

“Digital transformation and customer loyalty: The mediating role of co-created service experience in Indonesian banking”

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DIGITAL TRANSFORMATION AND CUSTOMER LOYALTY: THE MEDIATING ROLE OF CO-CREATED SERVICE EXPERIENCE IN INDONESIAN BANKING

Abstract

Banks invest in digital platforms expecting stronger loyalty. Yet, it remains unclear why some investments build durable relationships while others do not, because prior research conflates what customers do with how they experience it. This study tests whether co-created service experience mediates the relationship between customer-perceived digital transformation and customer loyalty among digital banking customers in Indonesia. Survey data were collected in 2025 from 360 customers of five banks in Medan, Indonesia, who had used mobile or internet banking for at least six months, ensuring direct experience with digital banking, and were analyzed using partial least squares structural equation modeling (PLS-SEM) with bootstrapping. All four hypotheses were supported: digital transformation was strongly associated with co-created service experience ($\beta = 0.659$, $p < 0.001$) and significantly associated with loyalty directly ($\beta = 0.425$, $p < 0.001$); co-created service experience was significantly associated with loyalty ($\beta = 0.478$, $p < 0.001$) and partially mediated the digital transformation–loyalty relationship (indirect effect $\beta = 0.315$, $p < 0.001$; VAF = 42.6%), with the model explaining 67.8% of the variance in loyalty. Digital transformation is thus associated with loyalty through two distinct routes, only one of which depends on customers feeling like genuine participants. Institutional trust was not measured directly in this study, so the link between this pattern and Indonesia's institutional trust conditions is interpretive and requires further testing. Because the sample is limited to a single city, findings apply to this market and should not be generalized to Indonesian banking as a whole.

Keywords

digitalization, co-creation, experience, loyalty, banking, service

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INTRODUCTION

Digital transformation has reshaped how services are designed, delivered, and consumed across industries (Verhoef et al., 2021), and banking is among the sectors where that urgency is most acute (Nadkarni & Prügl, 2021). Yet a well-documented paradox persists: large-scale technology investment frequently fails to deliver the relational outcomes organizations expect (Calderón-Monge & Ribeiro-Soriano, 2024; Nadkarni & Prügl, 2021). Digital platforms lower entry barriers, intensify competition, and erode the functional differentiation that has traditionally sustained customer commitment (Paul et al., 2024), while proliferating digital touchpoints risk value co-destruction when digital design misaligns with customers' resource-integration goals (Hanelt et al., 2021; Vargo & Lusch, 2016).

This raises a scientific problem: the mechanism linking digital transformation to customer loyalty remains poorly specified. Existing research has not distinguished the experiential quality of customer participation – how meaningfully customers feel they have shaped the service outcome – from what customers merely do (co-production behavior) or intend to do (co-creation intention), even though these are conceptually distinct states (Becker & Jaakkola, 2020). Without this distinction, it remains unclear why equivalent digital investments produce divergent loyalty outcomes across banks, and whether digital transformation's loyalty effects operate through customers' participative experience, through purely functional channels unrelated to participation, or through both simultaneously.

This problem is especially unresolved in emerging-market contexts. Indonesia's digital financial services sector has grown rapidly alongside regulatory initiatives such as Bank Indonesia's Payment System Blueprint and the Financial Services Authority's Digital Financial Innovation framework, yet this growth coexists with historically fragmented institutional trust in conventional banking – a context in which this experiential mechanism has not yet been empirically examined.

1. LITERATURE REVIEW AND HYPOTHESES

The model draws on Service-Dominant Logic (SDL) (Vargo & Lusch, 2016; Vargo et al., 2023). SDL holds that value is co-created and realized in use, so technologies affect outcomes only through how actors integrate them in context. Digital transformation accelerates institutional change by enabling new resource-integration patterns (Vargo et al., 2023) but generates experiential value only when it genuinely enables participation. The digital transformation–loyalty relationship is therefore not purely direct but experientially mediated: digital transformation creates the structural conditions for co-created service experience, which in turn sustains loyalty.

Digital transformation in financial services is an organization-wide reconfiguration of strategies, structures, and processes, not mere technology adoption (Nadkarni & Prügl, 2021). In banking, it displaces branch delivery with mobile platforms, AI-driven advisory, and data-rich personalization (Hentzen et al., 2022), as fintech competitors challenge incumbents on speed, convenience, and personalization (Barroso & Laborda, 2022). Servitized, platform-based, and ecosystem-oriented configurations are now the dominant mechanisms through which digital transformation reshapes value creation and competitive differentiation (Payne et al., 2021), with advantage flowing from ecosystem-wide value orchestration rather than product differentiation alone (Verhoef et al., 2021). Yet heavy technology investment without

aligned customer-facing capabilities consistently fails to deliver the loyalty outcomes it promises (Calderón-Monge & Ribeiro-Soriano, 2024).

