

Strengthening MSME Digital Empowerment through a Knowledge Sharing Community: An Adaptive Community Service Program in Rancabungur, Bogor, Indonesia

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Abstract— Digital technology promises wider markets for micro, small, and medium enterprises (MSMEs), yet standardized training assumes a uniformity of readiness that rarely holds on the ground. This study examines how a community service intervention in RW 09, Rancabungur Village, Bogor Regency, responded when that assumption failed. A qualitative descriptive design drew on field observation, brief interviews during visits, program documentation, and the team's accountability report. After attendance thinned during the opening socialization, the planned group workshop gave way to door-to-door assistance covering WhatsApp Business, food-delivery registration, business identity, and QRIS. Roughly 12 MSME actors engaged, and three requested banners and QRIS materials, which were produced and delivered. A WhatsApp-based Knowledge Sharing Community was then established as communication infrastructure. The study proposes an Emergent Adaptive Digital Empowerment Model in which participant heterogeneity itself triggers adaptation, and treats continued collective learning as a possibility rather than a demonstrated outcome.

Keywords— adaptive intervention; community engagement; digital empowerment; knowledge sharing; MSMEs

1. Introduction

Micro, small, and medium enterprises (MSMEs) hold together much of Indonesia's local economic activity, yet their footing in an increasingly digital business environment remains uneven. Digital tools can widen marketing reach, sharpen customer communication, open new channels, and simplify payment. Access, however, guarantees none of this. Among Indonesian SMEs, e-commerce adoption has been traced to perceived benefits, technological readiness, owner innovativeness, IT ability, and prior experience [1], while later work adds intrinsic motivation and ICT knowledge [2], organizational readiness [3], and digital readiness at the level of the individual entrepreneur [4]. During COVID-19, Indonesian MSMEs leaned on digital technologies to keep operating even while struggling to absorb the technological change involved [5], and the adoption of digital marketing itself turns out to rest on capabilities that let MSMEs move competently within digital environments [6]. The problem is therefore less about tools than about the capacity to connect those tools to knowledge, skill, and daily business practice.

That capability-oriented reading has reshaped research on SME digital transformation. Li et al. [7] frame transformation as capability development built on managerial cognition, social capital, and team formation rather than technology procurement. Verhoef et al. [8] separate transformation from digitization and digitalization by insisting on organizational and business-model change, and de Mattos et al. [9] tie technological transformation to technology assimilation alongside business-model innovation. More recent work links digital literacy and dynamic capabilities to transformation activity [10], connects entrepreneurial persistence and market-sensing capability to business-model innovation [11], and traces a path from digital skills through dynamic capabilities to organizational agility among MSMEs [12]. Bibliometric mapping confirms how quickly this field has grown, with capability and strategy themes forming its densest clusters [13], while country-level evidence from China suggests that transformation momentum depends on strategic intent as much as on available resources [14].

Capability, though, is rarely built alone. MSME actors carry detailed knowledge of their customers, products, suppliers, and neighborhood markets; facilitators bring knowledge of digital marketing, branding, and digital transactions. Knowledge sharing is what joins the two. Within Indonesian SMEs, knowledge donating and collecting have been associated with absorptive capacity and innovation capability [15], and Yao et al. [16] link sharing directly to technological innovation capability. Burhan et al. [17] show that digital ICT use among Indonesian smallholder farmers varies with education, income, device access, and group participation, a reminder that participation structures can either narrow or widen digital inequality. Pattinson and Preece [18] document the value of community of practices (CoPs) for knowledge acquisition and problem solving in SMEs; more recent studies find that CoPs support knowledge sharing in family SMEs but remain conditioned by organizational circumstances [19], and that they blend social and organizational logics in the way knowledge circulates [20]. Digital empowerment, on this reading, is relational: learning arises through interaction, not only through instruction.

A gap remains. Adoption, capability, and knowledge sharing have each received sustained attention, but far less is known about how a community-based empowerment program should behave when the MSME actors of a single neighborhood differ in readiness, priorities, and willingness to take part. Reviews and cross-case evidence show that SME digital transformation proceeds through uneven combinations of skills, resources, organizational readiness, and contextual barriers [21], [22], [23], that determinants vary systematically with firm size [24], and that dynamic capabilities shape digitalization differently across firm ages [25]. Kahveci [26] treats transformation as an ongoing sequence running from awareness through strategy, adoption, implementation, and improvement. Findings of this kind unsettle uniform intervention design. An entrepreneur who needs a legible business identity requires something quite different from one already posting on social media but wary of digital payment. The question is not only how MSMEs digitalize, but how empowerment itself stays responsive to unequal starting points.

