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BUILDING SUSTAINABLE COMMUNITY DIGITAL ECOSYSTEMS IN ISLAMIC BOARDING SCHOOLS

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ABSTRACT

Digital transformation increasingly requires organizations to orchestrate technological, organizational, and institutional resources beyond the adoption of digital technologies. However, prevailing digital ecosystem theories remain predominantly grounded in firm-centric assumptions, providing limited explanation for community-based institutions whose sustainability depends on shared values, institutional legitimacy, and collective participation. This study develops the Sustainable Community Digital Ecosystem (SCDE) as a middle-range theoretical framework to explain how digital transformation is institutionally orchestrated within community-based organizations. An explanatory qualitative single-case study was conducted at Pondok Pesantren Sunan Drajat, Indonesia, using semi-structured interviews, participant observation, and document analysis. Data were analyzed through reflexive thematic analysis, pattern matching, and explanation building. The findings demonstrate that sustainable digital ecosystems emerge through the dynamic interaction of six interrelated dimensions: Digital Infrastructure, Community

Platform, Entrepreneurial Capability, Collaboration Network, Islamic Governance, and Community Empowerment, which collectively reinforce Institutional Sustainability. Rather than functioning as independent organizational resources, these dimensions co-evolve through value-based institutional orchestration, whereby governance aligns digital innovation with institutional missions, ethical principles, and stakeholder participation. The study extends digital ecosystem theory by identifying an important boundary condition of prevailing firm-centric perspectives and demonstrates that ecosystem sustainability in community-based institutions is achieved through institutional legitimacy rather than market-based platform coordination. The proposed SCDE provides a theoretically grounded explanation of digital transformation in educational, religious, and other value-oriented organizations while offering practical guidance for designing sustainable digital transformation strategies in community settings.

INTRODUCTION

Digital transformation has become one of the defining forces reshaping contemporary organizations across business, public, and community sectors. Rapid advances in artificial intelligence (AI), cloud computing, big data analytics, the Internet of Things (IoT), and digital platforms have fundamentally altered how organizations create, coordinate, and sustain value. Rather than representing the adoption of new digital technologies alone, digital transformation is increasingly understood as a strategic and continuous process that reshapes organizational structures, governance, business models, operational routines, and institutional arrangements



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(Bharadwaj et al., 2013; Hess et al., 2016; Verhoef et al., 2021; Vial, 2019). From an institutional perspective, digital transformation also involves the emergence of new organizational forms, institutional infrastructures, and governance mechanisms through which digital innovation gains legitimacy and becomes embedded in organizational practice (Hinings et al., 2018). Across public, private, and nonprofit sectors, organizations are therefore expected not only to adopt digital technologies but also to develop new organizational capabilities that enable continuous adaptation in increasingly interconnected and uncertain environments (Nambisan et al., 2019; Warner & Wäger, 2019). Consequently, the strategic challenge of digital transformation has shifted from technology implementation toward the orchestration of complex interactions among technological, organizational, and institutional actors.

This shift has elevated the importance of ecosystem theory as a dominant perspective for understanding digitally enabled value creation. Early ecosystem research conceptualized ecosystems as communities of interdependent actors that co-evolve around shared value creation (Moore, 1993). This perspective was subsequently refined by strategy scholars who emphasized complementarities, ecosystem structure, and orchestration among heterogeneous actors (Adner, 2017; Jacobides et al., 2018). Recent ecosystem scholarship further differentiates business, platform, innovation, entrepreneurial, and knowledge ecosystems, highlighting that ecosystem diversity reflects differences in governance structures, value creation mechanisms, and forms of actor interdependence (Thomas & Autio, 2020). Likewise, ecosystem management increasingly relies on orchestration across dynamic actor networks rather than hierarchical control, requiring continuous coordination, collaboration, and relationship management (Aarikka-Stenroos & Ritala, 2017). More recent studies extend this view by explaining how digital infrastructures and platforms facilitate ecosystem emergence and coordination in digitally enabled environments (Constantinides et al., 2018; Nerbel & Kreutzer, 2023). Meanwhile, entrepreneurship scholars argue that ecosystem development also depends on entrepreneurial agency, institutional affordances, and collective intelligence that enable ecosystem evolution beyond firm boundaries (Autio et al., 2022; Elia et al., 2020; Sussan & Acs, 2017). Consequently, digital transformation is increasingly understood not as the modernization of individual organizations but as the development of interconnected ecosystems through which technological, organizational, and institutional resources are continuously integrated.

Recent scholarship has further expanded this perspective by recognizing that ecosystem sustainability depends on more than technological connectivity (Autio et al., 2022). Digital infrastructures create opportunities for interaction, but long-term ecosystem development also requires governance mechanisms, collaborative capabilities, institutional trust, and continuous learning among participating actors (Constantinides et al., 2018). Socio-technical systems theory argues that organizational performance emerges from the joint optimization of social and technical subsystems (Baxter & Sommerville, 2011; Trist, 1981). Recent studies further emphasize that



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digital systems should be designed as meaningful socio-technical arrangements that integrate technology, human agency, and organizational sustainability (Bednar & Welch, 2020).

Despite these advances, contemporary ecosystem research remains largely grounded in a firm-centric perspective. Across strategic management, innovation, and information systems literature, ecosystems are predominantly examined as configurations orchestrated by focal firms or digital platform owners seeking innovation, competitive advantage, and value capture (Adner, 2017; Jacobides et al., 2018). Governance mechanisms are therefore commonly interpreted as instruments for coordinating market complementarities, while ecosystem success is assessed through innovation performance, competitive positioning, and economic outcomes. This perspective has generated significant theoretical advances in explaining digital transformation within commercial environments. However, it also embeds an implicit assumption that sustainable ecosystems emerge primarily through market-based coordination.

