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Architectural Openness and Relational Anchoring in Digital Banking Ecosystems

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Abstract

Purpose – This study examines how interoperability capability and value management capability shape ecosystem based digital transformation in the banking sector, with particular attention to the alignment between structural openness and relational anchoring.

Methodology – The study adopts a quantitative explanatory research design. Data were collected through a cross sectional survey of 325 senior executives across 49 banking institutions in Indonesia. To test the hypotheses, data were analyzed using Structural Equation Modeling (SEM) to evaluate the direct impacts and the interaction effect of the capabilities.

Findings – The empirical testing confirms that both interoperability and value management capabilities significantly and positively enhance ecosystem competitiveness. Furthermore, the results reveal a significant interaction effect between the two, proving that structural openness must be anchored by relational value to achieve optimal performance and prevent the commoditization of services.

Implications – The results highlight that digital transformation requires a balanced dual-pillar approach. Banks must adopt a coordinated strategy that integrates interoperability development with value creation strategies.

Originality – This study advances digital transformation literature by empirically testing a dual pillar capability model in an emerging market context, providing statistical evidence on the interaction effect between structural openness and relational anchoring.

Introduction

Industry reports further indicate that the global financial sector is rapidly moving toward interoperable and real time payment ecosystems, increasing competitive pressure on traditional banking models (McKinsey & Company, 2021). In such environments, technological integration alone is insufficient to sustain competitive advantage. Digital transformation (DT) has undergone a profound conceptual evolution over the past two decades. Initially framed as a program of technological upgrading, modernizing legacy IT systems, digitizing back office processes, and automating operational workflows, DT is now widely understood as a structural reconfiguration of industries around digitally enabled ecosystems (Vial, 2019). This transition reflects a shift from inward looking efficiency enhancement to outward facing network integration. In contemporary settings, digital transformation no longer centers on improving isolated organizational processes; instead, it involves repositioning firms within interconnected constellations of platforms, partners, and complementary service providers.

Nowhere is this transformation more visible than in the financial services sector. Banks are no longer competing solely on proprietary infrastructure, balance sheet strength, or physical distribution networks. Rather, they increasingly operate within digitally mediated ecosystems that include e-commerce platforms,

mobility applications, government payment infrastructures, fintech startups, and merchant marketplaces (Jacobides et al., 2018; Yoo et al., 2010). In this environment, value creation is distributed across networks rather than confined within firm boundaries. Competitive advantage depends on the ability to orchestrate data flows, integrate services modularly, and participate effectively in multi sided digital architectures (Parker et al., 2016).

This shift toward ecosystem embedding signals a deeper transformation in strategic logic. Traditional banking models derived advantage from control over infrastructure and customer access. However, digital ecosystems dissolve such exclusivity. Open interfaces, standardized payment rails, and API based integrations reduce switching costs and enhance cross platform compatibility. As a result, advantage increasingly emerges not from ownership of assets but from participation in networked value systems. Digital transformation thus becomes synonymous with ecosystem positioning, requiring not only technological change but also organizational and leadership alignment to drive transformation outcomes (Tilson et al., 2010), requiring banks to redesign technical architectures, governance frameworks, and value propositions to operate in environments characterized by modularity, interoperability, and rapid innovation cycles.

Despite the widespread adoption of ecosystem discourse in both academic research and industry practice, critical theoretical gaps remain. First, there is limited clarity regarding the specific structural capabilities that determine ecosystem success in banking. While digital platforms promise scalability and openness, architectural modernization alone does not guarantee superior competitive outcomes. Many institutions invest heavily in digital technologies yet fail to translate openness into sustained performance gains. This suggests that ecosystem participation requires more than technological readiness; it demands strategic capability alignment. Second, an unresolved question concerns how banks convert ecosystem openness into durable competitive advantage. Openness expands connectivity and accelerates innovation, but it may simultaneously increase substitutability. When customers can seamlessly transact across institutions connected to the same digital rails, differentiation becomes more difficult. Under such conditions, banks risk commoditization unless they cultivate relational depth and embedded value. Thus, openness without anchoring may erode advantage rather than strengthen it.

To address these challenges, this study proposes a dual capability framework for ecosystem based digital transformation in banking. We argue that transformation outcomes depend on the interaction between two interdependent pillars: ecosystem interoperability and value management. Ecosystem interoperability refers to the structural capacity of banks to integrate seamlessly across institutional boundaries through standardized APIs, secure authentication protocols, shared data governance mechanisms, and national payment infrastructures (Tilson et al., 2010). This capability expands market reach and enhances innovation velocity by enabling participation in distributed networks.

Value management, in contrast, represents a relational capability focused on deepening customer dependence through personalization, service bundling, engagement design, reliability, and economic optimization (Parker et al., 2016). Whereas interoperability determines how broadly a bank can connect, value management determines how deeply it can anchor customers within its ecosystem. Sustainable advantage emerges only when both capabilities develop in tandem. Overemphasis on interoperability risks commoditized openness; overemphasis on stickiness without integration limits scale and innovation.