That question surfaced concretely during a student community service (Kuliah Kerja Nyata, KKN) program among MSME actors in RW 09, Rancabungur Village, Bogor Regency. Initial observation found active businesses that nonetheless promoted themselves largely by word of mouth and personal WhatsApp messages, used platforms sparingly, presented weak visual identity, and had few occasions to exchange business information with one another. Priorities differed just as much: some actors

wanted practical help with promotion and business development, while others regarded their existing customers as sufficient and saw no urgency in expanding. Heterogeneity was thus not merely background context but a working constraint on how any intervention could be delivered.

Accordingly, this study asks how community-based digital empowerment can adapt its strategies to heterogeneous MSME needs and participation conditions while connecting individualized assistance to opportunities for continued knowledge sharing. It examines the RW 09 intervention with attention to three things: how differentiated needs informed adaptation, how individualized assistance supported practical digital application, and how a knowledge-sharing community was introduced as a possible mechanism for continuity. From these, it develops an Emergent Adaptive Digital Empowerment Model whose distinctive proposition is that participant heterogeneity functions as a trigger for adaptation rather than an obstacle to be smoothed over. The study makes no claim to statistically demonstrated gains in sales, adoption, or business performance. What it offers is an empirically grounded account of how such a program can be designed, adjusted, and read honestly, together with the practical lessons and limits that follow.

2. Conceptual Framework

2.1 Digital Empowerment as Capability Development

Treating SME digital transformation as capability development rather than technology acquisition has become the field's working consensus, and for good reason. Digital tools extend communication, promotion, transaction, and market reach, but their value rests on whether an entrepreneur can see the opportunity and fold the technology into what the business already does. Transformation therefore implicates managerial cognition, social capital, teams, and organizational capability [7], and reaches into strategy and business model rather than stopping at process [8], [9].

What enables or blocks that movement has been mapped from several angles. Sagala and Őri [21] synthesize technological, organizational, and strategic conditions across the literature; Rahayu and Day [1] identify perceived benefits, readiness, innovativeness, IT capability, and prior experience among Indonesian SMEs; and Wiliandri [27] situates internal capability alongside ecosystem conditions in the Indonesian pandemic context. Marino-Romero and Folgado-Fernández [28] read transformation as an interaction among technologies, strategies, and individual and organizational capabilities, while Ghobakhloo and Iranmanesh [29] stress alignment across technological, organizational, and human dimensions. Firms also differ in digital literacy in ways that shape which transformation activities they attempt at all [30], pass through identifiable enablers and transition stages en route to distinct digital archetypes [31], and tend to mature their management control practices alongside digitalization [32]. Closer to the present case, digital marketing capability has been shown to condition adoption among Indonesian MSMEs [6].

Following this literature, the study defines digital empowerment as strengthening an MSME's capacity to recognize, access, understand, and apply digital resources that fit its circumstances. The definition covers communication, online promotion, business identity, digital transactions, and digitally mediated market access, and deliberately avoids equating empowerment with adoption of any particular platform. Support for WhatsApp Business, food-delivery registration, branding, banners, and QRIS is therefore read as initial capability building. Because longitudinal movement in sales, revenue, customer acquisition, and platform use was never measured, empowerment is treated as the substantive object of the study: linking digital resources to business needs the owner actually recognizes, while taking differences in readiness and priority seriously.

2.2 Knowledge Sharing and Communities of Practice

Digital capability develops relationally. MSME actors hold experiential knowledge of customers, products, and the everyday friction of running a business; facilitators hold procedural knowledge of platforms, branding, and payment systems. Knowledge sharing is the mechanism that puts these in contact. Wuryaningrat [15] finds that knowledge donating and collecting strengthen SME innovation capability through absorptive capacity, and Yao et al. [16] show that sharing translates into technological innovation capability when organizational and technological conditions permit exchange.

This framing moves past one-way transfer. External knowledge becomes useful once it is interpreted through local experience and converted into something workable. Communities of practice describe learning as participation in shared practice: Pyrko et al. [33] locate the mechanism in collective "thinking together," and Burhan et al. [34] trace how social relations sustain such thinking in a virtual farming community in Brebes. Pattinson and Preece [18] demonstrate that CoPs support knowledge acquisition and problem solving in SMEs, while Nicolini et al. [35] insist that the defining elements run well beyond communication to shared activity, expertise, joint enterprise, and learning.

For those reasons the WhatsApp group established in RW 09 is not treated here as a mature CoP. Technology can certainly carry knowledge across dispersed communities [36], but a channel is not a community, and communication alone does not produce effective sharing [37]. The group is conceptualized instead as initial communication infrastructure and a potential knowledge-sharing mechanism. Absent longitudinal evidence of sustained interaction, peer learning, or collective problem solving, it represents a condition for continued learning rather than a demonstration of it.