Although this assumption is appropriate for many commercial settings, it becomes increasingly problematic when digital transformation unfolds within community-based institutions. Educational organizations, religious institutions, cooperatives, and social enterprises operate under multiple institutional missions that extend beyond economic performance. Their long-term sustainability depends simultaneously on educational quality, social legitimacy, ethical governance, community participation, and organizational resilience. Within these settings, digital technologies are not introduced solely to improve efficiency or strengthen competitiveness; they are also expected to reinforce institutional values, expand community engagement, and support broader social development. Consequently, ecosystem coordination is shaped not only by market incentives but also by shared norms, collective responsibility, and institutional legitimacy.

This distinction suggests an important boundary condition of prevailing ecosystem theory. If existing explanations assume that ecosystem sustainability is primarily driven by platform leadership, competitive complementarities, and market incentives, they provide only a partial explanation for organizations whose development depends on value-oriented institutional coordination (Elia et al., 2020; Jacobides et al., 2018; Nambisan et al., 2017). Community-based organizations demonstrate that digital transformation often involves the simultaneous orchestration of technological infrastructures, collaborative relationships, governance arrangements, entrepreneurial initiatives, and community participation. These interactions indicate that sustainable digital ecosystems may emerge through mechanisms that differ fundamentally from those predicted by conventional firm-centric perspectives.

We therefore argue that sustainable digital ecosystems in community-based institutions emerge through value-based institutional orchestration rather than market-based platform orchestration. This proposition constitutes the central theoretical premise of the present study. Rather than treating digital technologies as the primary drivers of organizational change, we contend that technology creates sustainable institutional value only when embedded within governance structures capable of aligning digital innovation with collective missions, ethical



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principles, and collaborative participation. In this sense, ecosystem sustainability is an emergent property of institutional orchestration rather than a direct consequence of technological capability.

Islamic boarding schools (pesantren) provide an ideal context for examining this alternative logic of ecosystem development. As one of Indonesia's oldest community-based institutions, pesantren simultaneously function as centers of education, religious authority, entrepreneurship, social services, and community development. Their institutional sustainability depends upon maintaining a balance between educational excellence, economic resilience, religious legitimacy, and long-term community participation. In recent years, many pesantren have adopted digital technologies to support educational administration, entrepreneurial activities, financial services, stakeholder communication, and collaborative partnerships. However, unlike commercial organizations, these digital initiatives are implemented to strengthen institutional missions and community welfare rather than to maximize market performance alone.

Among Indonesian pesantren, Pondok Pesantren Sunan Drajat represents a particularly theoretically revealing case. The institution has developed an extensive ecosystem that integrates educational activities with entrepreneurial ventures, cooperatives, digital platforms, financial technologies, government partnerships, industrial collaborations, alumni networks, and community empowerment programs. More importantly, these diverse activities are coordinated through Islamic governance that emphasizes ethical leadership, collective responsibility, and long-term institutional sustainability. Rather than functioning as isolated digital initiatives, technological infrastructures, collaborative platforms, entrepreneurial capability, and community participation operate as mutually reinforcing components of a broader institutional ecosystem. This configuration presents a theoretical puzzle for prevailing ecosystem research: while existing theory would predict that ecosystem sustainability is primarily achieved through market-oriented coordination, the experience of Pondok Pesantren Sunan Drajat suggests that sustainable digital ecosystems can instead emerge through value-based institutional orchestration embedded in community-centered governance. Resolving this puzzle requires a broader conceptualization of digital ecosystems that extends beyond prevailing firm-centric assumptions and provides a more comprehensive explanation of digital transformation within community-based institutions.

The theoretical puzzle outlined above indicates that the principal challenge addressed by this study is conceptual rather than contextual. While digital transformation and ecosystem research have substantially advanced understanding of digitally enabled value creation, three complementary streams of scholarship remain insufficiently integrated. The first stream explains digital transformation primarily through technological capabilities, organizational adaptation, and strategic renewal. The second emphasizes ecosystem governance, platform coordination, and inter-organizational collaboration as mechanisms for value co-creation. The third investigates community-based institutions by highlighting educational innovation, social entrepreneurship, Islamic governance, and community empowerment. Although each stream has generated important insights, they have largely evolved in parallel. Consequently, current scholarship



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provides limited explanation of how technological, organizational, entrepreneurial, collaborative, and governance mechanisms collectively interact to sustain digitally enabled community institutions.

This fragmentation reveals a broader limitation in prevailing ecosystem theory. Existing studies successfully explain how firms orchestrate ecosystems through market complementarities and platform leadership, yet they provide only limited insight into ecosystems coordinated through institutional legitimacy, shared values, and collective responsibility. Community-based organizations illustrate that ecosystem sustainability often depends not on competitive positioning alone but on the continuous alignment of digital technologies with governance, entrepreneurship, collaboration, and community participation. The theoretical challenge, therefore, is not merely to extend ecosystem theory into a new empirical context, but to refine its underlying assumptions so that it can explain alternative mechanisms of ecosystem orchestration beyond commercial environments.

To address this limitation, this study develops the Sustainable Community Digital Ecosystem (SCDE) as a middle-range theoretical framework for explaining digital transformation in community-based institutions. Rather than conceptualizing ecosystems as networks primarily coordinated by dominant firms or digital platforms, the SCDE explains ecosystem development as an institutionally embedded process of value-based orchestration. Within this framework, digital infrastructure provides the technological foundation for connectivity and information exchange, while community platforms facilitate interaction, knowledge sharing, and stakeholder participation. Entrepreneurial capability transforms digital resources into educational, social, and economic opportunities, and collaboration networks mobilize complementary capabilities through partnerships with government agencies, universities, industries, alumni, and local communities. Importantly, these interactions are continuously guided by Islamic governance, which aligns technological innovation with institutional values, ethical principles, and strategic direction. Community empowerment emerges from this dynamic interaction and, in turn, reinforces long-term institutional sustainability.

The SCDE therefore proposes a different explanation of ecosystem sustainability from that advanced by prevailing firm-centric perspectives. Rather than viewing governance as an instrument for coordinating market transactions or maximizing competitive advantage, the framework conceptualizes governance as the institutional mechanism through which technological capabilities are translated into collective value. Sustainable digital ecosystems are thus understood as emergent socio-technical systems in which governance, collaboration, entrepreneurship, digital infrastructure, and community participation continuously reinforce one another. This perspective broadens ecosystem theory by demonstrating that long-term sustainability can also arise from value-based institutional orchestration embedded within community-centered organizations.

