

DIGITAL TECHNOLOGY-BASED EMPOWERMENT OF MARGINALIZED COMMUNITIES: TRANSFORMATION OF POWER RELATIONS AND SUSTAINABILITY OF INTERVENTIONS

Abdul Gani

Universiti Malaysia Sabah

correspondence: abdulgani@gmail.com

Abstract - This literature study examines how digital technology functions as a medium for transforming power relations in the empowerment of marginalized communities and identifies the forms of technological intervention that yield the most sustainable outcomes. Through qualitative analysis of academic literature from multiple disciplines, the study finds that technology transforms power relations through four pathways: collective coordination across space and time, knowledge production from the subject position, disintermediation of economic chains, and decentralized legal advocacy. Sustainable empowerment requires six systemic criteria: internal capacity for autonomous technology management, collective ownership of digital infrastructure, development of community-based facilitators, creation of viable livelihoods, respect for the right to reject technology, and diversification of financial resources alongside open technology adoption. These criteria must be realized simultaneously, as no single criterion suffices independently. The study concludes that authentic technological empowerment cannot be achieved through short-term projects or one-size-fits-all approaches but demands long-term commitment and respect for local wisdom and self-determination.

Keywords: community empowerment, digital technology, power relations, sustainability, marginalized communities, collective ownership, internal capacity.

INTRODUCTION

Marginalized communities are frequently placed in the most dead-end positions regarding access to economic, educational, and informational resources. They live in areas with limited infrastructure, strong social pressure, and minimal reach of public services. In their daily lives, the absence of channels to voice their needs and potentials is the heaviest barrier. Their sphere of movement is narrowed by various unsupportive policies, compounded by negative stereotypes from dominant groups (Mahladar & Jana, 2025). This aligns with the view that social stereotypes play a fundamental role in creating inequality of opportunity in society, which directly impacts educational access and job opportunities for marginalized groups (Sajjapong et al., 2022). At this point, technology should open a way out because of its nature to transcend the boundaries of space and time. However, that hope often collides with the fact that the design of technology itself originates from centers of economic power. Consequently, marginalized groups are increasingly sidelined when technology arrives without adaptation to the reality of their lives. They do not merely require hardware or internet connections, but rather guidance that enables them to master digital tools. This access disparity is not an ordinary technical issue, but a reflection of a structural social inequality. If left unaddressed, the gap between the connected and the isolated will continue to widen alongside the acceleration of innovation (Griffin, 2025).

The empowerment of marginalized communities through technology cannot be separated from the issue of agency, namely the ability of these groups to determine their own life direction. Many technology-based assistance programs fail because they treat marginalized communities as passive beneficiaries (Anuyah et al., 2023). They are given brief training, computer equipment, or Wi-Fi access without exploring the real needs they experience daily. A fisherman in an urban poor coastal area certainly needs real-time weather and fish price information, but he also needs to understand how that data is generated and verified. A disabled woman in a rural area might be greatly helped by a grocery delivery application, but she must be included in the interface design process to suit her physical limitations. When technology is imposed from above, what emerges is a new dependency, not independence. True empowerment occurs when marginalized communities have control over the tools they use, including the ability to repair, modify, and even reject technology that is unsuitable (Toyama, 2014). From this perspective, literature study becomes important because it allows researchers to map various failures and successes from diverse technology-based empowerment programs that have been documented. Experiences across various parts of the world show that the main determining factor is not the sophistication of the technology, but the extent to which that technology is integrated with local value systems (Feige et al., 2017).

The rapid current of digitalization over the past two decades has fundamentally transformed the landscape of empowerment. Digitalization has deeply altered the operational foundation of various economic and social activities in the era of globalization, thus impacting not only technical aspects but also the structure and working methods of the system as a whole (Darmawan & Eddine, 2024). Communication costs have dropped drastically so that information can

spread faster and cheaper to remote corners. On the other hand, giant technology corporations consolidate their power by collecting user data on an unprecedented scale. Marginalized groups are the most vulnerable to data exploitation due to low digital literacy and limited legal options protecting them. A smallholder farmer using an online loan application may unknowingly consent to sharing their land location data with agribusiness corporations. A housewife in an urban slum following e-commerce training could lose her hard-earned money due to unscrupulous merchants exploiting loopholes in the payment system. Therefore, the role of technology in empowerment must be critically examined, not merely as an auxiliary tool, but as a medium loaded with interests. This issue demands an interdisciplinary approach combining communication science, sociology, political economy, and development studies. Only with an adequate analytical framework can researchers distinguish between authentic empowerment programs and programs that merely utilize technological rhetoric to reinforce existing domination. Systematic literature studies allow researchers to trace various arguments and findings from diverse scientific traditions without getting trapped in marketing claims often wrapped in beautiful words about the digital revolution.

