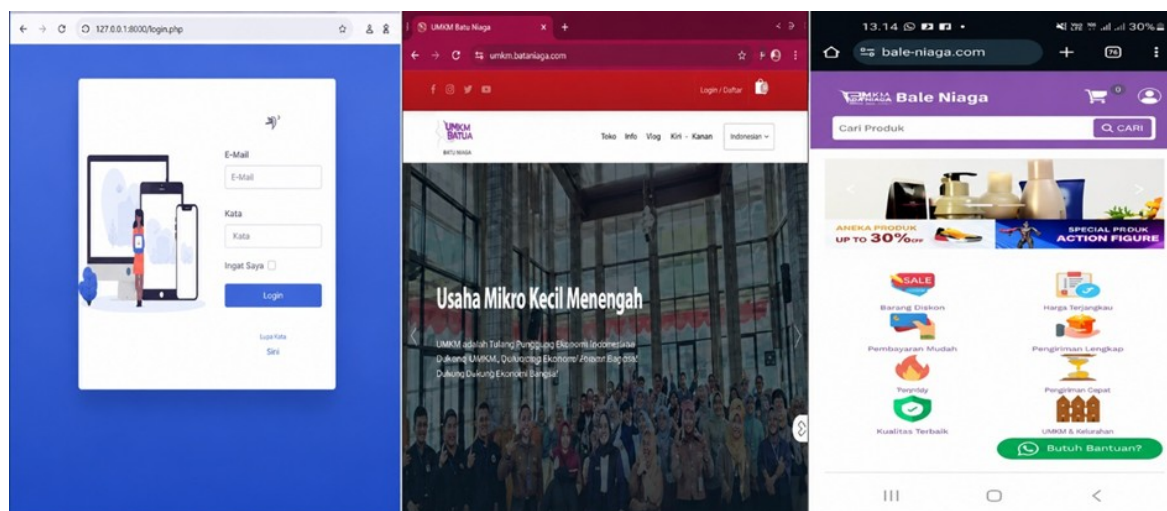


Figure 4. Digital tools developed to support bookkeeping, branding, and online marketing

For evaluation purposes, baseline data were collected from 55 women-owned MSMEs who participated in Training 1. After this stage, the team conducted a curation process based on product feasibility, operational readiness, and the potential for sustained use of digital technology. The results showed that 22 MSMEs met the criteria to proceed to the implementation stage, Training 2, and intensive mentoring. Therefore, the endline data represent the progress of these 22 curated MSMEs. Accordingly, the findings reflect developments across two intervention stages rather than repeated measurements of exactly the same participant group.

The results of the 10-item pre-test/post-test indicated an increase in participants' knowledge following the training. At baseline ($n = 55$), the average score increased from 56% to 78%, representing an increase of 22 percentage points. At endline ($n = 22$), the average score increased from 60% to 85%, representing an increase of 25 percentage points. These findings indicate that participants' understanding improved after the training and mentoring activities.

The results of the 12-item Likert-scale questionnaire also showed improvement in digital financial literacy skills and attitudes. At baseline ($n = 55$), the average score increased from 64% to 76%, while at endline ($n = 22$), it increased from 66% to 82%. This improvement reflects positive changes in transaction security awareness, bookkeeping habits, the separation of business and personal finances, and the use of bookkeeping applications.

These improvements indicate that the intervention was effective not only in increasing participants' conceptual understanding, but also in strengthening their confidence and attitudes toward digital financial practices. The increase in knowledge scores shows that

participants were able to absorb the training materials, while the improvement in digital financial literacy scores suggests that participants began to recognize the importance of transaction security, systematic bookkeeping, and the separation of personal and business finances. This distinction is important because knowledge improvement does not always lead directly to behavioral change. Therefore, the combination of training and mentoring was necessary to encourage participants to translate knowledge into practical business routines.

Based on the digital adoption observation rubric, intensive assistance was provided from October 1 to October 30, 2025, to strengthen all practice indicators from baseline to endline. E-commerce utilization increased from 84% to 89%, website utilization from 82% to 88%, bookkeeping using SiBatik from 40% to 50%, and market expansion through online marketing from 20% to 50%. The program also showed an economic impact, reflected in an average turnover increase of 12%. Table 1 presents the changes in practical adoption indicators and economic impact after the intervention. The data show that all adoption indicators increased, although the magnitude of improvement varied across indicators. The largest increase occurred in online market expansion, while the increase in bookkeeping adoption was more moderate. This pattern indicates that participants responded more quickly to market-oriented digital practices than to financial recording routines.