Guided by this framework, the present study seeks to explain how a Sustainable Community Digital Ecosystem is developed and sustained within an Islamic boarding school undergoing



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digital transformation. Specifically, the study addresses the following research questions: (1). How is a Sustainable Community Digital Ecosystem institutionally orchestrated within an Islamic boarding school undergoing digital transformation? (2). How do digital infrastructure, community platforms, entrepreneurial capability, collaboration networks, and Islamic governance interact to generate community empowerment? (3). Through what mechanisms does community empowerment contribute to long-term institutional sustainability within a digitally enabled community ecosystem?

By addressing these questions, the study makes three interrelated theoretical contributions. First, it extends digital ecosystem theory by identifying an important boundary condition of prevailing firm-centric perspectives. The findings demonstrate that ecosystem sustainability in community-based institutions cannot be fully explained through market coordination or platform leadership alone but also depends on institutional legitimacy, ethical governance, and collective participation. Second, the study develops the Sustainable Community Digital Ecosystem (SCDE) as an integrative theoretical framework that explains how digital infrastructure, community platforms, entrepreneurial capability, collaboration networks, Islamic governance, and community empowerment function as mutually reinforcing dimensions of institutional sustainability. Third, the study contributes to digital transformation research by demonstrating that sustainable institutional development is an emergent outcome of ecosystem orchestration rather than a direct consequence of technology adoption, thereby shifting analytical attention from technological implementation toward the governance processes through which digital transformation generates enduring institutional value.

Beyond these theoretical contributions, the study also offers practical implications for educational leaders, policymakers, and organizations responsible for digital transformation initiatives in community settings. The findings suggest that investments in digital technologies are unlikely to produce sustainable institutional outcomes unless accompanied by governance mechanisms that cultivate stakeholder trust, strengthen collaborative networks, encourage entrepreneurial capability, and align digital innovation with institutional values. Accordingly, digital transformation strategies should be designed as ecosystem-building initiatives that integrate technological capability with governance, collaboration, and community empowerment rather than as isolated technology implementation projects.

Overall, this study argues that understanding digital transformation within community-based institutions requires moving beyond prevailing firm-centric assumptions toward a broader conceptualization of ecosystem sustainability. We contend that sustainable digital ecosystems are sustained through value-based institutional orchestration rather than market-based platform orchestration. By developing the Sustainable Community Digital Ecosystem (SCDE) and examining its operation within Pondok Pesantren Sunan Drajat, this study extends digital ecosystem theory to community-centered institutional contexts and provides a theoretically grounded explanation of how digital transformation can generate enduring organizational and

societal value. Accordingly, an explanatory single-case study was undertaken to investigate the mechanisms through which the proposed ecosystem is developed, coordinated, and sustained.

METHODE

This study employed an explanatory qualitative single-case study to investigate how a Sustainable Community Digital Ecosystem (SCDE) emerges within an Islamic boarding school. A qualitative case study is particularly appropriate for examining complex contemporary phenomena in their real-world settings when the boundaries between the phenomenon and its context are difficult to distinguish. Rather than testing causal relationships, this study seeks to explain the mechanisms through which digital infrastructure, community platforms, entrepreneurial capability, collaboration networks, and Islamic governance interact to generate community empowerment and institutional sustainability.

Pondok Pesantren Sunan Drajat, Lamongan, Indonesia, was purposively selected as a critical case because it represents one of the most digitally developed Islamic boarding schools in Indonesia. In addition to educating approximately 16,000 students, the institution operates numerous business units and has established an integrated digital ecosystem comprising institutional websites, social media, e-commerce platforms, Sundra App, and Pesantara.id. These characteristics provide an appropriate empirical setting for investigating ecosystem formation beyond conventional firm-centric contexts.

The unit of analysis was the institutional digital ecosystem of Pondok Pesantren Sunan Drajat, while the analytical dimensions followed the proposed SCDE framework consisting of Digital Infrastructure, Community Platform, Entrepreneurial Capability, Collaboration Network, Islamic Governance, Community Empowerment, and Institutional Sustainability.

Participants were selected through purposive sampling based on their direct involvement in institutional digital transformation and strategic decision-making. Informants included the pesantren leader, business unit managers, digital platform administrators, cooperative managers, information technology personnel, educators, and representatives of community partners. Participant recruitment continued until theoretical saturation was reached, whereby additional interviews no longer generated substantively new insights.

Data were collected between Mei-Juli 2026 through semi-structured interviews, non-participant observations, and document analysis. Interviews explored participants' experiences regarding digital transformation, ecosystem collaboration, governance practices, entrepreneurship, and institutional sustainability. Each interview lasted approximately 45-90 minutes, was conducted with participants' informed consent, audio-recorded, and transcribed verbatim.

To strengthen contextual understanding, observations focused on organizational activities related to digital platform utilization, business operations, community interactions, and collaborative practices. Documentary evidence included institutional reports, strategic plans, cooperative reports, official websites, social media, and digital platform records, including

Pesantara.id and Sundra App. The integration of multiple data sources enabled methodological triangulation and enhanced the credibility of the findings.

Data were analyzed using reflexive thematic analysis Braun & Clarke (2021) combined with pattern matching and explanation building techniques (Yin, 2018). Analysis began with repeated reading of interview transcripts, observation notes, and documentary materials to achieve familiarity with the data. Initial codes were generated to identify meaningful patterns before being grouped into broader categories and themes.

Coding combined deductive and inductive strategies. Deductive coding was guided by the preliminary SCDE dimensions identified in the literature, while inductive coding allowed additional concepts and relationships to emerge from the empirical evidence. This iterative process enabled continuous comparison between theoretical expectations and empirical observations.

The resulting themes were subsequently compared with the assumptions of prevailing digital ecosystem literature through pattern matching. Areas of convergence and divergence were identified to explain how ecosystem development within a community-based Islamic institution differs from dominant firm-centric ecosystem models. Finally, explanation building was employed to integrate the empirical findings into a coherent theoretical explanation, leading to the refinement of the Sustainable Community Digital Ecosystem (SCDE) Model.