The experiences of various countries show that technological interventions for marginalized communities often fail due to non-technical factors that are precisely the most decisive (Patnaik & Bhowmick, 2019). In the interior of the Amazon, a project providing tablets to indigenous tribes failed because there was no local personnel capable of performing device maintenance and no available content in their native language (Goñas et al., 2025). In the slums of Nairobi, the provision of free Wi-Fi attracted massive interest in the first week, but was later abandoned because residents prioritized food costs over buying electricity credits to charge their phones (Guma, 2022). In remote villages in India, government-funded digital service centers often sat empty because the appointed officers did not receive a fixed salary, thus choosing to earn a living elsewhere (Parsheera, 2025). The fundamental flaw of such projects is ignoring the socio-economic ecosystem in which technology is to be planted. A smartphone is meaningless if its owner has no safe place to store it. Coding training is useless if graduates cannot access the job market due to racial or religious discrimination. Sustainable empowerment requires changes to broader structures, not merely a transfer of devices. Technology acts as a catalyst, not a magician capable of turning poverty into prosperity overnight. Technology functions as a tool to enhance communication and accelerate work processes, while leaders focus on developing skills, collaboration, and maintaining relationships among teams (Darmawan & Gardi, 2024). By carefully reviewing previous case studies, researchers can construct a typology of supporting and inhibiting factors that are cross-regional in nature.

Marginalized groups are not a homogeneous entity uniform in their needs and capacities. There are indigenous communities isolated geographically, people with disabilities hindered by environmental design, urban poor trapped in the lack of population documents, and sexual minority groups facing systemic discrimination (Najmuddin, 2024). Each faces different barriers when dealing with technology. A blind person might be greatly helped by a screen reader, but an incompatible banking application will isolate them from digital financial transactions. A transgender person in a conservative village may need an anonymous online space to access healthcare, but they must also remain vigilant against hacking and doxing. A homeless child living a nomadic life requires a device that is durable and hard to steal, along with training that can be followed non-continuously. Because of this diversity, literature studies must be able to capture the nuances of these differences without hastily making overly broad generalizations. Available literature from various disciplines offers a wealth of concepts such as participatory design, appropriate technology, and asset-based empowerment, each possessing its own strengths and weaknesses. The task of the researcher is to formulate a coherent synthesis from these various traditions of thought, and then test their coherence with diverse social realities. A phenomenological approach in literature studies allows researchers to capture the meaning of empowerment from the perspective of the marginalized community itself, as documented in qualitative research reports, ethnographies, and reflective notes from practitioners.

One of the greatest difficulties in examining the role of technology in empowering marginalized communities is the blurring of boundaries between authentic empowerment and new forms of exploitation disguised under the cloak of digital progress. Many programs claim to empower, but the end result turns marginalized communities into sources of cheap data or new markets for high-risk financial products (Binabiba, 2025). Although digitalization offers conveniences such as the use of electronic money as a substitute for cash, marginalized communities need to understand its advantages and disadvantages so they do not fall into detrimental financial risks (Sinambela & Darmawan, 2022). A woman in a remote village taught to use a peer-to-peer lending application might eventually become entangled in online debt due to interest rates not explained transparently. A fishermen's cooperative provided with supply chain management software could lose control over their catch data, which is then sold to large corporations without their knowledge. This problem is exacerbated by weak data protection regulations in developing countries, coupled with low legal awareness among marginalized communities. Consequently, technology that should be an instrument of liberation turns into a new model of colonization. The difference between empowerment and exploitation is often invisible in the early stages of a project, emerging only after the community begins to depend on the system and cannot exit due to high transition costs. Literature studies must be able to uncover the subtle mechanisms of how this exploitation works, including through the analysis of contracts, platform ownership structures, and the track records of technology companies entering marginalized regions.