Customer-perceived digital transformation, as used here, is customers' subjective assessment of their bank's digital environment across breadth, cross-channel integration, personalization, and responsiveness. This is distinct from firm-reported investment or adoption metrics, since it is the customer's perception, not the firm's capability, that is theoretically relevant to co-created service experience and loyalty. Digital platforms extend actor-to-actor connectivity through data-driven, personalized interaction, and ease of use, responsiveness, security, and interactivity function as antecedents to co-creation in mobile banking (Hijazi, 2022; Mostafa, 2020). Touchpoint coherence, goal-enablement, and sensory richness in customer journey design enhance service experience quality and attitudinal outcomes (Kuehn et al., 2019). More broadly, digital transformation deepens customers' involvement in configuring their own experiences through continuous, technology-mediated resource integration (Kamalaldin et al., 2020).

This relationship, however, is positive but conditional. Higher perceived digital transformation should generate richer co-created service experience by expanding both integrable resources and touchpoints for participation (Kamalaldin et al., 2020; Mostafa, 2020). Banks whose architectures let customers configure and shape the encounter build the conditions for co-created experience; those that are technically sophisticated but op-

rationally closed generate less of it even at high investment levels, since technology-centric implementations that fragment journeys or constrain participation produce value co-destruction rather than co-creation (Hanelt et al., 2021; Reinartz et al., 2019). The defining question is not how many digital features a bank offers, but whether engaging with them feels like meaningful participation.

Co-created service experience is theorized here as the customer's subjective perception of having actively shaped the service outcome through meaningful participation. This is distinct from both co-production behavior and co-creation intention, since behavior is what customers do while experience is the qualitative state that emerges from doing (Becker & Jaakkola, 2020). Studies that operationalize co-creation as behavioral frequency or intention (e.g., Auh et al., 2007; Mostafa, 2020) cannot capture this experiential dimension, and this gap between theoretical richness and measurement precision has limited evidence on how participative experience, rather than behavior, shapes relational outcomes (Becker & Jaakkola, 2020).

This three-dimensional state spans a cognitive sense of influence over service configuration, an emotional sense of ownership when participation feels meaningful rather than performative, and a social sense of relational reciprocity distinguishing co-created from standardized encounters (Hollebeek et al., 2019). These three dimensions align with SDL's premise that value realization is experiential and multi-dimensional. Co-creation's outcomes for customers are similarly multiple and reinforcing: systematic review evidence confirms the mechanisms linking co-creation to loyalty are multiple, context-dependent, and mediated by experiential quality (Landry & Furrer, 2023).

Digital transformation intensifies co-creation opportunities by expanding available channels and touchpoints. Online and mobile banking let customers configure services and jointly shape encounters in ways branch banking cannot (Chauhan et al., 2022); digital interfaces enhance perceived co-ownership through dynamic feedback (Hoyer et al., 2010), value co-creation via social media is shaped by identifiable antecedents in retail banking (Casper Ferm & Thaichon, 2021a) and in turn drives attitudinal loyalty (Casper

Ferm & Thaichon, 2021b), and channel interactivity amplifies co-creation by widening the range of meaningful touchpoints (Cui et al., 2022). But co-created experience is not automatic: fragmented journeys or constrained participation generate value co-destruction instead (Hanelt et al., 2021; Reinartz et al., 2019).

When customers experience their inputs as genuinely shaping the outcome, they develop bonds passive consumption cannot generate. Customers who co-produce advisory services show significantly stronger loyalty than those who do not (Auh et al., 2007), and value co-creation exerts a significant positive effect on attitudinal loyalty, which drives behavioral loyalty (Cossío-Silva et al., 2016). Firm-initiated efforts to empower customer engagement generate loyalty through reciprocal value exchange (Harmeling et al., 2017), and it is co-creation quality, not frequency, that sustains loyalty over time (Kumar et al., 2019) – co-creating customers show stronger loyalty than passive consumers even controlling for service experience (Anshu et al., 2022). Customers who see themselves as genuine resource-integrating partners develop greater psychological investment, tolerance for failures, advocacy, and resistance to switching (Vargo et al., 2023).

These mechanisms linking co-created experience to loyalty reinforce one another: emotional engagement, trust, and reciprocity foster advocacy and durable bonds (Pansari & Kumar, 2017; Woratschek et al., 2020). At the ecosystem level, co-creation generates social value and reinforces provider commitment through embeddedness (Moharrak & Mogaji, 2025). In digital banking specifically, the experiential dimension of service delivery is central to how digital transformation generates loyalty (Papathomas & Konteos, 2024), corroborated by evidence that psychological engagement with digital platforms mediates brand attachment's effect on bank loyalty (Levy, 2022), while cross-sector evidence confirms co-created experience generates stronger loyalty than passive consumption (Roy et al., 2019; Wu & Gao, 2019).