The trustworthiness of the study was ensured through multiple procedures. Credibility was enhanced through triangulation of interviews, observations, and documentary evidence, together with source triangulation involving participants occupying different institutional roles. Preliminary findings were verified through member checking with selected participants. Dependability and confirmability were strengthened by maintaining an audit trail documenting data collection, coding decisions, and analytical interpretations throughout the research process. In addition, peer debriefing with scholars experienced in digital transformation and Islamic educational management was conducted to improve analytical rigor and minimize interpretive bias.

RESULT AND DISCUSSION

1. Developing the Sustainable Community Digital Ecosystem in Islamic Boarding Schools

The findings reveal that the Sustainable Community Digital Ecosystem (SCDE) at Pondok Pesantren Sunan Drajat emerged through a gradual institutional transformation rather than a technology-driven modernization initiative. Across all participant groups, digitalization was consistently described as a strategic organizational response to increasing institutional complexity, expanding educational services, strengthening economic independence, and maintaining Islamic values. Rather than functioning as isolated digital applications, technological initiatives were intentionally embedded within the pesantren's educational, entrepreneurial, and social missions, resulting in an integrated ecosystem that connects multiple institutional actors.

The institutional leader explained that digital transformation was introduced to improve organizational effectiveness while preserving the pesantren's broader mission:

“Digital transformation has become a strategic necessity to improve educational services, business operations, and Islamic outreach. Technology enables us to manage the institution more effectively while remaining committed to our religious mission.” (Institutional Leader)

The emphasis on institutional transformation was reinforced by another leader, who viewed digitalization as a long-term strategy for organizational sustainability rather than merely improving operational efficiency:

“Digitalization is not only about efficiency. It is also a strategy to strengthen the pesantren's economic independence so that educational and social missions can be sustained.” (Institutional Leader)

These statements demonstrate that digital transformation was conceptualized as an institutional capability rather than an investment in information technology alone. Instead of separating educational management, business development, and community services into independent domains, digital technologies were deliberately designed to integrate these institutional functions through shared digital infrastructure.

This strategic orientation was consistently confirmed by other participant groups. Teachers explained that digital platforms had become integral to educational administration and daily learning activities, allowing instructional processes to become more organized while simultaneously improving students' digital literacy. One teacher commented:

“Digital platforms have made teaching administration much more organized. At the same time, students become familiar with technology because they use digital systems as part of their daily learning activities.” (Teacher)

Similarly, students described digitalization as an integrated service rather than merely an administrative tool:

“Through SantriLink, attendance, payments, and institutional information are all integrated into one platform. Our parents can also monitor our activities remotely, making communication much easier.” (Student)

Beyond education, digital transformation also reshaped the pesantren's entrepreneurial activities. According to the Business Unit Manager:

“Digitalization has expanded our business beyond the pesantren. Through digital platforms and online marketplaces, our products reach broader markets while operational processes become faster and more transparent.” (Business Unit Manager)

Taken together, these perspectives demonstrate that digital transformation was collectively understood as a mechanism for institutional integration. Leaders emphasized strategic vision, teachers highlighted educational effectiveness, students experienced improved service quality, and business managers observed increased organizational competitiveness. This convergence of perspectives suggests that ecosystem development did not emerge from a single technological initiative but from coordinated institutional change involving multiple stakeholder groups.

The coding process further illustrates how participants consistently associated digital transformation with broader institutional objectives rather than isolated technological functions.

Table 1. Coding Structure for Developing the Sustainable Community Digital Ecosystem

Representative Evidence	Open Code	Analytical Theme	SCDE Dimension
Digital transformation as a strategic necessity	Strategic digital vision	Institutional digital transformation	Digital Infrastructure
Educational services supported by digital platforms	Integrated educational services	Community-oriented platform	Community Platform
Digitalization strengthens economic independence	Economic sustainability	Community empowerment through entrepreneurship	Community Empowerment
Technology supports Islamic outreach	Mission integration	Institutional value creation	Islamic Governance
Digital systems connect education, business, and services	Institutional integration	Ecosystem development	SCDE Formation

The empirical evidence suggests that digital infrastructure should not be conceptualized solely as a technological resource. Instead, digital infrastructure represents a strategic organizational capability that acquires value only when translated into community-oriented digital platforms facilitating interaction among heterogeneous stakeholders. This interpretation is consistent with Bharadwaj et al. (2013), who argue that digital technologies should be viewed as integral components of organizational strategy rather than stand-alone information technology assets. This finding also aligns with socio-technical systems theory, which argues that organizational performance emerges through the interaction between technological and social subsystems rather than through technology alone (Baxter & Sommerville, 2011). Similarly, digital transformation literature emphasizes that organizational value is generated through changes in work practices and stakeholder relationships rather than through technological implementation (Vial, 2019). This interpretation is also consistent with the distinction between digital infrastructures and digital platforms proposed by Constantinides et al. (2018), while extending



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recent work on digital platform ecosystem emergence by showing that digital infrastructures generate value through institutional participation and community interaction rather than through complementor expansion alone.

This finding also extends the digital transformation literature. Previous studies have predominantly conceptualized digital transformation as organizational adaptation enabled by technological capabilities (Vial, 2019). However, the present findings suggest that, within community-based religious institutions, digital transformation represents a broader process of institutional integration in which technology becomes inseparable from governance, community participation, and social purpose. Consequently, digital technologies should be understood not merely as operational tools but as institutional infrastructures that enable collaboration among heterogeneous stakeholders.

The findings complement recent discussions on the evolution of digital platform ecosystems, which emphasize ecosystem emergence as a dynamic and multi-stage process (Nerbel & Kreutzer, 2023). However, unlike prevailing platform ecosystem models that remain centered on focal platform governance, the present study demonstrates that ecosystem formation in community-based institutions is initiated through value-based institutional orchestration embedded in shared institutional values and collective missions.