The pace of digital disruption shows no signs of slowing down; instead, it is accelerating with the emergence of generative artificial intelligence, the internet of things, and cloud computing (Murari et al., 2025). Every wave of innovation brings promises of efficiency and prosperity, but also new risks for groups that are already marginalized. Those unable to keep pace with the speed of change will fall further behind, not only economically, but also cognitively and socially (Kaur et al., 2025). In the future, jobs currently serving as the livelihoods of marginalized communities such as farm laborers, scavengers, or street vendors will be increasingly displaced by automation. Without careful preparation and proper understanding of technology-based empowerment strategies, marginalized groups will face an existential crisis far more severe than what they currently experience. Therefore, examining the role of technology in empowerment is not an academic activity detached from reality, but an ethical and political necessity. Policymakers, civil society organizations, and social movements require a strong theoretical footing to design effective responses. Literature studies provide this foundation of knowledge in an organized, critical, and accountable manner.

Research on technology and marginalized communities has thus far been scattered across various disciplines with languages and assumptions that are often incompatible with one another. Communication science tends to focus on access and media literacy, sociology is more interested in shifting power relations, economics discusses incentives and efficiency, while computer science frequently cares only about the technical usability of interfaces. Without systematic efforts to synthesize findings from these various fields, our understanding will remain fragmented. Consequently, practitioners in the field often accept only a narrow perspective, subsequently designing programs that are flawed from the outset. An activist who reads only optimistic literature about fintech for poverty alleviation may fail to recognize the dangers of digital debt. A bureaucrat who hears only success stories of e-government for public services in urban areas will force similar policies in remote regions with near-zero literacy rates. Through a comprehensive literature study, these various pieces of knowledge can be unified into a more complete map. This map will help stakeholders identify potential pitfalls while recognizing best practices that have been tested in various locations.

This literature study aims to analytically outline two central aspects of the relationship between technology and the empowerment of marginalized communities: the function of technology in altering oppressive power relations, and the characteristics of technological intervention forms that produce lasting change. The theoretical contribution of this research is offering a conceptual framework that combines critical theory of technology with community empowerment theory, thereby moving beyond instrumental approaches that view technology as a neutral tool. Its practical contribution is providing reflective guidance for policymakers and development practitioners to evaluate technology programs they are running or intend to run, particularly in avoiding the pitfalls of digital exploitation and ensuring partisanship toward the most vulnerable groups. Grounded in a systematic literature review, this research is expected to serve as an initial reference for more specific subsequent studies, for instance in specific sectors such as agriculture, non-formal education, or community-based social entrepreneurship.

RESEARCH METHODS

This study uses a qualitative literature study design, an approach that emphasizes the collection and analysis of data from various written documents without involving direct interaction with human subjects in the field. Creswell (2009) explains that qualitative research aims to understand the meaning individuals or groups attach to a social problem, and a literature study is one operational manifestation of that purpose when the main data source takes the form of academic text. Within this framework, the researcher does not depart from a hypothesis to be tested, but rather from a series of interpretive questions that guide the systematic literature search process. The data sources used include indexed journal articles, textbooks, research reports, and conference proceedings discussing the intersection between digital technology and marginalized communities. Source selection was carried out using a purposive strategy, meaning only documents that directly answer the research questions were included, while documents that only touched upon the topic in passing were set aside. This process ensures that the collected data possesses high relevance and adequate analytical depth. Denzin and Lincoln (2005) assert that qualitative research is never value-neutral, so researchers must explicitly state their theoretical position, which in this case is a critical view of technology as a socially constructed entity laden with power.

Data analysis in this literature study follows thematic analysis procedures adapted from the framework proposed by Braun and Clarke (2006). The first stage is familiarization, which involves reading all selected documents repeatedly to capture the main arguments, methodological weaknesses, and emerging thematic patterns across studies. The second stage is initial coding, where the researcher labels text segments relevant to the research questions, such as regarding data exploitation mechanisms or factors influencing the sustainability of empowerment programs. The third stage is searching for themes, which involves grouping codes with similar meanings into more abstract categories, such as the transformation of power relations or participatory design. The fourth stage is reviewing themes, which checks whether the formed themes truly represent the data content or need to be split or combined. The fifth stage is defining and naming themes, resulting in a cohesive conceptual framework to answer the research problem. Silverman (2010) reminds us that qualitative data analysis must be accompanied by efforts to verify the validity of findings, for instance by searching for negative cases that do not conform to general patterns, as well as by conducting source triangulation from various scientific disciplines.