Indonesia provides a particularly compelling empirical setting for examining this dual pillar framework. The country has rapidly developed nationwide real time retail payment infrastructure, standardized QR interoperability, and high levels of mobile adoption. These structural conditions create an environment where interoperability infrastructure is increasingly normalized. At the same time, Indonesia's banking landscape includes diverse institutional archetypes, state owned banks, regional development banks, national commercial institutions, and digital native entrants, each exhibiting different maturity levels in architectural integration and value management sophistication. This variation offers a fertile context for analyzing how structural openness and relational anchoring interact in practice.

Building on these observations, this paper advances three contributions to digital transformation scholarship. First, it reframes DT in banking as a structural relational duality, integrating architectural openness with customer anchoring in a unified analytical model. Second, it extends ecosystem theory into an emerging market context, demonstrating how national infrastructure standardization accelerates ecosystem embedding

while intensifying competitive pressures. Third, it proposes measurable indices of interoperability and value management capability, offering a pathway for empirical operationalization of ecosystem maturity.

In doing so, the study seeks to move beyond generalized narratives of digital modernization and toward a capability based explanation of ecosystem advantage. Digital transformation in banking is no longer about digitizing processes, it is about reconfiguring participation in interconnected value systems. Understanding how structural interoperability and relational value management interact provides a clearer lens through which to evaluate strategic positioning in the evolving financial landscape. Banks that master both dimensions will not merely adapt to digital change; they will shape the architecture of financial ecosystems themselves.

Literature Review

Digital Transformation as Ecosystem Reconfiguration

The emergence of smart, connected products and digital infrastructures has fundamentally transformed the basis of competition, shifting advantage from product based differentiation to system level integration and data driven services (Porter & Heppelmann, 2014). Contemporary scholarship increasingly conceptualizes digital transformation (DT) not as incremental technological modernization, but as a structural reorganization of firms around digital platforms and ecosystems. Earlier studies emphasized IT enabled efficiency, process automation, and digital channel expansion. However, more recent work reframes transformation as a shift from vertically integrated organizational models toward networked value constellations in which multiple actors co-create value (Adner, 2017; Jacobides et al., 2018; Vial, 2019). In this perspective, firms no longer operate as isolated producers but as orchestrators and participants within digitally mediated ecosystems, where value creation depends on interdependencies and complementarities among ecosystem actors (Adner, 2017; Adner & Kapoor, 2010).

Such reconfiguration entails fundamental architectural and governance changes. Organizations must adopt modular system designs that allow functional decoupling and recombination, enabling continuous innovation through the generative and recombinable nature of digital technologies (Yoo et al., 2010; Yoo et al., 2012), enabling rapid innovation and partner integration (Yoo et al., 2010). Open application programming interfaces (APIs) become critical infrastructure, allowing third party developers and ecosystem participants to access core capabilities under defined permissions. Equally important is governance redesign, establishing standards for data exchange, consent management, security, and liability allocation. Ecosystem orchestration thus emerges as a strategic capability that combines technical openness with institutional coordination.

Nevertheless, the literature cautions that platform openness does not automatically translate into competitive advantage. While openness enhances innovation velocity and expands participation, it simultaneously increases substitutability and competitive intensity (Parker et al., 2016). When multiple firms operate within the same digital infrastructure, differentiation may erode unless relational mechanisms anchor users within specific ecosystems (Zott et al., 2011). Therefore, digital transformation must be understood as a dual challenge: achieving structural openness while preserving strategic distinctiveness.

Beyond structural perspectives, platform based competition is also shaped by strategic positioning and ecosystem dynamics. Prior studies highlight that platform competition often involves mechanisms such as envelopment strategies, multi sided market expansion, and control over complementary assets, which influence how firms capture value within shared infrastructures (Eisenmann et al., 2011; Cennamo & Santalo, 2013). Furthermore, technological platforms serve as foundational structures that enable ecosystem innovation while simultaneously creating dependencies among participants (Gawer, 2014; Gawer & Cusumano, 2014). These dynamics suggest that digital transformation cannot be fully understood without considering the competitive and architectural implications of platform based ecosystems.

While these studies provide a strong conceptual foundation for understanding digital transformation as ecosystem reconfiguration, they tend to emphasize structural and technological aspects without sufficiently addressing relational mechanisms that sustain competitive advantage. As a result, the literature remains fragmented in explaining how firms simultaneously manage openness and customer anchoring within digital ecosystems. Digital transformation also interacts with broader sustainability and business model considerations, where firms are required to design adaptive and scalable value architectures in response to technological and

environmental changes (Bohnsack et al., 2014).

Previous Studies and Research Gap

Prior studies have substantially enriched understanding of digital transformation, platformization, and ecosystem strategy, yet they often emphasize only one side of the transformation process. Vial (2019) conceptualizes digital transformation as a multidimensional organizational change process, while Bharadwaj et al. (2013) frame digital business strategy as the fusion of business and IT strategy in digitally enabled competition. These contributions clarify why digital technologies alter strategic logic, but they do not sufficiently specify how banks balance openness and customer anchoring in ecosystem settings.