Beyond the experiential pathway, digital transformation also affects loyalty directly through mechanisms independent of co-creation: improved accessibility, reduced friction, and data-

based relational assets that raise switching costs (Mbama & Ezepue, 2018; Reinartz et al., 2019). Personalization and hedonic motivation are identified as direct loyalty drivers in omnichannel banking (Tyrväinen et al., 2020), consistent with maturing digital ecosystems generating switching costs that reinforce retention (Schweidel et al., 2022). Testing this direct pathway alongside the experiential one determines whether co-created service experience fully or partially mediates the digital transformation–loyalty relationship.

This mediating role follows from SDL's proposition that it is the quality of resource integration in use, not the technology itself, that determines relational outcomes (Vargo & Lusch, 2016); investments that fail to engage customers as resource-integrating partners risk value co-destruction instead (Vargo et al., 2023). Experience is a dynamic, multilevel phenomenon spanning cognitive, emotional, behavioral, and social responses (Becker & Jaakkola, 2020). Loyalty follows from this totality rather than from deployment itself. Whether digital transformation's loyalty effects run entirely through this experiential channel or also build loyalty through structural pathways independent of it, carries distinct strategic implications.

This literature review points to two gaps. First, co-created service experience is conceptually and empirically distinct from co-production behavior and co-creation intention, and existing co-creation measures have not consistently captured this experiential state (Auh et al., 2007; Becker & Jaakkola, 2020; Mostafa, 2020). Second, evidence on how digital transformation, co-created service experience, and loyalty relate to one another comes mainly from high-institutional-trust Western markets (Mainardes et al., 2020; Mbama & Ezepue, 2018), leaving the mediating role of co-created service experience untested under conditions of fragmented institutional trust such as those found in Indonesia.

The purpose of this study is to test whether co-created service experience mediates the relationship between customer-perceived digital transformation and customer loyalty among digital banking customers in Indonesia, and whether that mediation is full or partial.

The following hypotheses formalize this purpose:

- H1: Customer-perceived digital transformation is positively associated with co-created service experience.*
- H2: Co-created service experience is positively associated with customer loyalty.*
- H3: Customer-perceived digital transformation is positively associated with customer loyalty.*
- H4: Co-created service experience mediates the relationship between customer-perceived digital transformation and customer loyalty.*

2. METHOD

This section describes the research design, sample, measures, common method bias assessment, and analytical strategy used to test the study's hypotheses.

2.1. Research design and context

This study used a quantitative, cross-sectional survey design to examine how customer-perceived digital transformation relates to customer loyalty through co-created service experience in digital banking. A correlational design suited the objective of testing a mediation model among perceptual constructs that cannot be experimentally manipulated in field settings. Data were analyzed using partial least squares structural equation modeling (PLS-SEM), appropriate for mediation models with reflective constructs and moderate sample sizes (Hair et al., 2019). Because concurrent measurement precludes establishing temporal precedence, all reported associations reflect covariation rather than causation.

Indonesia was selected for theoretically motivated reasons. Its digital financial services sector has grown rapidly, alongside a large underserved population and a regulatory environment that has actively accelerated digital banking adoption through frameworks such as Bank Indonesia's Payment System Blueprint and the Financial Services Authority's Digital Financial Innovation framework. This rapid digital adoption coexists with historically fragmented institutional trust in conven-

tional banking, conditions in which experiential quality becomes a particularly consequential basis for relational commitment, making Indonesia a theoretically appropriate context for examining the co-created service experience pathway.

2.2. Sample and data collection

This study used non-probability purposive sampling because the unit of analysis had to have experience directly relevant to the study's constructs. A purposive sample of banking customers was recruited through a structured online survey distributed across five major commercial banks in Medan, Indonesia. Eligibility required active use of mobile or internet banking for at least six months, ensuring respondents' assessments of Digital Transformation, Co-Created Service Experience, and Customer Loyalty were grounded in sufficient direct experience with the digital service environment to respond meaningfully to all constructs. The sample's demographic, tenure, and usage profile is summarized in Table 1.

Five commercial banks (anonymized as Bank A to Bank E for confidentiality) were used as the institutional context for data collection to capture variation in digital service experience across bank environments and to reduce the dominance of observations from any single institution. Recruitment was allocated at the bank level, with 500 eligible prospective respondents approached through a combination of branch-based and digital channels – an initial allocation of 100 per bank. The survey followed standard ethical practice for human-subjects research: participation was voluntary and unpaid; respondents were informed of the study's purpose before starting, gave informed consent by proceeding, and could withdraw at any point without penalty; no personally identifying information was collected. Respondents who agreed to take part completed the questionnaire independently via a self-administered survey. Of the 500 prospective respondents approached, 360 completed the questionnaire in full, yielding a response rate of 72.0%; the remaining 140 (28.0%) declined to participate.