Table 1. Baseline–Endline Adoption and Economic Impact

No	Indicator	Baseline	Endline	Increase (points)	Relative increase
1	E-commerce utilization	84%	89%	+5	+5.95%
2	Website utilization	82%	88%	+6	+7.32%
3	Application of bookkeeping (SiBatik)	40%	50%	+10	+25.00%
4	Market expansion (online marketing)	20%	50%	+30	+150.00%
5	Economic impact (turnover)	–	+12% (average)	+12%	–

The Empowerment Index shows a positive change between baseline and endline. The index increased from 56.50 to 69.25, representing an absolute gain of 12.75 points or a relative increase of 22.57%. This finding indicates that the program contributed to strengthening the practical digital empowerment of women-owned MSMEs.

$$IK_{\text{baseline}} = (84 + 82 + 40 + 20) / 4 = 56.50$$

$$IK_{\text{endline}} = (89 + 88 + 50 + 50) / 4 = 69.25$$

$$\Delta IK = 69.25 - 56.50 = 12.75 \text{ points}$$

$$\Delta IK (\%) = 12.75 / 56.50 * 100\% = 22.57\%$$

The increase in the Empowerment Index from 56.50 to 69.25 shows that the program contributed to strengthening practical digital empowerment among curated participants. However, the index should not be interpreted merely as a numerical achievement. Conceptually, the increase reflects the combined progress of participants in adopting digital

marketing channels, strengthening digital visibility, applying bookkeeping tools, and expanding market reach. The relatively high baseline scores for e-commerce and website utilization indicate that participants were already more familiar with market-facing digital tools. In contrast, the lower baseline and endline scores for bookkeeping suggest that financial recording remained a more challenging practice to institutionalize. This finding reinforces the need for longer mentoring to transform bookkeeping from a training output into a daily business habit.

These findings indicate that an integrated approach combining training, operational digital facilities, and mentoring was effective in strengthening the capacity of women-owned MSMEs in Balaraja. The program did not stop at knowledge transfer, but also provided digital tools that could be directly integrated into business practices, namely the e-commerce platform, the website, and the SiBatik bookkeeping application. This finding is consistent with the view that digital transformation becomes more meaningful when technology is embedded in work processes and routines [1]. It also supports previous studies highlighting the importance of digital financial literacy and digital financial inclusion for women entrepreneurs [5], [6].

The increase in pre-test/post-test scores at both baseline and endline indicates that participants experienced substantial knowledge improvement after the intervention. Likewise, the increase in Likert-scale scores suggests improvement in skills and attitudes, particularly in transaction security, bookkeeping habits, the separation of business and personal finances, and the use of bookkeeping applications. These results support previous findings that the benefits of digital accounting systems and e-commerce depend heavily on user competence, organizational readiness, and sustained use [7]–[9].

However, not all aspects of digital transformation developed at the same pace. The greatest increase occurred in online marketing, while the increase in bookkeeping practices using SiBatik was relatively smaller. This may be explained by the fact that bookkeeping requires a disciplined and repetitive routine, creating greater behavioral barriers. In contrast, digital marketing tends to be adopted more quickly because its benefits are more immediately visible in the form of promotion and wider market reach. This pattern is consistent with studies showing that market-oriented digital practices are often adopted more readily than financial record-keeping practices that require habituation [14], [15].

From a technology adoption perspective, the different pace of adoption across program indicators can be explained by perceived usefulness, perceived ease of use, and the immediacy of perceived benefits, as suggested in technology adoption studies on SMEs and digital systems [17], [25]. E-commerce and online marketing practices were adopted more quickly because participants could directly observe their benefits through wider product exposure, customer inquiries, customer awareness, and potential sales [16], [23]. These practices were also closely related to participants' existing promotional habits, making the transition from conventional marketing to digital marketing relatively easier. In contrast, SiBatik bookkeeping adoption required greater behavioral discipline, consistency, and repeated daily routines.

Studies on digital accounting systems show that sustained use depends not only on perceived usefulness and ease of use, but also on system quality, satisfaction, compatibility, organizational readiness, and continuance intention [24], [25]. For many micro-business actors, financial recording may therefore be perceived as an administrative burden rather than an activity that immediately generates income. This helps explain why the increase in SiBatik bookkeeping adoption was positive but slower than the increase in online market expansion.