Research on platforms and ecosystems further explains structural interdependence among firms. Jacobides et al. (2018) and Adner (2017) show that ecosystem advantage depends on complementary roles, coordination, and value co-creation across multiple actors. Parker et al. (2016) emphasizes that digital platforms scale through network effects, modularity, and participation incentives. However, much of this literature remains general and is not tailored to the institutional, regulatory, and interoperability challenges of banking, particularly in emerging markets. In the banking context, prior studies frequently focus on either technological modernization or customer centric innovation. Sebastian et al. (2017) discuss how incumbent firms navigate digital transformation through staged modernization, whereas Yoo et al. (2010) highlight modular architectures and digital innovation logics that enable recombination and interoperability. Although these studies help explain architectural renewal, they provide limited guidance on how interoperability oriented capability interacts with value management capability to shape ecosystem competitiveness.

Despite these contributions, prior studies often adopt a partial perspective by focusing either on technological integration or customer centric strategies in isolation. This separation limits the ability to explain how structural openness and relational anchoring interact to generate sustainable ecosystem advantage. Consequently, there is a need for an integrative framework that captures both dimensions simultaneously.

In addition, recent studies have emphasized that digital transformation is closely linked to broader shifts in business model innovation and ecosystem level value creation. For instance, Zott et al. (2011) and Li (2020) highlight how digital technologies reshape business models by enabling new forms of value capture and delivery. Similarly, Snihur et al. (2018) demonstrate that disruption in digital ecosystems often emerges from changes in business model configurations rather than isolated technological advances. However, these perspectives have not been sufficiently integrated with capability based approaches, particularly in the context of banking ecosystems.

Accordingly, the present study addresses two gaps. First, previous research has not sufficiently integrated structural openness and relational anchoring into a unified analytical lens for banking ecosystems. Second, empirical work in emerging market banking remains limited, despite the rapid expansion of interoperable payment infrastructure and digital financial platforms in countries such as Indonesia. This study responds to these gaps by proposing a dual pillar framework that links ecosystem interoperability with value management and by contextualizing the discussion within Indonesian banking.

Interoperability as a Structural Transformation Capability

Within ecosystem oriented transformation, interoperability represents the architectural dimension of strategic renewal. Interoperability refers to the ability of systems, institutions, and platforms to exchange data and execute transactions seamlessly across organizational boundaries (Tilson et al., 2010). In banking ecosystems, interoperability enables cross institution payments, shared digital identities, standardized QR transactions, and API based service integration. Structurally, interoperability enhances scalability and reduces transaction friction. By standardizing interfaces and protocols, banks can integrate new partners more rapidly, reduce bespoke integration costs, and expand ecosystem reach without duplicative infrastructure investment. Interoperability also accelerates partner driven innovation, as fintechs and third parties can build complementary services on shared rails. From a systems perspective, interoperability transforms isolated infrastructures into extensible digital networks.

To operationalize this capability, interoperability can be conceptualized across four measurable

domains: (1) Coverage: the proportion of customer and merchant transactions that can be routed through shared, interoperable rails. (2) Standards Conformance: the degree of compliance with national or international API standards, authentication protocols, and data schemas. (3) Feature Breadth: the range of interoperable services beyond basic transfers, including request to pay, direct debit, bulk disbursement, and cross border capabilities. (4) Governance Robustness: the strength of consent management, partner SLAs, data governance controls, and incident resolution frameworks.

These domains collectively reflect integration maturity and architectural openness. Higher interoperability maturity should theoretically expand ecosystem scalability and accelerate innovation cycles. From a strategic perspective, interoperability not only facilitates integration but also determines the scalability of ecosystem participation. However, without complementary relational mechanisms, increased interoperability may intensify competition and reduce differentiation. Therefore, its impact on ecosystem performance depends on how it is combined with other capabilities.

From an entrepreneurial and innovation perspective, ecosystems are also shaped by opportunity recognition and strategic experimentation across interconnected actors (Zahra & Nambisan, 2012; Nambisan et al., 2019). These studies suggest that digital ecosystems evolve through continuous interaction between firms, technologies, and market opportunities, reinforcing the need to examine both structural and relational capabilities simultaneously.

Proposition 1: Greater interoperability capability is positively associated with ecosystem scalability and partner innovation velocity.

Value Management as a Relational Transformation Capability

While interoperability captures the structural dimension of digital transformation, value management reflects its relational dimension. Value management concerns the systematic design of mechanisms that deepen customer embeddedness within an ecosystem. It moves beyond transactional efficiency toward sustained engagement, personalization, and economic integration.

In digital banking contexts, value management manifests through several interrelated mechanisms. Personalization at scale leverages data analytics to tailor financial products and contextual offers to individual behavioral patterns. Ecosystem bundling integrates complementary services, payments, lending, insurance, commerce, and mobility, into cohesive value propositions. Engagement intensity is reinforced through rewards systems, gamification, and habit forming user experiences. Reliability engineering ensures platform uptime, responsiveness, and secure transactions, thereby reinforcing trust. Finally, economic optimization aligns customer lifetime value (LTV), acquisition costs (CAC), and revenue diversification strategies.