2. Digital Infrastructure and Community Platforms as Mechanisms for Community Empowerment

The findings demonstrate that digital infrastructure at Pondok Pesantren Sunan Drajat extends beyond technological assets to function as an institutional enabler that connects educational, administrative, and community activities. Across participant groups, digital infrastructure was consistently perceived as the foundation upon which community platforms facilitate interaction, coordination, and service delivery. Rather than treating infrastructure and platforms as separate organizational resources, participants described them as mutually reinforcing components of an integrated digital ecosystem.

Institutional leaders explained that digital infrastructure was developed systematically to support the pesantren's long-term strategic objectives. Investments in internet connectivity, integrated information systems, digital applications, and financial technologies were intended to improve organizational coordination while maintaining institutional values.

“Digital infrastructure was developed based on institutional needs and implemented gradually through a strategic roadmap. Every technological investment is intended to improve services while supporting the pesantren's educational and social missions.”
(Institutional Leader)

This strategic perspective was reinforced by teachers, who emphasized that digital infrastructure had transformed educational administration. Rather than replacing conventional

teaching, digital systems simplified routine administrative tasks and enabled teachers to devote more attention to instructional activities.

“Ustadz Link has significantly improved teaching administration. Attendance, academic records, and institutional communication are now better organized, allowing us to focus more on learning activities.” (Teacher)

Teachers further highlighted that continuous interaction with digital systems contributes to students' digital capability development.

“Students do not simply use technology; they learn how to adapt to digital systems responsibly as part of their educational experience.” (Teacher)

Students described similar experiences from the user perspective. They consistently identified SantriLink as the primary interface connecting them with institutional services.

“SantriLink integrates attendance, payments, and institutional information into one application. Everything becomes easier because we can access services through a single platform.” (Student)

Importantly, students also emphasized that the platform extends beyond internal administration by strengthening communication between the pesantren and parents.

“Our parents can monitor attendance and payment information from home, so they remain involved in our activities without having to visit the boarding school.” (Student)

Viewed together, these accounts reveal two complementary mechanisms within the SCDE. The first mechanism is Digital Infrastructure, which provides the technological foundation through integrated systems, internet connectivity, and institutional applications. The second mechanism is the Community Platform, which transforms that infrastructure into meaningful interactions among institutional actors. Digital infrastructure enables technological functionality, whereas community platforms generate participation, communication, and collaborative engagement.

This distinction is particularly evident in the perspectives of different participant groups. Institutional leaders primarily emphasized strategic investments and organizational integration; teachers focused on educational efficiency and digital capability development; students highlighted accessibility, convenience, and service quality. The convergence of these perspectives indicates that community empowerment does not arise directly from technology itself but from the institutional interactions enabled by digital platforms.

Table 2. Coding Structure for Digital Infrastructure and Community Platforms

Representative Evidence	Open Code	Analytical Theme	SCDE Dimension
Strategic investment in digital systems	Digital infrastructure planning	Institutional digital capability	Digital Infrastructure
Integrated attendance and administration	Administrative integration	Digital service management	Digital Infrastructure



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One platform for multiple services	Platform integration	Community platform	Community Platform
Parents monitor student activities	Stakeholder connectivity	Community participation	Community Platform
Students adapt to digital systems	Digital literacy	Educational empowerment	Community Empowerment
Easier access to institutional services	Service accessibility	User-centered services	Community Empowerment

The empirical evidence suggests that digital infrastructure should not be conceptualized solely as a technological resource. Instead, infrastructure acquires organizational value only when translated into community-oriented digital platforms that facilitate interaction among heterogeneous stakeholders. This finding aligns with socio-technical systems theory, which argues that organizational performance emerges through the interaction between technological and social subsystems rather than through technology alone (Baxter & Sommerville, 2011). Similarly, digital transformation literature emphasizes that organizational value is generated through changes in work practices and stakeholder relationships rather than through technological implementation (Vial, 2019). This interpretation is also consistent with the distinction between digital infrastructures and digital platforms proposed by Constantinides et al. (2018), while extending recent work on digital platform ecosystem emergence by showing that digital infrastructures generate value through institutional participation and community interaction rather than through complementor expansion alone.

However, the present findings also extend existing digital platform literature. Previous studies commonly portray digital platforms as intermediaries facilitating transactions or innovation among market participants (Nambisan et al., 2019). In contrast, the community platforms observed in this study perform broader institutional functions. SantriLink and UstadzLink simultaneously support educational administration, institutional communication, parental engagement, and community participation. Platform value therefore emerges from strengthening institutional relationships rather than merely increasing transactional efficiency.

This distinction is theoretically important because it demonstrates that community-oriented platforms generate multidimensional value. Beyond improving operational efficiency, they enhance transparency, reinforce stakeholder engagement, develop digital literacy, and strengthen institutional trust. These outcomes collectively contribute to community empowerment, illustrating that digital platforms within Islamic boarding schools function as socio-institutional infrastructures rather than conventional transactional technologies.

These findings refine the SCDE model by identifying Digital Infrastructure as the enabling layer and Community Platform as the relational layer of the ecosystem. Community empowerment is therefore not a direct consequence of technological investment but an emergent outcome of continuous interactions among digital infrastructure, institutional actors, and stakeholder

participation. This mechanism extends existing digital platform theory by demonstrating how community-oriented institutions create digital value through service integration, participatory engagement, and institutional connectivity rather than through market transactions alone.

3. Entrepreneurial Capability and Collaboration Network as Drivers of Ecosystem Orchestration

The findings demonstrate that the sustainability of the SCDE depends not only on digital infrastructure but also on the capability of institutional actors to transform technological resources into social and economic value. Across interviews with the Business Unit Manager and the Pesantara.id Manager, entrepreneurial capability emerged as a dynamic organizational competence encompassing digital innovation, business management, and capability development. Simultaneously, collaboration networks expanded the ecosystem beyond organizational boundaries by connecting multiple Islamic boarding schools through shared digital platforms.

The Business Unit Manager explained that digitalization fundamentally changed how business units operated. Previously, commercial activities relied on manual processes and local markets, whereas digital technologies enabled integrated business management, wider market access, and more efficient operations.