Table 1. Respondent characteristics (N = 360)

Characteristic	Category	n	%
Bank	Bank_A	75	20.8
	Bank_B	73	20.3
	Bank_C	72	20.0
	Bank_D	71	19.7
	Bank_E	69	19.2
Gender	Female	195	54.2
	Male	165	45.8
Education	Bachelor's degree or above	263	73.1
	Below bachelor's degree	97	26.9
Customer tenure	< 2 years	47	13.1
	2-5 years	118	32.8
	6-10 years	124	34.4
	> 10 years	71	19.7
Primary-bank status	Bank is respondent's primary bank	257	71.4
	Bank is not respondent's primary bank	103	28.6
Main banking channel	Mobile banking	221	61.4
	ATM	58	16.1
	Internet banking	43	11.9
	Branch/offline service	38	10.6
Number of banking products used	1 product	89	24.7
	2 products	137	38.1
	3 products	82	22.8
	≥ 4 products	52	14.4
Frequency of service interaction	Rarely	74	20.6
	Occasionally	146	40.6
	Frequently	101	28.1
	Very frequently	39	10.8

This protocol and its full procedure were reviewed and approved by the Research Ethics Committee of the Faculty of Economics and Business, Universitas Sumatera Utara. Data were collected in 2025 in Medan, a city selected for its concentration of major commercial bank branches and a customer base broadly representative of Indonesia's rapidly digitizing urban banking segment. This dataset was collected specifically for this study and has not been reported elsewhere.

The self-administered format allowed respondents to provide their assessments without interviewer intervention. Combining physical and digital channels was also intended to reach customers with differing patterns of banking interaction, and the same eligibility criteria were applied across all banks to keep recruitment consistent across institutions. Duplicate responses were prevented by giving each recruit only one opportunity to access and complete the survey, delivered by enumerators via a unique link or QR code.

Respondents were nested within five banks, so individual scores may not have been fully independent of one another. This potential dependence was tested by computing the one-way intraclass correlation coefficient, ICC(1), for the three main constructs. The resulting ICC(1) values were close to zero for all three constructs, and a one-way F-test for differences in means across banks was non-significant throughout, indicating that individual responses were not systematically clustered at the level of the constructs tested. Full clustering statistics are provided in Appendix A.

2.3. Measures

All constructs were measured using established scales adapted to the digital banking context, rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). A standard back-translation protocol was applied, and a pilot test with 30 respondents confirmed item clarity.

Digital Transformation (6 items) was measured with items adapted from established scales (Hanelt et al., 2021; Verhoef et al., 2021), capturing customers' perceptions of breadth of digital service offerings, cross-channel integration, personalization, responsiveness, security, and transactional ease.

Co-Created Service Experience (6 items) was operationalized with items adapted from established measures (Auh et al., 2007; Becker & Jaakkola, 2020; Verleye, 2015; Ranjan & Read, 2016), capturing the cognitive sense of influence, emotional ownership, and relational reciprocity that emerge from meaningful participation.

Customer Loyalty (5 items) was measured with items from established scales (Mainardes et al., 2020; Woratschek et al., 2020), spanning attitudinal and behavioral loyalty, consistent with the dual-component conceptualization of loyalty that SDL and relationship marketing theory recognize as the appropriate outcome construct for co-creation research. Two bilingual academics with expertise in service marketing and digital banking research reviewed the construct operationalizations and confirmed content validity and conceptual alignment with the theoretical definitions adopted in this study.

The digital transformation scale reflects the SDL premise that value is determined by how actors integrate resources in context (Vargo & Lusch, 2016). The co-created service experience scale was developed through iterative conceptual specification anchored in SDL and adapted from established co-creation, co-production, and customer experience instruments; three items were revised for clarity and two were dropped for cross-loading during piloting. Full documentation of the literature sources, the adaptation logic for each item, the purification process, the elimination rationale, and the wording refinements is provided in Appendix B. The resulting 17-item instrument, using the five-point Likert format recommended for PLS-SEM applications (Hair et al., 2019), covers the cognitive, emotional, and social dimensions of co-created service experience and jointly captures the breadth, personalization, participatory, and relational dimensions identified as theoretically central in the co-creation and customer experience literature; the item pool was kept concise to limit respondent fatigue. The complete questionnaire, in both Bahasa Indonesia and English, is provided in Appendix C.

2.4. Common method bias assessment

Prior to structural model evaluation, two procedural and two post hoc strategies assessed

the threat of common method variance (CMV). Predictor, mediator, and outcome items were assigned to distinct, clearly labeled survey sections separated by psychological buffer text, and respondents were told at the outset that responses were anonymous and that no correct answers existed (Podsakoff et al., 2003).