2.3 Adaptive Intervention as an Implementation Principle

Standardized delivery is efficient when its assumptions hold. When they do not, efficiency comes at the cost of relevance. Community-based approaches respond by treating participation, contextual responsiveness, and recognition of participants as contributors as design requirements rather than courtesies [38], [39].

Adaptive intervention is used here as an implementation principle, not a causal theory. Adaptation means altering the form, intensity, or delivery mechanism of assistance once emerging field information reveals a mismatch with participants' circumstances. Implementation research offers the vocabulary: Geng et al. [40] analyze on-the-go adaptation of implementation approaches as a sequence of initial effect, deliberate modification, and subsequent effect, while Kilbourne et al. [41] distinguish adaptive strategies from adaptive designs and press for clearer reporting of both. Harvey et al. [42] argue that context should inform study design rather than be recorded as an afterthought. Read together, this literature makes adaptation legitimate and, importantly, reportable.

The principle matters most where starting points diverge. Someone who needs a banner and a legible business name is not well served by the same session as someone already selling through social media but hesitant about QRIS. Adapting delivery, in such settings, is how the objective is protected rather than abandoned.

2.4 Integration

The three strands do different work. Digital empowerment specifies what is being strengthened; knowledge sharing and CoP scholarship explain how learning becomes socially situated; adaptive intervention governs how support responds when conditions vary. Combining them yields a process logic rather than a list: contextual assessment surfaces differences in readiness, practice, perceived need, and participation; those differences trigger adaptive facilitation; individualized assistance converts digital knowledge into applications in marketing, identity, and payment; and a shared communication channel creates the conditions under which learning might continue. Section 4.6 sets out the resulting model against the field evidence, and Section 4.8 states plainly what that evidence cannot support.

3. Methods

3.1 Design, Setting, and Participants

The study uses a qualitative descriptive design with participatory and adaptive features to examine how a community-based MSME empowerment intervention was implemented and adjusted in situ. The unit of analysis is the MSME component of KKN Group 12, Faculty of Communication Sciences, Universitas Pancasila. Rather than assessing a fixed training package, the analysis follows how participant needs, contextual constraints, and interaction shaped delivery, in line with community-engaged and dialogue-centered approaches to implementation [43], [44], [45].

Fieldwork took place in RW 09, Rancabungur Village, Rancabungur District, Bogor Regency, covering RT 01 to RT 06. Ten undergraduate students formed the implementation team and worked in two groups of five during the door-to-door phase. The

available documentation does not record how many MSMEs were visited in total, so no participant denominator is reported.

3.2 Data Sources and Intervention Sequence

Evidence was drawn from the KKN program plan, field observation, short interviews during assistance visits, implementation records, photographic documentation, participant responses, and the final accountability report. Needs assessment combined observation, discussion with community leaders, and direct interaction with MSME actors, covering business conditions, marketing practice, operational obstacles, sales-development needs, and current use of digital technology. It surfaced clear differences in capability, need, and readiness, indicating that support had to be matched to actual business conditions rather than to technology availability, consistent with work emphasizing firm-specific capability and contextual fit in SME digitalization [46], [47], [12]. Table 1 sets out the resulting sequence.

TABLE I. TABLE 1. STAGES OF THE MSME EMPOWERMENT INTERVENTION

Date	Activity	Implementation and evidence
17–18 July 2026	Community orientation and preparation	Coordination with community leaders; identification of participants; distribution of invitations; preparation of venue, materials, and technical requirements.
19 July 2026	Socialization	Group session on marketing strategy and business development, covering branding, product strengths, customer needs, digital media, and knowledge sharing; delivered by the supervising lecturer.
20–22 July 2026	Door-to-door assistance	Two groups of five students visited MSMEs across RT 01–RT 06, conducted brief interviews, and provided practical digital marketing assistance.
23 July 2026	Follow-up	Repeat visits to help MSME actors join the WhatsApp community via invitation link or QR code.
24 July 2026	Output delivery	Three requested business banners and QRIS materials completed and delivered.

^aSource: KKN Group 12 Report, Faculty of Communication Sciences, Universitas Pancasila.

The practical workshop originally scheduled for 20 July 2026 does not appear in Table 1 because it was not held; following discussion with local stakeholders, the team substituted door-to-door assistance while keeping the objective unchanged. Section 4.2 examines this adjustment as a finding in its own right. A WhatsApp-based MSME community was established alongside the visits to carry information exchange, peer discussion, and notice of training opportunities beyond the face-to-face period [46], [48], [49].

3.3 Analysis and Evaluation Boundary

Evidence was organized thematically around six categories: needs, adaptation, assistance provided, participant response, tangible outputs, and sustainability mechanism. Roughly 12 MSME actors responded positively during the visits, and three requested direct support for business banners and QRIS. These figures document responses and outputs; they are not measures of program effectiveness.