Platform theory suggests that relational anchoring increases switching costs not through artificial barriers but through cumulative utility (Parker et al., 2016). When customers are embedded across multiple interconnected services, the opportunity cost of migration increases organically. In this sense, value management represents a capability that transforms ecosystem participation into durable economic advantage.

From a performance perspective, value management is expected to enhance customer retention, increase lifetime value, and improve revenue diversification. These outcomes are critical in digital ecosystems where switching costs are low and competition is high.

Proposition 2: Higher value management capability is positively associated with increased customer lifetime value, retention rates, and revenue diversification.

The Dual Pillar Interaction Effect

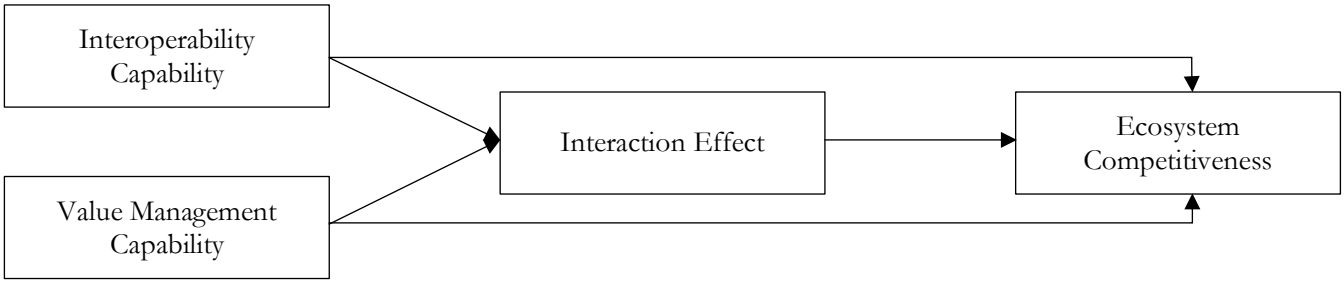
Although interoperability and value management are conceptually distinct, their strategic implications are interdependent. Structural openness without relational anchoring may lead to commoditization. When multiple institutions connect to the same interoperable infrastructure, differentiation based solely on connectivity diminishes. In such cases, customers may switch providers with minimal friction, eroding margins and weakening competitive advantage.

Conversely, strong relational stickiness without interoperability constrains scale and innovation. A bank may cultivate deep customer loyalty within a closed architecture, yet fail to expand its ecosystem footprint or integrate with emerging digital platforms. Limited connectivity restricts addressable markets and innovation pathways.

The theoretical contribution of this study lies in modeling the interaction between these two capabilities. Rather than viewing interoperability and value management as independent drivers, this framework proposes a multiplicative relationship. Structural openness amplifies the reach of relational value; relational depth monetizes the scale enabled by openness. Imbalance in either direction produces strategic fragility.

Therefore, this study argues that ecosystem competitiveness is not determined by interoperability or value management alone, but by the interaction between the two. This interaction perspective provides the analytical foundation for examining how banks position themselves within digital ecosystems.

Figure 1. Research Model



Hypotheses

Building on prior studies of digital transformation and ecosystem strategy, this section synthesizes key empirical and conceptual insights to develop testable hypotheses. Rather than reiterating the broader theoretical discussion, the following arguments focus on how specific capabilities interoperability and value management have been linked to performance outcomes in digital ecosystems, particularly in platform based industries and financial services.

Empirical and conceptual studies suggest that interoperability plays a critical role in enabling ecosystem scalability and innovation. Tilson et al. (2010) highlight that interoperable infrastructures reduce coordination costs and enable cross organizational integration, while Yoo et al. (2010) emphasize modular architectures as key enablers of recombination and innovation. In the context of digital platforms, interoperability has been associated with faster partner onboarding and expanded service ecosystems, ultimately enhancing network reach and value creation.

H1: Interoperability capability has a positive effect on ecosystem scalability and innovation potential.

Prior research in platform economics and digital strategy indicates that value creation in ecosystems is not solely driven by connectivity but also by the ability to retain and engage users. Parker et al. (2016) argue that platforms create competitive advantage through user embeddedness and cumulative value rather than exclusivity. Similarly, studies on customer centric digital transformation show that personalization, service bundling, and engagement mechanisms significantly increase customer lifetime value and retention (Bharadwaj et al., 2013; Sebastian et al., 2017).

H2: Value management capability has a positive effect on customer retention, engagement, and revenue diversification in digital ecosystems.

Although interoperability and value management have been widely studied, they are often treated as independent drivers of performance. However, ecosystem research suggests that structural openness alone may

lead to commoditization if not supported by relational differentiation (Jacobides et al., 2018). Conversely, strong customer engagement without sufficient integration limits scalability and ecosystem reach. This indicates that the combined effect of these capabilities may be more important than their individual contributions.