Harman's single-factor test, conducted by submitting all 17 indicator items to an unrotated principal component analysis in SPSS, showed the first unrotated factor accounted for 31.42% of total variance, well below the 50% threshold, indicating that CMV is unlikely to threaten the validity of the structural estimates (Podsakoff et al., 2003). The marker variable technique (Lindell & Whitney, 2001) was also applied by incorporating a theoretically unrelated marker construct (satisfaction with public transportation services) into a supplementary SmartPLS model. All three paths from the marker variable to the study constructs were non-significant (marker to DT: $\beta = -0.045$, $t = 0.776$, $p = 0.438$; marker to CSE: $\beta = 0.055$, $t = 1.078$, $p = 0.281$; marker to CL: $\beta = -0.042$, $t = 0.876$, $p = 0.381$), with 95% confidence intervals spanning zero. The primary structural paths remained substantially unchanged in the marker-augmented model (DT to CSE: $\beta = 0.661$; CSE to CL: $\beta = 0.479$; DT to CL: $\beta = 0.423$), confirming that CMV does not materially distort the estimated relationships.

2.5. Analytical strategy

Data were analyzed using PLS-SEM in SmartPLS 4.0 with bootstrapping 5,000 resamples (Hair et al., 2019). The measurement model was evaluated for reliability (Cronbach's $\alpha \geq 0.70$; composite reliability $\rho_c \geq 0.70$), convergent validity (AVE ≥ 0.50 ; outer loadings ≥ 0.70), and discriminant validity (Fornell–Larcker criterion; Heterotrait–Monotrait ratio of correlations [HTMT] below 0.85 for theoretically proximate pairs, 0.90 for remaining pairs; Henseler et al., 2015). The structural model was evaluated for explanatory power (R^2), effect sizes (Cohen's f^2), predictive relevance (Stone–Geisser Q^2 , blindfolding, omission distance = 7), and fit (SRMR ≤ 0.08 ; NFI ≥ 0.90). Mediation was assessed using the specific indirect effect and the variance accounted for (VAF) statistic, with VAF of 20–80% indicating partial mediation (Hair et al., 2019).

3. RESULTS

This section reports the measurement model assessment, followed by the structural model results and hypotheses tests.

3.1. Measurement model

All three constructs exceeded the 0.70 reliability threshold (Cronbach's alpha [α]; composite reliability based on outer weights [ρ_a] and outer load-

Table 2. Measurement model: outer loadings, reliability, and convergent validity

Construct	Item	Loading	α	CR (ρ_a)	CR (ρ_c)	AVE
Digital Transformation	DT1	0.823	0.891	0.891	0.916	0.646
	DT2	0.810				
	DT3	0.795				
	DT4	0.817				
	DT5	0.802				
	DT6	0.775				
Co-Created Service Experience	CSE1	0.814	0.879	0.881	0.908	0.623
	CSE2	0.795				
	CSE3	0.777				
	CSE4	0.759				
	CSE5	0.806				
	CSE6	0.781				
Customer Loyalty	CL1	0.853	0.909	0.909	0.932	0.732
	CL2	0.864				
	CL3	0.859				
	CL4	0.863				
	CL5	0.839				

Note. α = Cronbach's alpha; ρ_a = composite reliability (outer weights); CR = composite reliability (outer loadings); AVE = average variance extracted. All loadings were significant at $p < 0.001$ (bootstrapped).

Table 3. Discriminant validity: Fornell–Larcker criterion and HTMT ratios

Construct	FL			HTMT			
	CSE	CL	DT	CSE	CL	DT	Threshold
Co-Created Service Experience (CSE)	0.789						
Customer Loyalty (CL)	0.758	0.856		0.847			0.90
Digital Transformation (DT)	0.659	0.740	0.804	0.742	0.822		0.85*

Note. FL = Fornell–Larcker criterion; HTMT = Heterotrait–Monotrait ratio of correlations. Diagonal entries in bold (FL) are the square root of AVE; off-diagonal entries are latent variable correlations. * – Threshold of 0.85 applies to the DT–CSE pair; 0.90 applies to all other pairs.

ings [pc]), all indicator outer loadings exceeded 0.70, and average variance extracted (AVE) exceeded 0.50 for all constructs, confirming convergent validity (Table 2).

Discriminant validity was assessed using both the Fornell–Larcker (FL) criterion and the Heterotrait–Monotrait ratio of correlations (HTMT). Under the FL criterion, the square root of each construct's AVE exceeded all of its inter-construct correlations, confirming discriminant validity (Fornell & Larcker, 1981); HTMT ratios likewise satisfied their respective thresholds for every pair – a stricter 0.85 threshold for the theoretically proximate digital transformation–co-created service experience pair and 0.90 for all remaining pairs (Table 3).

3.2. Structural model

Variance inflation factors ($VIF \leq 1.766$) confirmed the absence of multicollinearity among the predictor constructs. The structural model explained 43.4% of the variance in co-created service experience ($R^2_{adj} = 0.432$) and 67.8% of the variance in customer loyalty ($R^2_{adj} = 0.676$), both substantially exceeding the moderate 0.25 benchmark (Hair et al., 2019). Cohen's f^2 indicated large effects for all three structural paths (Table 4). Stone–Geisser Q^2 values were positive for both endogenous constructs ($Q^2_{predict_CSE} = 0.265$; $Q^2_{predict_CL} = 0.492$), confirming medium-to-large predictive

relevance (Hair et al., 2019). Model fit was acceptable ($SRMR = 0.045 < 0.08$; $NFI = 0.935 > 0.90$).