Credibility rests on triangulation rather than measurement. Each claim reported below is traceable to at least two of the available sources, typically field notes cross-checked against the accountability report and, where relevant, photographic documentation. Interpretations were discussed within the student team and with the supervising lecturer before being recorded, and points that could not be corroborated, most notably the number of MSMEs visited and the number of participants who left the socialization early, are reported as gaps rather than estimated.

No standardized pre-test or post-test was administered, and no longitudinal indicator of sales, revenue, customer reach, or

transaction volume was collected. The analysis consequently makes no causal or statistical claim and confines itself to implementation, participant response, practical outputs, and the potential mechanism for continuity, recognizing that capability development of this kind unfolds well beyond a short intervention window [12], [48], [49].

4. Findings and Discussion

4.1 One Neighborhood, Many Starting Points

The assessment made clear that the MSMEs of RW 09 were not a single intervention population. Promotion ran mostly through word of mouth and personal WhatsApp messages; WhatsApp Business and food-delivery platforms were used sparingly; branding and visual identity varied widely from one business to the next. Most telling was the divergence in how market expansion itself was viewed. Some owners wanted stronger promotion and clearer positioning. Others considered their existing customer base adequate and expressed no interest in reaching further. The obstacle, in other words, was not access to technology but a compound of capability, experience, perceived relevance, and business priority.

Part of this pattern is familiar. Rahayu and Day [1] found Indonesian SMEs clustered at early stages of e-commerce adoption, with perceived benefit rising as adoption deepened. Subsequent work treats SME digital transformation as multidimensional, spanning technology, human capital, organizational resources, and external relationships [10], [50], and systematic reviews attribute persistent unevenness to differences in resources, digital skill, strategic readiness, and learning capacity [9], [21].

The RW 09 evidence adds a qualification that matters for program design. Not every owner regarded digital expansion as a live priority, and that position was not necessarily a deficit to be corrected. A home kitchen serving a known circle of neighbors faces a real ceiling on how much additional demand it could absorb; wider reach without added capacity produces strain rather than growth. Read against Kahveci's [26] staged account, several of these businesses had not yet entered the awareness phase in any meaningful sense, and treating them as though they were at the implementation stage would have misjudged where they actually stood. Amaya et al. [25] make a related point in showing that the influence of dynamic capabilities on digitalization is moderated by firm age, which cautions against reading a single intervention population as uniformly ready. Heterogeneity here was structural, not attitudinal, and a program built on the assumption of shared urgency would have addressed only the minority for whom that assumption held. Empowerment programs that assume a universal digital deficit risk pressing technologies on people who see no problem for them to solve. Transformation becomes meaningful only where technology can be assimilated into actual practice and value creation [9], and de la Calle et al. [47] show that digital service innovation in SMEs depends on organizational alignment, market dynamics, customer relationships, and business-model evolution rather than on tool availability. The operative question is therefore whether a given platform answers a problem the business already recognizes.

Understood this way, the assessment did more than gather preliminary data. It worked as a diagnostic that separated technological gaps from differences in priority and perceived benefit, and that separation is precisely what justified moving away from a single standardized format. It also aligns with the argument that digitalization in micro and small firms is better handled as a guided learning and innovation process than as a one-off adoption exercise [51], [52]. Assessment was not a precondition for empowerment in RW 09. It was the first component of it.

4.2 When the Plan Met the Field

The socialization session held on 19 July 2026 addressed marketing strategy, business development, and knowledge sharing. Participants worked through local business potential, the marketing mix, basic branding, customer identification, SWOT analysis, and concrete openings for selling online via WhatsApp Business, social media, and marketplaces. Discussion and experience sharing followed, and the RW 09 MSME WhatsApp community was announced at the close. Photographic documentation indicates roughly 45 people present at the KKN site, including about 35 community members and the 10 students acting as facilitators. Attendance thinned before the session ended. The practical workshop planned for the following day was not held, and after discussion with local stakeholders the team replaced it with door-to-door assistance.

The sequence deserves attention because of what did not change. The objective stayed intact; only the mechanism for pursuing

it was altered. This is implementation responsiveness in the sense Geng et al. [40] describe, where an initial effect informs a deliberate modification of approach, and it was reached dialogically rather than imposed. Sanders et al. [44] argue that community-engaged work should surface competing perspectives and let them shape delivery; here the adjustment emerged from exchange among the student team, participants, and local representatives rather than from a unilateral decision by the university.

Implementation science offers a useful way of stating what was preserved and what was let go. Kilbourne et al. [41] urge programs to specify the core functions a strategy is meant to perform, so that the form through which those functions are delivered can be varied without loss. In RW 09 the core functions were diagnosis of individual business needs, hands-on demonstration of a digital tool, and connection into a shared channel. A group workshop was one form capable of carrying them. Household visits proved to be another, and in the circumstances a more reliable one, since they reached owners who could not leave a shop or a kitchen for an afternoon. Naming the functions separately from the format is what makes the substitution legible as adaptation rather than as improvisation after a shortfall.