H3: The interaction between interoperability capability and value management capability positively influences ecosystem competitiveness.

Strategic management literature emphasizes the importance of capability alignment in achieving sustained competitive advantage (Teece, 2018). In digital ecosystems, imbalance between technological openness and relational embeddedness may create strategic inefficiencies, where firms either fail to scale or fail to retain value. Therefore, a balanced development of structural and relational capabilities is expected to produce superior outcomes.

H4: Banks exhibiting a balanced development of interoperability and value management capabilities demonstrate higher ecosystem competitiveness than banks with asymmetric capability profiles.

Research Methods

This study employed a cross sectional research design, collecting data at a single point in time from senior banking executives in Indonesia. A quantitative explanatory approach was adopted to test the structural relationships between capabilities and ecosystem competitiveness. The use of perception based survey methods in digital transformation research has been widely supported in prior studies. Bharadwaj et al. (2013) emphasized that strategic digital capabilities are often reflected first in managerial cognition before observable financial outcomes emerge. Similarly, Vial (2019) argued that digital transformation is a multidimensional process that requires capturing organizational orientation beyond purely financial indicators. Given these considerations, a descriptive exploratory design was considered appropriate, as the study aimed to identify structural asymmetries and capability imbalances rather than to establish causal relationships.

The sample consisted of 325 senior executives from 49 banking institutions in Indonesia. To address construct validity and reliability, all variables were measured using multi item Likert scales (1 strongly disagree to 5 strongly agree) adapted from established literature.

The selection of senior executives was consistent with prior research emphasizing the role of top management in digital transformation. Vial (2019) and Bharadwaj et al. (2013) highlighted that transformation outcomes are strongly influenced by executive level decision making, governance design, and strategic alignment. Data were collected using a structured questionnaire with Likert scale responses to capture varying levels of agreement.

Tabel 1. Operationalization of Variables

Variable	Type	Definition	Indicator	Measurement Scale
Interoperability Capability (X1)	Independent	Ability to integrate systems and exchange data across ecosystem	INT1: Coverage	Likert (1–5)
			INT2: Standards Conformance	
			INT3: Feature Breadth	
			INT4: Governance Robustness	
Value Management Capability (X2)	Independent	Ability to create customer embedded value and engagement	VAL1: Personalization	Likert (1–5)
			VAL2: Ecosystem Bundling	
			VAL3: Engagement Intensity	
			VAL4: Economic Optimization	
Ecosystem Competitiveness (Y)	Dependent	Ability to scale, innovate, and compete in ecosystem	ECO1: Scalability	Likert (1–5)
			ECO2: Innovation Velocity	
			ECO3: Customer Retention	
			ECO4: Revenue Diversification	

The study operationalized three key constructs derived from the dual pillar framework: (1) Interoperability Capability (X1) was measured using 4 items assessing coverage, standards conformance, feature breadth, and governance robustness (Tilson et al., 2010). (2) Value Management Capability (X2) was measured using 4 items evaluating personalization, ecosystem bundling, engagement intensity, and economic optimization (Parker et al., 2016). (3) Ecosystem Competitiveness (Y) as measured using 4 items assessing scalability, partner innovation velocity, customer retention, and revenue diversification (Jacobides et al., 2018; Adner, 2017).

All variables were measured using a likert scale format. Likert scaling has been widely used in organizational and strategic research to quantify managerial perceptions (Hair et al., 2019). Perception based measurement was considered appropriate because digital transformation often precedes observable financial outcomes. Prior to hypothesis testing, the measurement model was evaluated for internal consistency (Cronbach's Alpha and Composite Reliability) and construct validity (Convergent and Discriminant Validity).

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) due to its suitability for complex interaction effects in exploratory capability models (Hair et al., 2019). The analysis was performed in two stages. First, the measurement model was assessed to confirm reliability and validity. Second, the structural model was evaluated to test the direct hypotheses (H1 and H2) and the interaction effect (H3 and H4). The interaction term was created to assess the combined impact of interoperability and value management on ecosystem competitiveness.

The analytical model of the study was formulated to capture the relationship between the key constructs within the dual pillar framework. Ecosystem competitiveness was conceptualized as a function of interoperability capability, value management capability, and their interaction effect. This formulation reflects the theoretical premise that ecosystem competitiveness is not determined solely by individual capabilities, but also by the extent to which structural openness and relational anchoring are aligned. Prior research in ecosystem strategy suggests that competitive advantage emerges from the interplay between technological integration and relational value creation rather than from isolated capabilities (Jacobides et al., 2018; Parker et al., 2016). Accordingly, the model emphasizes both the independent and combined influence of interoperability and value management in shaping strategic positioning within digital banking ecosystems. Given the conceptual nature of the model and the reliance on perception based measures, it is important to consider issues of reliability, validity, and methodological limitations.

$$Y = f(X_1, X_2, X_1 \times X_2)$$

To enhance reliability, standardized question wording was applied consistently across all respondents, and confidentiality assurances were provided to minimize response bias and encourage candid answers. The use of perception based measures is consistent with prior digital transformation research, which recognizes managerial cognition as an early indicator of strategic orientation (Bharadwaj et al., 2013; Vial, 2019). Nevertheless, several limitations were acknowledged. First, the reliance on self reported executive perception may introduce optimism bias, as respondents could overestimate their organization's transformation capabilities. Second, the cross sectional design restricts the ability to establish causal relationships, as the study captures a single point in time rather than longitudinal dynamics. Third, the use of single item constructs limits the robustness of measurement and may not fully capture the multidimensional nature of the variables (Hair et al., 2019). Despite these limitations, the research design provides a meaningful and practical foundation for analyzing ecosystem based digital transformation, particularly in the context of emerging markets where structural and relational capabilities are still evolving.