Table 4 reports the hypothesis tests; all four received empirical support. H1 was supported: digital transformation was strongly and positively associated with co-created service experience. H2 was supported: co-created service experience was significantly and positively associated with loyalty. H3 was supported: digital transformation showed a significant positive direct association with loyalty. H4 was supported: the specific indirect effect through co-created service experience was positive and significant. With both direct and indirect effects significant, $VAF = 42.6\%$, within the 20–80% range associated with partial mediation (Hair et al., 2019).

4. DISCUSSION

The results raise five interpretive points: the strength of digital transformation's association with co-created service experience, the construct-level contribution of co-created service experience to loyalty, the dual-pathway structure of the digital transformation–loyalty relationship, the role of Indonesia's institutional context, and their theoretical and practical implications.

The foundation of this pattern is the strength of *H1*: digital transformation is strongly and positive-

Table 4. Structural model results and hypothesis tests

Hypo.	Path	β	t	p	95% CI	f^2	Decision
H1	DT → CSE (direct)	0.659	22.657	< 0.001	[0.595, 0.709]	0.766	Supported
H2	CSE → CL (direct)	0.478	12.782	< 0.001	[0.403, 0.550]	0.402	Supported
H3	DT → CL (direct)	0.425	11.712	< 0.001	[0.352, 0.496]	0.317	Supported
H4	DT → CSE → CL (indirect)	0.315	11.403	< 0.001	[0.263, 0.372]	–	Supported

Note: β = standardized path coefficient; t = bootstrapped t-statistic (two-tailed); CI = bias-corrected bootstrapped 95% confidence interval; f^2 = Cohen's effect size. Total effect DT → CL = 0.740.

ly associated with co-created service experience ($\beta = 0.659$, $f^2 = 0.766$), the single largest effect in the model – exceeding both digital transformation's direct association with loyalty ($f^2 = 0.317$) and co-created service experience's own association with loyalty ($f^2 = 0.402$). Substantively, this association indicates that expanding digital capability is the lever most strongly associated with the customer relationship, co-occurring primarily with the resource-integration opportunities it creates for meaningful participation, rather than merely through direct convenience. This is consistent with the SDL premise that customers co-create value when firms provide accessible, configurable touchpoints (Kamalaldin et al., 2020; Mostafa, 2020), and with evidence that mobile and online banking specifically let customers configure services and jointly shape encounters in ways branch banking cannot (Chauhan et al., 2022). The strongest path in the model is consistent with the possibility that customers in a market with fragmented institutional trust are especially responsive to digital capability as a signal of participatory opportunity – a plausible but untested interpretation, since institutional trust was not measured in this study.

The most consequential finding is that co-created service experience retains substantial, independent explanatory power for loyalty ($\beta = 0.478$, $f^2 = 0.402$) even after digital transformation's direct association ($\beta = 0.425$, $f^2 = 0.317$) is accounted for. The two coefficients are comparable, indicating that the experiential dimension is associated with loyalty variance comparable to that of digital transformation's functional utility, through categorically distinct and separately estimated pathways. Customers' perceived cognitive influence, emotional ownership, and social reciprocity are associated with relational depth that functional improvements alone do not replicate in this data; this experiential stratum is not reducible to platform-use frequency or intention to participate but appears to capture the qualitative state that emerges when participation feels meaningful, and it is this stratum that carries the independent loyalty association observed. This converges with Auh et al.'s (2007) finding that co-production is associated with stronger loyalty than passive receipt, and with Cossío-Silva et al.'s (2016) evidence that value co-creation is positively associated with loyalty. It extends both by locating the asso-

ciation in experiential quality rather than behavioral frequency. It also corroborates Papathomas and Konteos's (2024) argument that experiential service delivery is central to how digital transformation is associated with loyalty in financial institutions, and Levy's (2022) finding that psychological engagement mediates brand attachment's association with loyalty. These results are consistent with the SDL proposition that value is realized experientially in use, not through capability provision alone (Vargo & Lusch, 2016). They also extend Becker and Jaakkola's (2020) distinction between participation as behavior and as experience by showing it carries measurable relational associations.