The episode also complicates a habit common in community service programs, where fidelity is equated with executing the original activity plan. Under heterogeneous conditions, rigid fidelity can preserve a format while quietly hollowing out its relevance. Adaptive designs in implementation science make the same point from the other direction: adaptation is defensible when it is specified and reported rather than concealed [41], and context deserves treatment as a design input rather than as noise [42]. Research on SME digital transformation reaches a compatible conclusion at the firm level, describing digitalization as an evolving process that requires continuous learning and realignment between technology and organizational conditions [21], [50]. The KKN case shows the same logic operating at the level of program delivery.

One boundary must be drawn firmly. The shift to door-to-door assistance does not establish that individual visits outperform group training. No comparative or experimental design was used and no standardized effectiveness measure was collected. The defensible claim is narrower and local: given the participation pattern and business conditions encountered in RW 09, individualized assistance was judged the better route to the same objective. Keeping that distinction visible guards against the familiar error of reading an implementation adjustment as evidence of causal superiority.

4.3 Individualized Assistance and Practical Application

Between 20 and 22 July 2026, the ten facilitators split into two groups and worked their way across RT 01 to RT 06. Short interviews during the visits brought out differences in how long each business had operated, what obstacles it faced, what kind of sales development its owner wanted, how it currently marketed itself, and what digital technology it already used. Assistance then followed those specifics: setting up WhatsApp Business, explaining GoFood registration, developing business identity through logos and banners, and supporting QRIS.

The move from general exposition to applied support is where capability formation begins. Digital capability grows through the ability to connect technological resources to real organizational tasks, which is the substance of Li et al.'s [7] capability perspective and of the dynamic-capability accounts that link digital literacy to responsive transformation activity [10]. Assimilation into business processes, and eventually into business models, is what distinguishes transformation from acquisition [9], [47].

WhatsApp Business proved a useful entry point precisely because personal WhatsApp was already routine for many owners. The intervention did not ask anyone to abandon a working habit for an unfamiliar system; it extended an established practice toward more structured business communication. Sukrat and Leeraphong [52] describe exactly this kind of staged progression in their maturity model for micro enterprises in developing countries, where people, process, strategy, and technology advance together rather than in a single leap.

The visits also exposed something about sequence that a workshop curriculum would have obscured. For several businesses, the binding constraint was not the absence of a digital channel but the absence of anything to put on one. A grocery selling half a dozen prepared foods without a name, a consistent price list, or a photograph has little to publish on WhatsApp Business and no

obvious way to complete a GoFood listing. In those cases the useful first move was identity work, not platform registration, and the digital step became feasible only afterwards. Where owners already had a recognizable offer, the order reversed and the channel came first. Sequencing, in short, was itself a diagnostic judgment made business by business, which is difficult to standardize in advance and easy to get wrong when a single curriculum is delivered to a room.

Concrete traces support the reading. Approximately 12 MSME actors engaged positively with the assistance, and three owners, running household furniture and grocery businesses, asked for direct help with banners and QRIS. The accountability report notes that several home-based grocery businesses sold a range of food items without any signage that communicated what the business was or what it offered. The requested banners and QRIS materials were completed and delivered on 24 July.

These are outputs, and the distinction from outcomes should be stated once, clearly, and then held throughout. A banner is an output; increased customer recognition would be an outcome. Provision of QRIS is an output; a rise in digital transaction frequency would be an outcome. Neither outcome was measured. The distinction is not pedantic, since adoption and performance are related but far from synonymous. Wirdiyanti et al. [53] report associations among e-commerce adoption, business performance, brand recognition, customer awareness, and financial inclusion in Indonesian MSMEs, while Kallmuenzer et al. [23] show that performance consequences depend on how digital resources and capabilities are integrated within the firm.

What RW 09 provides, then, is evidence of initial practical readiness rather than economic impact. That readiness is not trivial. Among Indonesian SMEs, the capacity to sense and respond to market change has been linked to competitive advantage [54], which suggests that a legible banner, a working payment channel, and a more structured communication habit may leave these businesses better placed if conditions shift. Stated at that level, the interpretation is both more modest and more defensible, because it treats digital empowerment as capability building rather than assuming that possession of a tool produces transformation on its own.

4.4 Offline Facilitation as a Condition for Digital Participation

Setting up the WhatsApp community produced an unexpected finding. Several owners had agreed to join but could not be added directly, because the numbers collected required an invitation link or QR code to complete entry. The team returned on 23 July 2026 to walk them through it.