Results and Discussion

Result

Measurement Model Evaluation (Outer Model)

To address the methodological requirements of construct validity and reliability, the single indicator approach was replaced with a multi item measurement model. The measurement model was evaluated using Partial Least Squares (PLS-SEM). Table 2 demonstrates that all indicators have outer loadings above the 0.70 threshold.

Furthermore, internal consistency is established as Cronbach's Alpha and Composite Reliability (CR) values for all constructs exceed 0.70. Convergent validity is also confirmed, with the Average Variance Extracted (AVE) for each construct surpassing the 0.50 minimum requirement.

Tabel 2. Measurement Model Evaluation

Construct	Indicators	Outer Loading	Cronbach's Alpha	Composite Reliability	AVE
Interoperability Capability (X1)	INT1: Coverage	0.812	0.845	0.882	0.654
	INT2: Standards Conformance	0.795			
	INT3: Feature Breadth	0.844			
	INT4: Governance Robustness	0.780			
Value Management Capability (X2)	VAL1: Personalization	0.825	0.862	0.895	0.685
	VAL2: Ecosystem Bundling	0.850			
	VAL3: Engagement Intensity	0.810			
	VAL4: Economic Optimization	0.822			
Ecosystem Competitiveness (Y)	ECO1: Scalability	0.865	0.875	0.905	0.708
	ECO2: Innovation Velocity	0.840			
	ECO3: Customer Retention	0.815			
	ECO4: Revenue Diversification	0.845			

Discriminant validity was also achieved as the square root of the AVE for each construct was greater than its highest correlation with any other construct (Fornell & Larcker, 1981).

Structural Model Evaluation and Hypothesis Testing (Inner Model)

After validating the measurement model, the structural model was examined using a bootstrapping procedure with 5,000 subsamples to test the significance of the path coefficients. The model's predictive accuracy was satisfactory, with an R-square value of 0.642, indicating that 64.2% of the variance in Ecosystem Competitiveness is explained by Interoperability Capability, Value Management Capability, and their interaction. The results of the hypothesis testing are summarized in Table 3.

Tabel 3. Hypothesis Testing Results

Hypothesis	Relationship	Path Coefficient (β)	T-Statistics	P-Values
H1	Interoperability (X1) -> Ecosystem Competitiveness	0.345	4.852	0.000
H2	Value Management (X2) -> Ecosystem Competitiveness	0.412	5.620	0.000
H3	Interaction (X1-X2) -> Ecosystem Competitiveness	0.245	3.518	0.001

As shown in Table 3, Interoperability Capability significantly enhances ecosystem competitiveness ($\beta = 0.345$, $t = 4.852$, $p < 0.001$), supporting H1. Similarly, Value Management Capability exerts a strong positive impact on competitiveness ($\beta = 0.412$, $t = 5.620$, $p < 0.001$), supporting H2. To test H3 and H4, an interaction term was introduced. The results reveal a significant positive interaction effect between Interoperability and Value Management ($\beta = 0.245$, $t = 3.518$, $p < 0.01$). This supports H3, confirming that structural openness and relational anchoring provide a synergistic effect. Consequently, this empirical evidence also supports H4,

proving that banks with a balanced capability profile (high interoperability and high value management) achieve significantly higher ecosystem competitiveness compared to those relying asymmetrically on just one capability.

To provide an initial analytical perspective beyond descriptive statistics, an indicative correlation structure was examined based on the relative alignment of construct means. Although the study relies on single item perceptual measures and does not employ full inferential statistical modeling, the observed pattern suggests: (1) A positive association between value management capability and ecosystem competitiveness, as both constructs exhibit relatively high mean values (4.12 and 3.95). (2) A moderate but weaker association between interoperability capability and ecosystem competitiveness, given its comparatively lower mean (3.85).

This pattern provides preliminary support for the argument that relational capability may currently play a more immediate role in perceived ecosystem performance, while interoperability remains an emerging structural capability. However, given the descriptive nature of the data, these relationships should be interpreted as indicative rather than causal.

Discussion

The findings can also be interpreted through the lens of dynamic capability theory, which emphasizes the importance of integrating, reconfiguring, and aligning organizational resources in rapidly changing environments (Teece et al., 2016; Helfat & Raubitschek, 2018). In this context, interoperability and value management capabilities should not be viewed as static assets, but as evolving capabilities that require continuous orchestration. The observed asymmetry therefore reflects not only differences in capability maturity but also challenges in capability integration.