“Digitalization has transformed the way we manage our business units. Transactions are faster, financial records are more organized, and our products are no longer limited to the local community because digital platforms allow us to reach broader markets.” (Business Unit Manager)

Digital transformation also stimulated organizational innovation. The Business Unit Manager described how the pesantren introduced digital marketplaces, online promotion, digital cooperative services, and integrated distribution systems to support business development.

“The introduction of a pesantren marketplace and digital cooperative has made our business processes more efficient while creating new opportunities to expand market access.” (Business Unit Manager)

Importantly, entrepreneurial capability was not perceived solely as technological competence. Informants consistently emphasized that successful digital entrepreneurship requires continuous investment in human capabilities, including digital marketing, business analytics, technology adoption, and Islamic business ethics.

“Human resources must continuously improve their digital competencies, but technological capability should always be accompanied by an understanding of Islamic economic principles.” (Business Unit Manager)

While entrepreneurial capability strengthened internal organizational performance, the interviews further revealed that Pesantara.id functions as the ecosystem orchestrator that coordinates collaboration among multiple pesantren. According to the platform manager:

“Pesantara.id was established as a digital holding platform connecting pesantren cooperatives into one integrated business ecosystem where members can exchange products, conduct transactions, and develop partnerships.” (Pesantara.id Manager)

The platform does not merely facilitate transactions. Instead, it provides institutional mechanisms that encourage collaboration through shared product catalogues, digital ordering systems, communication channels, technical assistance, and continuous training.

“We continuously organize training, technical assistance, and service improvements because ecosystem participation depends on members' ability to use the platform effectively.” (Pesantara.id Manager)

This finding indicates that collaboration is actively cultivated rather than emerging automatically from technology adoption. The platform manager further explained that members participate more actively when they perceive tangible economic benefits, including faster transactions, wider market access, and stronger inter-pesantren cooperation. Consequently, network participation evolves through reciprocal learning, institutional support, and shared value creation rather than through competitive market incentives.

Table 3. Coding Structure for Entrepreneurial Capability and Collaboration Network

Representative Evidence	Open Code	Analytical Theme	SCDE Dimension
Digital marketplace expands market access	Market expansion	Digital business innovation	Entrepreneurial Capability
Integrated financial management	Business process digitalization	Operational capability	Entrepreneurial Capability
Continuous digital skills development	Capability building	Human capital development	Entrepreneurial Capability
Platform connects pesantren cooperatives	Ecosystem orchestration	Collaboration network	Collaboration Network
Training and technical assistance	Capacity development	Network governance	Collaboration Network
Shared transactions and product catalogues	Resource integration	Inter-organizational collaboration	Collaboration Network

The findings refine existing perspectives on entrepreneurial capability by demonstrating that digital entrepreneurship in community-based institutions extends beyond opportunity exploitation and technological innovation. Entrepreneurial capability emerges through the interaction of organizational resources, collaborative relationships, and institutional support that enable collective learning and value creation across the ecosystem. This interpretation is consistent with entrepreneurial ecosystem research, which emphasizes that entrepreneurial outcomes are shaped by networks, institutional conditions, and knowledge exchange rather than by individual



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entrepreneurial action alone (Spigel, 2017; Stam, 2015). In the context of Islamic boarding schools, entrepreneurial capability is simultaneously directed toward strengthening institutional resilience, community welfare, and value creation consistent with religious principles. This observation complements digital entrepreneurship literature by illustrating that entrepreneurial capability can be socially embedded within institutional missions rather than driven solely by commercial objectives.

The findings also contribute to ecosystem theory by clarifying how collaboration networks are governed. Previous ecosystem studies frequently describe orchestration as the role of a dominant platform owner coordinating complementary actors through market mechanisms (Adner, 2017; Jacobides et al., 2018). In contrast, Pesantara.id performs orchestration through network governance, combining digital infrastructure with capability development, technical assistance, and shared institutional values. Participation is sustained not through hierarchical control or market dependence, but through continuous learning, mutual trust, and reciprocal economic benefits among member institutions.

The findings further extend ecosystem orchestration research by demonstrating that collaborative capability building and institutional learning function as ecosystem coordination mechanisms beyond value creation and capture traditionally emphasized in innovation ecosystem research (Ritala et al., 2013). Together, they demonstrate that ecosystem orchestration in Islamic boarding schools is achieved through capability building and collaborative governance rather than firm dominance or purely transactional coordination. This extends prevailing digital ecosystem theory by showing that community-based ecosystems can sustain innovation through value-driven inter-organizational collaboration, providing an alternative orchestration logic for non-commercial institutional contexts.

4. Islamic Governance and Institutional Sustainability

The findings reveal that the sustainability of the Sustainable Community Digital Ecosystem (SCDE) is not determined solely by technological capability or entrepreneurial performance. Instead, ecosystem sustainability is continuously reinforced through Islamic governance, which provides ethical direction, institutional legitimacy, and collective commitment for digital transformation. Across all participant groups, Islamic values were consistently described as the underlying principles guiding strategic decisions, business operations, digital platform management, and community relationships. Rather than functioning as an external contextual factor, Islamic governance emerged as an integral institutional mechanism that coordinates technological, entrepreneurial, and collaborative activities toward long-term sustainability.

The Institutional Leader emphasized that digital transformation should never be separated from the pesantren's educational and religious mission:

"Technology is only a tool. Every digital innovation must strengthen education, economic independence, and da'wah while remaining consistent with Islamic values. If technology

moves away from these values, it no longer serves the mission of the pesantren."
(Institutional Leader)

This statement illustrates that digital technologies are evaluated not merely according to operational efficiency but also according to their contribution to institutional missions and public benefit (masalahah). Digital transformation therefore becomes an ethical institutional strategy rather than a purely technological initiative.

Similar perspectives were expressed by the Business Unit Manager, who explained that digital entrepreneurship is always conducted within Islamic economic principles.

"Business innovation is encouraged, but every transaction must remain transparent, accountable, and consistent with Sharia principles. Digital technology helps us achieve these objectives more effectively." (Business Unit Manager)

This perspective indicates that entrepreneurial capability is institutionally constrained and simultaneously strengthened by ethical governance. Innovation is encouraged, yet technological development remains aligned with religious legitimacy and organizational accountability.