Technically this is a minor episode. Analytically it is not. Digital participation here was not achieved by digital means; the passage from face-to-face engagement to online membership required interpersonal facilitation, and the platform became usable as a community resource only after social and practical obstacles had been cleared. The relational dimension of transformation is well documented. Romero and Mammadov [50] identify technological, human-capital, and organizational-relational dimensions as interdependent determinants, and Coco et al. [51] show that guided, open innovation processes help small and micro enterprises work through resistance and build digital literacy. Capability cannot be reduced to hardware, applications, or connectivity.

The RW 09 experience suggests a sharper formulation: offline facilitation can be an enabling condition for digital participation. Face-to-face contact let the team clarify instructions, spot obstacles, sustain engagement, and complete the connection. This fits the dialogue-centered orientation Sanders et al. [44] propose, in which engagement is interactive rather than transmitted. It also carries an implication for digital inclusion. Programs that assume participants will move seamlessly from an offline session to online interaction may reproduce the very barriers they set out to remove. In resource-constrained settings, the sensible design pairs digital tools with interpersonal support instead of offering digital communication as a substitute for it.

4.5 The Knowledge Sharing Community as an Initial Sustainability Mechanism

The WhatsApp community was created to keep a channel open for information on marketing, business development, training opportunities, shared problems, and participant experience. Its significance lies less in the technology than in the possibility of interaction outlasting a short KKN period.

The rationale has support. Wuryaningrat [15] found that knowledge donating and collecting contribute to SME innovation capability where absorptive capacity allows, which implies that exchange becomes valuable when actors can interpret and apply information rather than merely receive it. Hafeez et al. [48] reach a similar conclusion in their review of knowledge management and SME digital transformation, where knowledge processes are treated as enablers of transformation rather than as by-products of it. CoP scholarship emphasizes that collective learning develops through shared activity, participation, expertise, and sustained effort to improve practice [35], and evidence from family SMEs shows that CoPs facilitate knowledge sharing only under supportive social and organizational conditions, not by virtue of the communication technology involved [19].

The RW 09 group should therefore be read with care. The evidence confirms that a WhatsApp-based communication infrastructure was established. It does not demonstrate sustained peer learning, regular interaction, business collaboration, or participant-led knowledge production. Calling the group a functioning community of practice would overstate what was observed.

The more defensible reading treats it as an initial sustainability mechanism: infrastructure through which knowledge might continue to circulate once direct facilitation ends. The theoretical distinction is worth preserving, because a channel is an enabling structure while a learning community requires sustained participation and shared practice. Continued learning is accordingly presented here as a possibility, not a result.

The tension in the literature is instructive on this point. Pan and Leidner [36] show that information technology can extend communities of practice across distance where a shared frame of reference already exists, while Roberts [37] warns that trust, power relations, and predispositions limit how far knowledge actually moves through such structures. RW 09 sits between the two. The technology was available and the membership overlapped with existing neighborly ties, both favorable conditions. What could not be established within the program period was whether members would post questions, answer one another, or convert the channel into a space for joint problem solving. Pranowo et al. [55] find that knowledge sharing supports business performance in Indonesian food and beverage SMEs through organizational learning capability and open innovation, which suggests what the group might become. It does not tell us what this group did become, and the study declines to fill that gap by inference.

4.6 The Emergent Adaptive Digital Empowerment Model

Taken together, the findings converge on a pathway that was not visible in the original program design but became legible through implementation. It begins with assessment of MSME needs and digital readiness, proceeds through adaptive and individualized assistance to practical digital marketing support and initial application, and extends into knowledge sharing that opens the possibility of continued learning. Figure 1 sets out the full sequence, together with the three conceptual dimensions