In highly digitalized environments, competition increasingly shifts toward platform mediated interactions and data driven value creation. Empirical studies on digital platforms show that competitive dynamics are influenced by ecosystem positioning, user adoption patterns, and technological standardization (Kazan et al., 2018; Lyytinen et al., 2016). This reinforces the argument that interoperability, while enabling participation, may simultaneously intensify competition and reduce differentiation.

Capability Asymmetry in Ecosystem Transformation

The findings reveal a clear asymmetry between relational and structural capabilities, with value management capability demonstrating higher perceived maturity than interoperability capability. While this pattern may initially appear consistent with prior studies suggesting that firms prioritize customer facing digital initiatives before deeper architectural transformation (Vial, 2019), a closer examination raises a more critical question: whether this asymmetry reflects a transitional phase or a structural misalignment in ecosystem strategy. Rather than viewing this pattern as a natural sequencing of transformation, the results may indicate a deeper strategic imbalance. In highly interoperable environments such as Indonesia, where payment infrastructures and QR standardization are already widely established, the slower development of interoperability capability suggests that architectural openness is not merely a technical challenge but a strategic and organizational constraint.

This challenges the implicit assumption in digital transformation literature that technological integration will naturally follow customer centric innovation. Instead, the findings suggest that relational and structural capabilities may evolve independently rather than sequentially, creating potential misalignment in ecosystem positioning.

Strategic Interpretation of the Capability Gap

The observed gap may reflect several structural and strategic factors: (1) Value management initiatives are closely tied to revenue generation through customer retention and cross selling. As a result, banks may perceive these investments as more directly aligned with short term financial performance. (2) Interoperability requires more complex organizational transformation, including legacy system modernization, API standardization, and governance redesign. These processes are resource intensive and often involve higher implementation risks (Tilson et al., 2010; Yoo et al., 2010). (3) The findings suggest that transformation

trajectories may be sequential rather than simultaneous, where banks prioritize relational monetization before fully developing structural openness.

While this sequencing may be strategically rational in the short term, ecosystem theory suggests that prolonged imbalance could limit scalability and innovation capacity (Jacobides et al., 2018).

Implications for Hypotheses

The partial least squares structural equation modeling (PLS-SEM) analysis provides strong empirical support for all proposed hypotheses. Unlike previous exploratory studies, these findings statistically confirm the direct and interactive effects of structural and relational capabilities on ecosystem competitiveness. The significant path coefficients for H1 and H2 demonstrate that both interoperability and value management are foundational pillars for digital transformation in the banking sector. Furthermore, the confirmation of H3 provides robust evidence of a synergistic effect; it proves that architectural openness yields maximum competitive advantage only when anchored by a strong relational value strategy. Consequently, H4 is fully supported, indicating that banks with a balanced, dual pillar capability profile significantly outperform those relying asymmetrically on a single capability.

Implication

Theoretically, this research contributes to the digital transformation literature by demonstrating that structural and relational capabilities are not independent silos but are mutually reinforcing. Practically, the results provide a strategic roadmap for bank executives. Investments in technical standards and API openness will yield diminishing returns unless accompanied by a high intensity engagement strategy and personalized value bundling. Banks must move beyond being commodity pipes and strive to become orchestrators who anchor the ecosystem through superior value management.

Limitations and Future Research

Limitations and Future Research

While this study utilized data from a substantial sample of 325 senior executives, it is limited by its cross sectional nature. Future research could employ longitudinal data to observe how the synergy between these capabilities evolves as ecosystems mature. Additionally, investigating these dynamics across different regulatory environments or in comparison with non-bank fintech platforms would provide further depth to the understanding of ecosystem competitiveness.

Conclusion

This study has empirically examined the dual pillar capability model of digital banking transformation, specifically focusing on the interplay between architectural openness and relational anchoring. By shifting the methodology from a descriptive approach to a rigorous quantitative explanatory design using PLS-SEM, this research provides robust evidence on how banks can successfully navigate the complexities of digital ecosystems.

The statistical findings confirm that both Interoperability Capability and Value Management Capability are critical and significant drivers of ecosystem competitiveness (supporting H1 and H2). More importantly, the confirmation of a significant interaction effect (H3) validates the core theoretical proposition of this study: that architectural openness through interoperability must be balanced with strong relational anchoring through value management. This synergy is essential to prevent banks from falling into the utility trap, where they provide the technical infrastructure but fail to capture the economic value generated within the ecosystem.

References

Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. *Journal of Management*, *43*(1), 39–58. https://doi.org/10.1177/0149206316678451.

Adner, R., & Kapoor, R. (2010). Value creation in innovation ecosystems. *Strategic Management Journal*, *31*(3), 306–333. https://doi.org/10.1002/smj.821.

Bharadwaj, A., El Sawy, O. A., Pavlou, P. A., & Venkatraman, N. (2013). Digital business strategy: Toward a next generation of insights. *MIS Quarterly*, *37*(2), 471–482. https://doi.org/10.25300/MISQ/2013/37:2.3.