The importance of governance was further reinforced by the Pesantara.id Manager, who explained that digital platforms were intentionally designed to strengthen transparency and trust among participating pesantren.

"Digital transactions are fully recorded through the platform. This improves accountability among member cooperatives and strengthens mutual trust because every transaction can be monitored transparently." (Pesantara.id Manager)

Teachers and students similarly emphasized that integrated digital services strengthened relationships between the pesantren and parents through improved communication, transparency, and accountability.

"Parents receive information more quickly and can monitor academic activities through the system. This creates greater confidence in institutional services." (Teacher)

"Our parents know our attendance, academic activities, and payments through the application. Communication has become much easier." (Student)

Taken together, these findings demonstrate that Islamic governance operates through multiple complementary mechanisms. First, it establishes ethical principles that guide technological decision-making. Second, it reinforces institutional legitimacy by aligning digital innovation with religious values. Third, it strengthens trust among internal and external stakeholders through transparency and accountability. Consequently, institutional sustainability emerges not simply because digital technologies improve efficiency, but because governance enables continuous alignment between technological innovation and institutional values.

Table 4. Coding Structure for Islamic Governance and Institutional Sustainability

Representative Evidence	Open Code	Analytical Theme	SCDE Dimension
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Technology supports education and da'wah	Mission alignment	Ethical digital governance	Islamic Governance
Digital business follows Sharia principles	Ethical entrepreneurship	Islamic business governance	Islamic Governance
Transparent digital transactions	Accountability	Institutional trust	Islamic Governance
Parents monitor institutional activities	Transparency	Stakeholder trust	Institutional Sustainability
Digital governance strengthens legitimacy	Institutional legitimacy	Sustainable governance	Institutional Sustainability
Technology supports long-term institutional missions	Value-oriented sustainability	Institutional resilience	Institutional Sustainability

The findings extend existing digital ecosystem literature by demonstrating that ecosystem sustainability cannot be explained solely through technological complementarities or market coordination (Adner, 2017; Jacobides et al., 2018). Rather, the sustainability of community-based ecosystems depends upon governance mechanisms that continuously align technological innovation with institutional values and collective objectives. This interpretation is consistent with institutional theory, which argues that organizational sustainability depends on the establishment of legitimate governance structures, shared norms, and socially accepted institutional arrangements that guide organizational behaviour (Scott, 1976). Unlike commercial platform ecosystems, where governance primarily regulates market interactions, Islamic governance simultaneously performs ethical, social, and institutional coordination functions.

These findings also complement recent discussions on digitally induced organizational change (Haug et al., 2024) and institutional entrepreneurship in digital transformation (Firk et al., 2025). Whereas prior studies explain digital transformation as requiring new institutional logics within organizations, the present study demonstrates that institutional legitimacy grounded in Islamic governance serves as the mechanism through which digital innovation is continuously aligned with organizational missions and community values.

These findings refine the SCDE model by positioning Islamic Governance as the institutional coordination mechanism that legitimizes digital transformation, reinforces stakeholder trust, and sustains ecosystem development. Institutional sustainability therefore emerges through the interaction between ethical governance, digital capability, entrepreneurial innovation, and collaborative participation rather than through technological advancement alone.

5. Refinement of the Sustainable Community Digital Ecosystem (SCDE)



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The preceding findings collectively demonstrate that the Sustainable Community Digital Ecosystem (SCDE) extends prevailing digital ecosystem theory by explaining how digitally enabled community institutions create sustainable institutional value through continuous interaction among technological, entrepreneurial, collaborative, and governance mechanisms. Rather than functioning as independent organizational resources, the six analytical dimensions identified in this study operate as mutually reinforcing components of a dynamic institutional ecosystem.

The refined SCDE model proposes that ecosystem development begins with Islamic Governance, which establishes institutional vision, ethical principles, and strategic direction for digital transformation. Guided by these values, Digital Infrastructure provides the technological foundation supporting integrated organizational activities. This infrastructure is subsequently operationalized through Community Platforms, which facilitate communication, service integration, knowledge exchange, and stakeholder participation across the pesantren ecosystem.

Building upon these technological foundations, Entrepreneurial Capability enables institutional actors to convert digital resources into educational, social, and economic value. Simultaneously, Collaboration Networks extend ecosystem participation beyond organizational boundaries through partnerships, shared learning, technical assistance, and inter-pesantren cooperation. The interaction among these mechanisms generates multidimensional Community Empowerment, reflected in improved educational services, economic independence, institutional participation, and digital capability development. Ultimately, these cumulative interactions strengthen Institutional Sustainability, allowing the pesantren to continuously adapt to technological change while preserving its educational mission and Islamic identity.

Unlike dominant digital ecosystem models that conceptualize ecosystem orchestration as firm-centric coordination driven by market complementarities, the refined SCDE model demonstrates that ecosystem sustainability within community institutions is achieved through value-based institutional orchestration. Technology functions as an enabling infrastructure rather than the central driver, while governance, community participation, and institutional legitimacy become essential mechanisms supporting long-term ecosystem resilience.

Based on the empirical findings, three theoretical propositions are proposed: (1). Islamic Governance legitimizes the adoption of digital infrastructure and community platforms by aligning technological innovation with institutional values and long-term educational missions. (2). Entrepreneurial Capability and Collaboration Networks mediate the relationship between digital platforms and community empowerment by transforming technological resources into collective institutional value. (3). Institutional Sustainability emerges through the continuous interaction of ethical governance, digital capability, entrepreneurial innovation, collaborative participation, and community empowerment rather than through technology adoption alone.

The refined SCDE model therefore broadens digital ecosystem theory beyond its prevailing firm-centric orientation. Instead of emphasizing competitive advantage and market-based



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complementarities, the model conceptualizes digital ecosystems as community-centered institutional systems in which technological capabilities, entrepreneurial initiatives, collaborative governance, and shared values continuously co-evolve to generate sustainable institutional development. This reconceptualization provides an alternative theoretical explanation for digital transformation within educational, religious, and other community-based organizations operating beyond purely commercial environments.