This approach enables the researcher to construct arguments that are not merely descriptive, but also critical and reflective regarding the limitations of existing literature.

RESULTS AND DISCUSSIONS

The sustainability of empowering marginalized communities through technology is determined not by the sophistication of hardware or application features, but by how strongly the technological intervention builds the internal capacity of the community to manage, maintain, and independently develop the technology systems they use (Fruijtter & Senyoni, 2018). The form of intervention that most frequently fails is the one-off device donation model without ongoing support. A computer laboratory donated to a school in an underdeveloped region will become dusty within two years because there is no funding for maintenance, no technical personnel available, and no local content relevant to the students' needs. Long-lasting interventions are those that from the outset involve the community in the design process, technology selection, maintenance budget planning, and the human resource development of local residents. This model is referred to as an asset-based approach, which starts from what the community already possesses rather than what it lacks. If a community has an electronic repair person, that individual should be trained further in digital devices. If a community has a women's group that routinely holds savings and loan gatherings, that mechanism can be adapted to raise funds for the sustainable financing of digital infrastructure (Odhiambo & Hadullo, 2025). Sustainability is born from local roots, not from temporary project funding injections.

Sustainable technological interventions are also characterized by collective ownership over digital infrastructure, both in legal forms and in daily practices (Ogbu & Onah, 2025). When a village internet service center is owned by a village-owned enterprise with democratically elected administrators, residents feel responsible for maintaining it. They will report damage more quickly, pay usage fees more orderly, and protect the asset from external appropriation efforts. Conversely, if an internet service center is a government project operated by contract employees paid from the central budget, residents tend to be passive and treat the facility as someone else's property. In such situations, minor damages such as a loose cable or a printer running out of ink can be left unaddressed for a long time because no one feels the obligation to fix them. Collective ownership also means that the community has the right to make decisions about who may use the technology, when, and for what purposes. This right is important to prevent technology from falling into the hands of individuals who will exploit it for personal gain or to reinforce unequal internal hierarchies. In other words, technology must be integrated into existing social governance, rather than imposed as a parallel institution detached from the community structure.

The intervention model that lasts the longest is one that develops peer facilitators from within the community itself, rather than relying on external consultants or volunteers who will eventually leave (Alejandro-White, 2024). Vaughn et al. (2018) in their systematic review show that peer-based models partnering with local insiders are increasingly used in community-based research, education, and social care due to higher sustainability and acceptance by the target community. Master trainer training systems implemented in a tiered manner have proven effective in various regions. Snowden et al. (2023) in the first systematic review of train-the-trainer (T3) initiatives in low- and middle-income countries found that implementation factors, as well as maintenance and development factors, are the two most critical factors in achieving and sustaining change. Ten individuals from the community possessing basic reading, writing, and arithmetic skills are selected to undergo intensive training for three months. Upon graduation, each of them trains ten other individuals, and so forth, so that within one year, one hundred community members possess adequate technical skills. The advantage of this model is that every trainer speaks the same native language as the participants, understands local norms regarding senior-junior and male-female relationships, and can adjust the training schedule according to harvest seasons or customary holidays. Internal trainers are also more trusted because the community knows they will not leave their hometown after the project ends. However, this model requires a longer investment of time and patience because the learning process in marginalized communities often proceeds more slowly due to lower prior formal education. This knowledge transfer process becomes more effective through an adaptive learning approach capable of responding to both individual and collective learning needs within the community (Kurniawan & Darmawan, 2021). Many project donors are unwilling to wait for results on such a timeline because they are accustomed to quarterly progress reports showing large numbers. This is where the contradiction lies between the logic of a project and the logic of true empowerment.