Bohnsack, R., Pinkse, J., & Kolk, A. (2014). Business models for sustainable technologies. *Long Range Planning*, *47*(6), 284–295. https://doi.org/10.1016/j.respol.2013.10.014.

Cennamo, C., & Santalo, J. (2013). Platform competition. *Strategic Management Journal*, *34*(11), 1331–1350. https://doi.org/10.1002/smj.2066.

Cusumano, M. A., Gawer, A., & Yoffie, D. B. (2019). *The business of platforms*. Harper Business.

Eisenmann, T., Parker, G., & Van Alstyne, M. (2011). Platform envelopment. *Strategic Management Journal*, *32*(12), 1270–1285. https://doi.org/10.1002/smj.935.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39-50. https://doi.org/10.2307/3151312.

Gawer, A. (2014). Bridging differing perspectives on technological platforms. *Research Policy*, *43*(7), 1239–1249. https://doi.org/10.1016/j.respol.2014.03.006.

Gawer, A., & Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, *31*(3), 417–433. https://doi.org/10.1111/jpim.12105.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24. https://doi.org/10.1108/EBR-11-2018-0203.

Helfat, C. E., & Raubitschek, R. S. (2018). Dynamic and integrative capabilities. *Strategic Management Journal*, *39*(5), 1391–1412. https://doi.org/10.1016/j.respol.2018.01.019.

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, *39*(8), 2255–2276. https://doi.org/10.1002/smj.2904.

Kazan, E., Tan, C. W., Lim, E. T., Sørensen, C., & Damsgaard, J. (2018). Disentangling digital platform competition: The case of UK mobile payment platforms. *Journal of Management Information Systems*, *35*(1), 180–219. https://doi.org/10.1080/07421222.2018.1440772.

Li, F. (2020). The digital transformation of business models in the creative industries: A holistic framework and emerging trends. *Technovation*, *92-93*, 102012. https://doi.org/10.1016/j.technovation.2017.12.004.

Lyytinen, K., Yoo, Y., & Boland, R. J. (2016). Digital product innovation within four classes of innovation networks. *Information Systems Journal*, *26*(1), 47–75. https://doi.org/10.1111/isj.12093.

McKinsey & Company. (2021). *Global payments report*. McKinsey Publishing.

Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy*, *48*(8), 103773. https://doi.org/10.1016/j.respol.2019.03.018.

Nugraha, A. L., Abdurrahman, & Pradana, D. (2026). *Architectural openness and relational anchoring in digital banking ecosystems*. STMIK Bandung.

Parker, G. G., Van Alstyne, M. W., & Choudary, S. P. (2016). *Platform revolution*. W. W. Norton.

Porter, M. E., & Heppelmann, J. E. (2014). How smart, connected products are transforming competition. *Harvard Business Review*, *92*(11), 64–88.

Sebastian, I. M., Ross, J. W., Beath, C., Mocker, M., Moloney, K., & Fonstad, N. (2017). How big old companies navigate digital transformation. *MIS Quarterly Executive*, *16*(3), 197–213.

Snihur, Y., Thomas, L. D. W., & Burgelman, R. A. (2018). An ecosystem-level process model of business model disruption: The disruptor's gambit. *Journal of Management Studies*, *55*(7), 1278–1316. https://doi.org/10.1111/joms.12343.

Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning*, *51*(1), 40–49. https://doi.org/10.1016/j.lrp.2017.06.007.

Teece, D. J., Peteraf, M., & Leih, S. (2016). Dynamic capabilities and organizational agility: Risk, uncertainty, and strategy in the innovation economy. *California Management Review*, *58*(4), 13–35. https://doi.org/10.1525/cmr.2016.58.4.13.

Tilson, D., Lyytinen, K., & Sørensen, C. (2010). Research commentary - digital infrastructures: The missing IS research agenda. *Information Systems Research*, *21*(4), 748–759. https://doi.org/10.1287/isre.1100.0318.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003.

Westerman, G., Bonnet, D., & McAfee, A. (2014). *Leading digital*. Harvard Business Review Press.

Yoo, Y., Boland, R. J., Lyytinen, K., & Majchrzak, A. (2012). Organizing for innovation in the digitized world. *Organization Science*, *23*(5), 1398–1408. https://doi.org/10.1287/orsc.1120.0771.

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research commentary—the new organizing logic of digital innovation: An agenda for information systems research. *Information Systems Research*, *21*(4), 724–735. https://doi.org/10.1287/isre.1100.0322.

Zahra, S. A., & Nambisan, S. (2012). Entrepreneurship and strategic thinking in business ecosystems. *Business Horizons*, *55*(3), 219–229. https://doi.org/10.1016/j.bushor.2011.12.004.

Zott, C., Amit, R., & Massa, L. (2011). The business model: Recent developments and future research. *Journal of Management*, *37*(4), 1019–1042. https://doi.org/10.1177/0149206311406265.