The findings collectively demonstrate that the Sustainable Community Digital Ecosystem (SCDE) provides an alternative explanation for digital transformation in community-based institutions. Recent ecosystem scholarship recognizes that ecosystems comprise multiple forms, including business, innovation, entrepreneurial, and platform ecosystems, each characterized by distinct governance structures, actor configurations, and value creation mechanisms (Thomas & Autio, 2020). While prevailing digital ecosystem theory predominantly conceptualizes ecosystems as networks coordinated by focal firms or platform owners pursuing competitive advantage (Adner, 2017; Jacobides et al., 2018), the present study reveals that ecosystem sustainability within Islamic boarding schools emerges through value-based institutional orchestration. Rather than being driven primarily by market complementarities, ecosystem development is guided by institutional legitimacy, shared values, ethical governance, and long term community participation. This finding addresses the theoretical puzzle identified in the Introduction by showing that digital ecosystem sustainability cannot be fully explained through existing firm-centric assumptions when digital transformation occurs within community-oriented organizations.

The analysis further demonstrates that ecosystem development is not initiated by technological investment alone but through the interaction of multiple institutional mechanisms. Islamic Governance provides the normative foundation by establishing institutional vision and legitimizing digital innovation. Digital Infrastructure supplies the technological capability required for organizational integration, while Community Platforms translate technological resources into participatory interactions among students, educators, parents, cooperatives, and external stakeholders. Entrepreneurial Capability transforms these digital resources into educational, social, and economic value, whereas Collaboration Networks extend institutional capacity beyond organizational boundaries through partnerships, shared learning, and inter-pesantren cooperation. Community Empowerment subsequently emerges as the cumulative outcome of these interacting mechanisms, ultimately reinforcing Institutional Sustainability. Rather than operating as independent dimensions, the components of the SCDE continuously co-evolve through reciprocal institutional relationships that strengthen the resilience of the ecosystem over time.

Collectively, these findings complement recent discussions on the evolution of digital platform ecosystems (Nerbel & Kreutzer, 2023), extend ecosystem orchestration beyond value creation and capture mechanisms (Ritala et al., 2013), and support the growing argument that digital transformation represents a process of institutional change rather than technological implementation alone (Firk et al., 2025; Haug et al., 2024). Building on these perspectives, the

SCDE framework proposes value-based institutional orchestration as the primary mechanism through which community-based digital ecosystems achieve long-term sustainability.

The study also contributes to the digital transformation literature by extending understanding beyond technology adoption and organizational adaptation. Previous studies have frequently conceptualized digital transformation as the deployment of digital technologies to improve organizational performance (Verhoef et al., 2021; Vial, 2019). The present findings suggest that, within community-based institutions, digital transformation should instead be understood as a process of institutional integration through which technological capability, governance, entrepreneurship, collaboration, and stakeholder participation become mutually reinforcing. Technology therefore derives strategic value not because of its technical characteristics alone, but because it enables the continuous alignment of organizational resources with institutional objectives and collective social purposes.

Beyond extending existing theories, the findings establish the Sustainable Community Digital Ecosystem (SCDE) as a middle-range theoretical explanation for digital transformation in value-oriented institutions. Rather than treating educational organizations, religious institutions, cooperatives, or community enterprises as exceptional contexts requiring separate theoretical treatment, the SCDE proposes a more general mechanism explaining how sustainable digital ecosystems emerge when institutional coordination is guided by shared values instead of market incentives. Consequently, the framework may provide analytical relevance beyond Islamic boarding schools, offering a conceptual basis for understanding digital transformation within universities, faith-based organizations, social enterprises, cooperatives, and other community-centered institutions whose sustainability depends upon institutional legitimacy, collaborative participation, and long-term social value creation.

Taken together, the findings indicate that sustainable digital ecosystems should be understood as socio-institutional systems rather than predominantly technological or market-driven arrangements. The central theoretical contribution of this study therefore lies not only in identifying the individual dimensions of the SCDE, but also in explaining the institutional mechanism through which these dimensions interact to generate sustainable organizational development. By demonstrating that ecosystem sustainability emerges through value-based institutional orchestration, the study extends prevailing digital ecosystem theory beyond its traditional commercial orientation and offers a broader explanation of how digital transformation can generate enduring institutional and societal value in community-based organizations.

CONCLUSION

This study set out to explain how a Sustainable Community Digital Ecosystem (SCDE) is developed and sustained within an Islamic boarding school undergoing digital transformation. The findings demonstrate that sustainable digital ecosystems are not established through technological



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adoption alone but through the continuous interaction of digital infrastructure, community platforms, entrepreneurial capability, collaboration networks, and Islamic governance. These interrelated dimensions collectively enable community empowerment while strengthening the long-term sustainability of the institution. The study therefore shows that digital transformation in community-based organizations represents an institutional process in which technology is embedded within educational, entrepreneurial, and social missions rather than functioning as an isolated technological initiative.

The findings further reveal that the coordination logic of community-based digital ecosystems differs from prevailing firm-centric ecosystem models. Whereas existing digital ecosystem literature predominantly emphasizes platform leadership, market complementarities, and value capture, the present study demonstrates that ecosystem sustainability is achieved through value-based institutional orchestration. Institutional legitimacy, ethical governance, collaborative participation, and shared community values become the primary mechanisms through which digital technologies generate sustainable organizational development. Consequently, technological capability derives its strategic value from its continuous alignment with institutional missions and collective social objectives.

The essential contribution of this study lies in the development of the Sustainable Community Digital Ecosystem (SCDE) as an integrated theoretical framework for explaining digital transformation in community-based institutions. The proposed framework broadens existing digital ecosystem theory by positioning value-based institutional orchestration as the central mechanism linking digital capability, governance, entrepreneurship, collaboration, community empowerment, and institutional sustainability. This perspective offers a broader understanding of digital ecosystem development beyond commercial environments and provides a conceptual foundation for future research on digitally enabled educational, religious, and other community-oriented organizations.

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