The partial mediation pattern is itself informative: with VAF = 42.6% and both the direct ($\beta = 0.425$) and indirect ($\beta = 0.315$) paths significant and large, digital transformation is associated with loyalty through two structurally distinct pathways. Roughly 57% of the total association is estimated independently of participative experience, alongside accessibility gains, reduced friction, and data-based relational assets (Mbama & Ezepeue, 2018; Schweidel et al., 2022) that co-occur regardless of how the interaction was experienced, based on the cross-sectional data used in this study. The remaining 43% flows through a pathway statistically related to customers perceiving themselves as genuinely shaping the service. This asymmetry may carry a durability dimension, although this interpretation extends beyond what this study's cross-sectional design can establish: the functional pathway is plausibly replicable by a competitor with comparable digital capability, whereas the experiential pathway is anchored in subjective relational agency and is not readily replicated merely by deploying the same technology stack; testing this durability claim would require longitudinal data. The pattern differs structurally from Anshu et al.'s (2022) moderation evidence, where co-creation amplifies an already-present experience-loyalty relationship rather than constituting an independent pathway. In this study, co-created service experience is a pathway in its own right, accounting for the majority of the indirect effect. This aligns with Woratschek et al.'s (2020) co-creation perspective on loyalty and extends Roy et al.'s (2019) and Wu and Gao's (2019) cross-sector evidence that co-created experience is associated

with stronger loyalty than passive consumption, consistent with the pattern where experiential and functional pathways are estimated simultaneously. These findings are consistent with one possible explanation for why banks with equivalent digital sophistication *may* produce divergent loyalty outcomes, extending Kamalaldin et al.'s (2020) servitization argument by identifying the experiential mechanism, not just infrastructure, as a candidate source of durable differentiation. They are also consistent with Reinartz et al.'s (2019) contention that technology change disconnected from customer-facing value is associated with weaker retention.

The model's explanatory power ($R^2 = 67.8\%$ for loyalty, with large effect sizes throughout) is noteworthy on its own terms. Institutional trust was not measured in this study: no instrument assessed customers' perceptions of institutional trust, no cross-city or cross-country comparison was conducted, and no interaction or moderation test involving institutional trust was included in the structural model. Consequently, the magnitude of the coefficients obtained – including the co-created service experience–loyalty path ($\beta = 0.478$, $f^2 = 0.402$) – cannot be empirically explained by institutional trust based on this study's data. As context from the literature, research in markets with relatively high institutional trust shows that functional digital improvements can be associated with loyalty without co-created experience as a mediator (Mbama & Ezepue, 2018), and that brand engagement and trust also anchor omnichannel loyalty (Tran Xuan et al., 2023). That the co-created service experience–loyalty path in this study is large and statistically significant is a finding that stands on its own, independent of any explanation for why it occurs. One possible explanation consistent with this pattern, though not directly tested by this study's design, is that the historically fragmented institutional trust in conventional banking in Indonesia may play a role as one relevant contextual factor. This interpretation remains post hoc and untested; confirming it would require a comparative cross-market research design with direct measurement of institutional trust.

This pattern also carries a policy dimension: regulatory initiatives that accelerate digital adop-

tion, such as Bank Indonesia's Payment System Blueprint and the Financial Services Authority's Digital Financial Innovation framework, expand the technological capacity for co-creation but do not by themselves guarantee that customers experience their engagement as participatory. Realizing the loyalty dividend from these initiatives may be more strongly associated with how individual banks translate that expanded capacity into perceived customer agency than with the pace of digital rollout alone – a relationship this study has not directly tested.

Two further theoretical contributions follow. First, the psychometric results support co-created service experience's construct validity as a state distinguishable from related constructs: AVE = 0.623, loadings above 0.759, and HTMT ratios within threshold across all pairs show its cognitive, emotional, and social dimensions cohere as a distinct latent variable. This latent variable shares substantial but bounded variance with digital transformation ($r = 0.659$) and loyalty ($r = 0.758$). These correlations are high but sub-unity, and the experience–loyalty path retains a large effect after digital transformation is statistically controlled; together, these are consistent with the claim that co-created service experience occupies a distinct explanatory position, consistent with Kumar et al.'s (2019) argument that engagement quality, not frequency, is associated with loyalty. Whether the three sub-dimensions carry differential weight across tenure, service complexity, or digital literacy remains untested and would require a hierarchical specification. Second, these cross-sectional results are consistent with, though they do not directly test, a falsifiable contextual prediction: that the VAF of the experiential pathway may vary with institutional trust. This single-market design cannot itself test that prediction; establishing the boundary condition would require a comparative design across markets on an institutional-trust continuum. Such a specification could also test whether the sub-dimensions respond differently to specific design choices. For instance, interface personalization may be more strongly associated with the cognitive-influence dimension than relational reciprocity, while relationship-oriented touchpoints such as personalized service follow-ups may show the reverse pattern – a distinction with direct implications for how banks prioritize

investment across digital touchpoints, which still requires confirmation through future research designs capable of testing directionality.