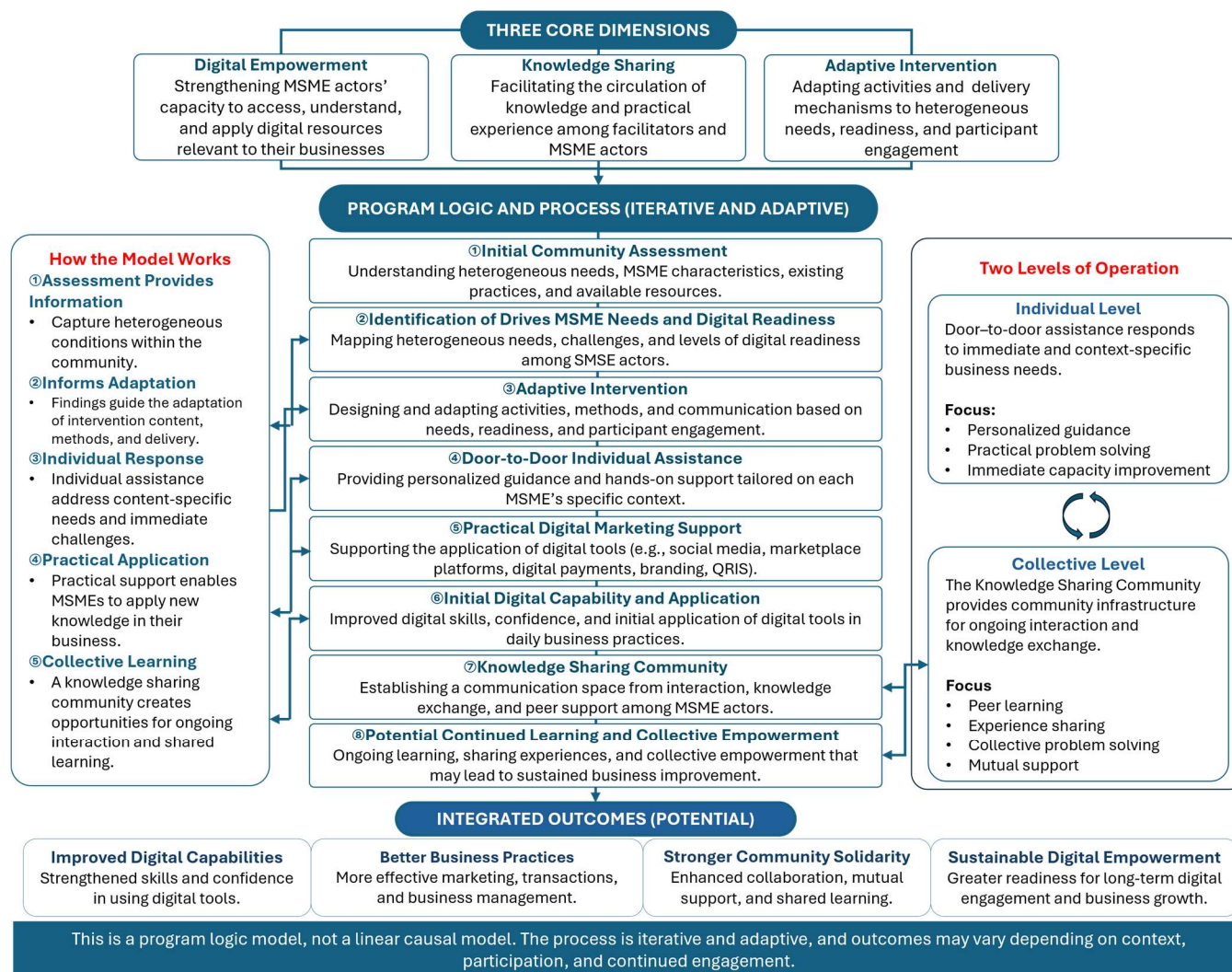


Fig. 1. An emergent adaptive digital empowerment model

that inform it and the two levels, individual and collective, at which it operates.

The stages themselves are described in the figure and need not be restated. Two features of their arrangement carry the argument. First, the pathway is program logic, not a causal chain: assessment informs intervention, and experience gathered during individualized assistance may reveal needs that send the process back for further adjustment, while knowledge sharing can generate learning needs of its own. The model is iterative in this sense, moving from individualized support and application toward collective learning and, potentially, longer-term empowerment [51], [55], [21]. Second, it operates on two levels at once.

Door-to-door-work built capability at the individual level; the Knowledge Sharing Community established meso-level infrastructure. Linking the two is consistent with CoP scholarship, though the evidence available here does not license any claim that collective empowerment was achieved [35], [19]. Establishing the conditions for collective learning and demonstrating that it occurred are different accomplishments, and only the first is claimed.

The model sits comfortably within the capability perspective on SME digital transformation [7], [9], [50], and it echoes Sagala and Öri's [21] emphasis on organizational readiness, resources, skills, strategic alignment, and continuous learning. Its contribution, however, is narrower than a general theory. None of the individual practices involved, WhatsApp Business, QRIS, banners, GoFood registration, digital marketing training, is novel. What is proposed is a mechanism at the level of intervention design: adaptation as the means by which heterogeneous digital needs are translated into context-sensitive capability development, with assessment feeding adaptation, individualized facilitation producing practical application, and individual learning connected to infrastructure for potential collective exchange.

Set against the conventional training logic that still governs much MSME empowerment work, the difference is one of direction. The standard model treats participant variation as a source of noise to be minimized through curriculum design, scheduling, and recruitment, and reads departures from the plan as implementation failure. The model proposed here inverts that reading. Variation is the signal the program is meant to detect, and departures from the plan are evidence that detection worked. What must then be defended is not the format but the objective, which is why specifying core functions in advance matters as much as any activity schedule.