The findings suggest that digital empowerment among women-owned MSMEs is not merely a matter of providing access to technology, but also of transforming business routines. Digital tools become effective when participants perceive them as useful, easy to integrate into daily operations, and relevant to their immediate business needs, consistent with technology adoption perspectives emphasizing perceived usefulness, perceived ease of use, compatibility, and organizational readiness [17], [25], [34]. In this program, market-oriented tools were adopted more rapidly because they were directly linked to visible sales opportunities, such as broader product exposure, customer inquiries, customer awareness, and online transactions [16], [23], [35]. In contrast, bookkeeping required deeper habit formation because its benefits, including improved cash flow control, pricing accuracy, debt management, financial reporting quality, and financial credibility, are often realized in the medium to long term [24], [36], [37]. Therefore, future empowerment programs should distinguish between digital tools that generate immediate visible benefits and those that require longer behavioral adaptation.

The average turnover increase of 12% suggests that the intervention began to produce economic effects. However, this short-term revenue impact should be interpreted cautiously, as it may also be influenced by production capacity, content and branding quality, price competitiveness, and operational readiness. In this respect, the findings are also consistent with previous studies showing that technological innovation, accounting information systems, and web-based systems can improve MSME performance [20]. The increase in the Empowerment Index from 56.50 to 69.25 confirms that the intervention strengthened the practical digital empowerment of participating women-owned MSMEs. Therefore, similar programs should be reinforced through multi-level mentoring tailored to participant readiness, especially to build stronger bookkeeping habits and improve the quality of digital marketing aimed at sales conversion.

In the context of women's economic empowerment, the program demonstrates that digital transformation can strengthen agency, capability, and market participation among women-owned MSMEs. Digital bookkeeping enabled participants to better understand their financial position, while e-commerce and website utilization created opportunities to improve business visibility and reach broader markets. These outcomes are particularly important because many women-owned MSMEs operate in informal and local market environments where financial records, digital visibility, and market access are often limited [5], [38], [39]. By combining literacy development, practical digital tools, and structured mentoring, the program helped participants move from passive technology exposure to active digital business practice.

The integrated model also offers practical implications for community service programs. Training alone may improve knowledge, but it is often insufficient to generate sustainable behavioral change. Conversely, providing digital tools without mentoring may lead to low utilization because participants may lack confidence, technical skills, or routine discipline. Therefore, the findings support the need for a combined intervention design that integrates capacity building, simple digital tools, and post-training assistance. This approach is particularly relevant for women-owned MSMEs, which require not only access to technology but also contextual support to embed digital tools into daily business management [16], [24], [27], [36], [40].

This program has several limitations. First, the number of participants in the endline stage was smaller than in the baseline stage because only 22 of the initial 55 MSMEs proceeded to the implementation and mentoring stage. Although this curation was necessary to ensure readiness for digital tool adoption, it limits the comparability between the baseline and endline groups. Second, the curation process may have created selection bias because the endline participants were MSMEs with relatively higher readiness, better product feasibility, and stronger potential for sustained digital adoption. Therefore, the results should be interpreted as evidence of program effectiveness among curated participants rather than as a representation of all women-owned MSMEs in Balaraja.

Third, the intervention period was relatively short, particularly the mentoring period conducted from October 1 to October 30, 2025. As a result, the findings mainly reflect short-term changes in knowledge, literacy, and adoption practices rather than long-term business sustainability. Fourth, the economic impact was measured through average turnover improvement, but turnover may also be influenced by external factors such as seasonality, product quality, pricing, production capacity, customer demand, and promotional intensity. Fifth, the program was implemented in Balaraja District, so the findings may not be fully generalizable to women-owned MSMEs in other regions with different digital infrastructure, market characteristics, and institutional support.

Future studies and community service programs should involve longer monitoring periods, larger participant groups, and comparative designs to assess the sustainability and scalability of the integrated empowerment model. Further research may also examine the long-term effects of digital bookkeeping and e-commerce adoption on profitability, access to financing, and business resilience.

4. Conclusion

This community service program demonstrates that the acceleration of women-owned MSMEs is more effective when digital financial literacy training is integrated with digital bookkeeping tools, e-commerce facilities, website support, and structured mentoring. The improvements in knowledge, digital financial literacy, adoption indicators, Empowerment Index, and business turnover indicate that digital empowerment is strengthened when learning activities are directly linked to practical business operations.

This program contributes theoretically by proposing an integrated empowerment model that combines digital financial literacy, bookkeeping adoption, and e-commerce utilization as interconnected dimensions that support MSME sustainability. The findings also highlight that digital transformation requires not only technological readiness but also behavioral change and the development of new business routines. From a policy perspective, empowerment programs should combine training, practical digital tools, and continuous mentoring, particularly in bookkeeping assistance, which requires longer adaptation. Future initiatives should involve a larger group of women-owned MSMEs, extend mentoring periods, and evaluate the long-term impacts of digital adoption on business performance, financing access, and resilience.

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