The sustainability of empowerment is also heavily determined by the extent to which technological interventions are able to create new livelihoods, rather than merely helping existing activities become slightly more efficient (Lechman & Paradowski, 2021). A training program on using digital sewing machines for poor housewives will endure if the graduates of that training can earn income from the sewing services they offer. Without market access, marketing networks, and protection from middlemen who buy up sewn goods at extremely low prices, such training merely wastes time and energy. This aligns with the view that the integration of technological mastery, business capital, and educational level serves as a primary prerequisite in efforts to genuinely increase business income at the community level (Sinambela et al., 2021). Therefore, the most successful technological interventions are those designed as comprehensive packages

encompassing hardware provision, technical training, marketing mentoring, access to low-interest capital, and legal protection against intellectual property rights violations regarding the products generated. A batik artisan taught to use digital pattern design software without being assisted in understanding digital copyright will lose their best motif when someone captures a screenshot and sells it on an international platform without permission. This complexity demonstrates that sustainable technology empowerment cannot be carried out by a single institution alone. Collaboration is required among the government, the private sector, universities, and civil society organizations within a coordinated ecosystem where each party performs its role without overlapping or passing the buck.

In practice, sustainable technological interventions always treat marginalized communities as subjects who possess the capacity to decide for themselves when they need technology and when they actually need to reject it (Jagtap, 2019). The rejection of technology is not a sign of failure or ignorance, but a manifestation of local wisdom that must be respected. A farming community on a mountain slope might refuse to use weather forecasting applications because they feel it is more accurate to read natural signs from bird behavior and wind direction. A coastal community might reject satellite-based fishing systems because they know those technologies will deplete fish stocks more rapidly and disrupt the ecological balance maintained for hundreds of years. In such situations, empowerment means supporting the community's decision not to adopt a certain technology, rather than forcing them to use it under the pretext of modernization. A form of sustainable intervention is one that provides options, delivers honest information regarding the positive and negative consequences of each choice, and then entrusts the final decision to the community through inclusive deliberation mechanisms. This attitude stands in sharp contrast to traditional intervention styles that view marginalized communities as a blank slate to be filled with technology from the outside. A paradigm shift from changing to accompanying is an absolute prerequisite for any sustainability.

Technological interventions that successfully achieve sustainability are also characterized by the presence of documentation systems and intergenerational knowledge transmission that do not rely solely on digital media (Ramankutty, 2023). Many empowerment projects collapse after the first generation of technology users retire or pass away because the technical knowledge they possessed was not passed down in time. In fact, the younger generation in marginalized communities is often uninterested in learning the technologies used by their parents because they are considered outdated or because they migrate to cities for work (Blake et al., 2021). To address this issue, interventions must design multiplex inheritance mechanisms, namely a combination of digital documentation (video tutorials, electronic manuals) and analog documentation (paper notebooks, wall drawings, songs) adapted to the learning preferences of the recipient generation. A mountain community with a strong oral tradition can pass down knowledge about solar panel maintenance through easily remembered regional songs. A coastal community accustomed to paintings on mosque walls can transmit water quality sensor calibration procedures through collectively painted murals. Innovations in these inheritance methods are often ignored by technology designers who are overly fixated on sophisticated user interfaces. Yet, without intergenerational sustainability, all empowerment achievements will vanish within a single human life cycle.

Sustainability also requires the diversification of financial resources so that communities do not depend on a single donor or a single source of income. A good intervention will help communities build a funding portfolio consisting of member dues, productive business revenues, village funds, philanthropic donations, and project grants whose sources vary each year (Kazanskaia, 2025). A digital cooperative that relies solely on grants from a single foreign foundation will collapse when that foundation shifts its priorities. Conversely, a cooperative that successfully attracts regular dues from two hundred members, secures service contracts from the village government, and sells training services to neighboring villages will survive even if one or two funding sources dry up. This diversification is not something that can be achieved in a short time. It takes years to build member trust so that they are willing to pay dues, to build a reputation so that the village government is willing to become a client, and to build service quality so that neighboring villages are willing to purchase training. Therefore, technological interventions for marginalized communities must be designed with a time horizon of at least five to ten years, rather than one or two years like most current development projects. Donors and governments need to change their habits of demanding quick results so that they align with the natural rhythm of authentic empowerment processes.