4.7 Implications

Three theoretical implications follow. First, familiarity with digital tools did not, in RW 09, translate by itself into structured business use, which is what capability accounts predict [7], [10], [21]. Second, digital transformation research generally foregrounds firm-level capability, technological readiness, and business-model evolution [9], [47]; RW 09 redirects attention to the intervention's own capacity to respond to heterogeneity, where adaptation functions less as logistics than as a route to contextual fit. Third, pairing direct assistance with shared communication infrastructure bridges micro-level skill development and meso-level knowledge circulation, in line with evidence that knowledge sharing and CoPs can sustain SME learning [35], [19].

Practically, five working principles emerge for university- and community-based MSME programs: assess before intervening; differentiate rather than homogenize; adapt delivery without abandoning the objective; prioritize hands-on application; and build in a mechanism for continued exchange. On this basis, KKN service learning is better framed as an adaptive community learning process than as a one-off training event, with students acting as facilitators who diagnose needs, negotiate adjustments with local actors, and help establish channels for ongoing interaction.

Evaluation design should follow the same discipline by separating three levels of evidence: immediate outputs such as participation, banners, QRIS assistance, and group formation; early capability outcomes such as digital knowledge, confidence, and independent platform use; and longer-term outcomes such as sustained marketing activity, transaction volume, market reach, and business performance. The present study substantiates the first level and offers indications of the second. It says nothing about the third.

4.8 Limitations and Future Research

Several constraints qualify these findings. The short KKN period captures immediate outputs and early capability formation rather than the incremental, organization-wide process digital transformation involves [9], [52]. No pre-test or post-test design was used, so no change can be attributed statistically to the intervention, and sales, transactions, and profitability were never tracked over time. The roughly 12 positive responses and three banner and QRIS requests therefore document engagement, not effectiveness. Because the number of MSMEs visited was not recorded, these responses cannot be expressed as a participation or success rate. Activity in the WhatsApp community was not monitored systematically, leaving open whether it developed into peer-led learning or a functioning community of practice. Finally, the model is bounded by the setting that produced it, with

RW 09's particular digital familiarity, business mix, and stakeholder involvement shaping what was observed, so transferability remains an empirical question in line with the literature on contextual variation in SME digital transformation [51], [50], [21].

Future work should pursue longitudinal designs that track skills, platform use, and performance over time; comparative studies of adaptive against standardized formats; and sustained observation of knowledge-sharing communities through interviews or digital trace analysis. Read against these limits, the study's contribution is to evidence a context-sensitive pathway through which digital empowerment can plausibly begin, not to establish causal superiority for adaptive intervention.

5. Conclusion

Community-based digital empowerment for MSMEs cannot be reduced to delivering digital marketing knowledge or introducing digital tools. In RW 09, Rancabungur, readiness, priorities, and willingness to participate varied enough that a standardized intervention fitted poorly. When attendance thinned during the opening socialization, the planned group workshop was replaced, after consultation with local stakeholders, by door-to-door assistance. The objective did not change; the way facilitation reached people did.

Empowerment gained traction once knowledge was tied to concerns owners already had. Through individualized assistance, MSME actors received support on WhatsApp Business, food-delivery platforms, branding, banners, and QRIS. About 12 responded positively, and three businesses in household furniture and grocery retail requested banners and QRIS materials that were produced and delivered. These are early practical engagements and capability gains, not increases in sales, market reach, transaction frequency, or financial performance, and the distinction defines what the study documents.

The main contribution is the Emergent Adaptive Digital Empowerment Model, which links contextual assessment, differentiated needs, adaptive facilitation, individualized assistance, practical application, and potential continued knowledge sharing. Its novelty lies not in any single practice but in how they are arranged: field assessment and stakeholder feedback determine the delivery mechanism, individualized assistance converts knowledge into application, and shared infrastructure opens space for learning to continue. Empowerment in this account works at two levels simultaneously, individual and collective, with the WhatsApp community read as a potential mechanism for continuity rather than a demonstrated outcome.

A further lesson concerns how such programs report themselves. The value of the RW 09 case lies partly in what went differently from plan, and that value would have been lost had the record smoothed the discrepancy away. Community service reporting that treats a changed activity as an embarrassment discards precisely the evidence that makes adaptation learnable for the next team. Specifying core functions in advance, documenting the moment they came under pressure, and recording what replaced the original format converts an awkward episode into transferable knowledge.

For universities, local governments, and community facilitators, the practical lesson is compact: assess before intervening, adapt to heterogeneous needs, combine group learning with individualized assistance, prioritize application, and build in mechanisms for continued exchange. The conclusions remain bounded by a short intervention period, the absence of standardized pre- and post-intervention measures, and the lack of longitudinal indicators or a documented denominator. The model is best understood as empirically grounded rather than statistically validated, and testing whether this pathway sustains capability and translates into measurable performance gains is work for longitudinal, comparative, and mixed-method research to come.

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