In highly diverse marginalized societies, there is no single form of technological intervention that suits all communities. The form of sustainable intervention for a fishing community differs from that for a farming community, which differs again from that for an urban disability community (Jagtap, 2019). These differences concern not only the type of technology used, but also organizational structures, decision-making mechanisms, and patterns of relationships with external parties. Fishing communities, accustomed to highly hierarchical organizations due to boat-owning skippers, will require a different approach from farming communities that may be more egalitarian. Disability communities with various types of physical limitations require universal design that cannot be equated with non-disabled communities. Therefore, the most sustainable interventions are those that begin with lengthy participatory research, where researchers live with the community for at least one year to study the intricacies of their lives before designing any intervention (Kendall & Dearden, 2020). Unfortunately, models like this are very rarely encountered because they are expensive and time-consuming. As a consequence, the result is the application of a one-size-fits-all recipe everywhere, with questionable

outcomes. As long as the one-size-fits-all approach continues to dominate, the sustainability of empowerment will remain a difficult dream to realize.

The greatest paradox in achieving sustainability through technological intervention is that technology itself changes very rapidly, whereas marginalized communities need stability to learn and adapt gradually (Bishop, 2021). An application learned with great difficulty over six months can become obsolete within a year due to operating system updates or because the developer discontinues the service. Hardware that was initially easy to repair locally becomes unrepairable when the manufacturer stops producing spare parts or locks the device with complex security. In this situation, the most sustainable intervention is precisely one that utilizes open and modular technology, namely open-source software whose program code can be modified by anyone, as well as hardware designed so that its spare parts are widely available and replaceable without special tools. This type of technology model enables communities to have full control over the lifecycle of the technology they use. They can ask volunteers around the world to fix bugs, they can produce simple spare parts themselves using 3D printers, and they can continue using the same system for years even though the outside world has moved on to other systems. This is the essence of true empowerment: the ability to determine one's own destiny amidst a swift current of change not by rejecting change, but by consciously choosing which changes to follow and which to bypass.

The sustainability of empowering marginalized communities through technology is achieved when the intervention fulfills six criteria: building the internal community's capacity to manage technology independently, creating collective ownership over digital infrastructure, developing peer facilitators from within the community, generating realistic new livelihoods, respecting the community's right to reject technology, and implementing financial resource diversification alongside open technology. These six criteria are systemic, meaning that not a single criterion is sufficient on its own. An intervention might successfully build internal capacity but fail to create livelihoods, resulting in an unsustainable outcome. An intervention might have well-diversified funding yet ignore collective ownership, leading to the technology being seized by more powerful parties. Therefore, intervention designers must treat sustainability as an integrated system rather than a collection of components that can be assembled separately. This systemic approach may feel complicated and expensive at the beginning, but it is far cheaper than the costs of repeatedly failing projects.

CONCLUSIONS

Digital technology functions as a medium for transforming power relations within marginalized communities through four primary pathways: collective coordination that transcends spatial and temporal boundaries, knowledge production from the standpoint of the subject, the shortening of intermediary chains in the economy, and decentralized legal advocacy. Each pathway contains both emancipatory potential and risks of exploitation, meaning that the effectiveness of transformation depends on the community's ability to critically master the technology. Sustainable empowerment is achieved when technological interventions meet six systemic criteria: internal capacity for self-management, collective ownership of infrastructure, development of facilitators from within the community, creation of new livelihoods, respect for the right to refuse technology, and diversification of financial resources alongside the use of open technologies. These six criteria cannot stand alone and must be realized simultaneously. This literature review emphasizes that authentic technological empowerment cannot be achieved through short-term projects or one-size-fits-all approaches, but requires long-term commitment and respect for local wisdom and the right to self-determination.

The findings of this study carry important implications for policymakers, development practitioners, and researchers in the field of marginalized community empowerment. For policymakers, a shift in funding frameworks is needed from short-term output-based projects to long-term process-based funding, with accountability mechanisms that measure community capacity rather than the number of devices distributed. For practitioners, a reorientation of roles is required from technical trainers to facilitators who assist communities in building collective ownership and developing intergenerational knowledge documentation systems. For researchers, the methodological implication is the need for longitudinal studies that follow community development for at least five to ten years, as well as participatory research that positions communities as co-designers of interventions rather than objects of observation. International donor agencies must also reconsider their practice of requiring quarterly progress reports, as the rhythm of authentic empowerment cannot be forced into artificial timeframes.

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