The partial mediation finding has direct implications for how banks evaluate digital investment. The 42.6% of the digital transformation–loyalty relationship running through co-created service experience is, by definition, inaccessible to technology investment alone – it requires design choices that let customers perceive their engagement as genuinely shaping what they receive. The three validated sub-dimensions – cognitive influence, emotional ownership, and relational reciprocity – offer a concrete diagnostic framework. An interface that only improves transactional ease and service breadth addresses the direct pathway but leaves the experiential dimension unaddressed, while one that also enables personalization and cross-channel responsiveness that customers perceive as customer-directed addresses both. For management, this implies a measurement gap: digital transformation success is typically evaluated through efficiency indicators (cost per transaction, adoption rates, session frequency) that do not capture whether customers feel they are shaping the service. A fuller scorecard would add co-created-experience indicators – perceived influence, emotional ownership, relational reciprocity – alongside the loyalty measures validated here (first-choice commitment, advocacy, resistance to switching). For banks in emerging markets, closing this measurement gap may be a strategic priority, though the claim that institutional reputation “buffers” loyalty more weakly in such markets has not been tested here. Operationally,

this could take the form of short pulse surveys embedded in the mobile banking application and timed to specific interaction milestones. For example, a survey could appear after a customer configures a savings goal or completes a first peer-to-peer transfer, so that experiential indicators are captured close to the moment of use rather than reconstructed retrospectively.

Several limitations bound these findings. The sample is restricted to five banks in a single city, Medan, Indonesia, constraining generalizability to other markets and cultural contexts. The cross-sectional design precludes causal inference: the data are consistent with, but do not prove, the proposed directional pathway, and longitudinal or experimental designs are needed to establish directionality. The model also treats co-created service experience as unidimensional in its structural estimates; a hierarchical specification could test whether its cognitive, affective, and social sub-dimensions carry differential predictive weight across segments, tenure, or digital literacy. Accordingly, these findings should be read as evidence about digital banking customers in Medan, not a claim about Indonesian banking as a whole; broader generalization would require a substantially larger and more diverse sample. Because institutional trust was not measured in this study, future comparative work might usefully target markets positioned differently on the institutional-trust spectrum, such as higher-trust neighboring markets, to test directly whether the VAF of the experiential pathway narrows as institutional trust rises – a plausible but currently untested prediction.

CONCLUSION

The purpose of this study was to test whether co-created service experience mediates the relationship between customer-perceived digital transformation and customer loyalty among digital banking customers in Indonesia, and whether that mediation is full or partial. The findings confirm that all four hypothesized relationships hold. Digital transformation is associated with stronger co-created service experience and shows its own direct association with loyalty, while co-created service experience in turn is associated with loyalty; roughly two-fifths of digital transformation’s total association with loyalty passes through this experiential channel (VAF = 42.6%). Loyalty is thus associated with two separate pathways operating side by side – one co-occurring with functional convenience, the other with customers’ sense that they helped shape their own service experience. This dual-pathway pattern is consistent with the possibility that technology deployment alone may not be sufficient to produce lasting differentiation, and that designing for participatory, customer-directed engagement may be associated

with additional loyalty tied to customers seeing themselves as genuine participants, although this interpretation needs to be confirmed through a research design capable of testing causal relationships before being treated as a managerial recommendation. These conclusions are bounded by a single-market, purposive, cross-sectional sample, and they warrant replication in settings that vary in institutional trust and sample diversity.

AUTHOR CONTRIBUTIONS

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APPENDIX A. Sample distribution and cluster effect assessment

Bank-level distribution figures are reported in Table 1. Clustering was assessed by computing the one-way intraclass correlation coefficient, ICC(1), for the three main constructs using a one-way analysis of variance with bank as a random factor; ICC(1) measures the proportion of total variance in a score attributable to group membership. The resulting values were close to zero throughout – digital transformation (ICC = 0.0029), co-created service experience (ICC = −0.0059), and customer loyalty (ICC = −0.0097) – indicating that between-bank variance was not statistically different from zero. A one-way F-test for differences in means across banks was also non-significant for all three constructs, meaning average scores did not differ systematically across the five banks, and the design effect computed from the ICC and average cluster size was close to or below 1 throughout, so no correction for standard errors due to bank clustering was required.

Table A1. Intraclass correlations and design effects by construct

Construct	ICC(1)	F(4, 355)	p	Design Effect
Digital Transformation	0.0029	1.212	0.305	1.21
Co-Created Service Experience	−0.0059	0.581	0.677	0.58
Customer Loyalty	−0.0097	0.312	0.870	0.31

APPENDIX B. Development documentation for co-created service experience items

Co-Created Service Experience (CSE) is positioned as a context-adapted, literature-informed measure developed for digital banking, rather than a verbatim copy of a single pre-existing scale. The literature was used to establish the construct's domain, substantive facets, and conceptual boundaries relative to adjacent constructs: conceptual sources such as Becker and Jaakkola (2020) clarified the boundaries of customer experience, while co-creation measurement sources strengthened content domain and item distinctiveness. Item wording was then contextualized to customers' experience with digital banking services and evaluated through expert review and pilot testing for clarity and potential overlap with other constructs. Four literature sources informed this development.

Table B1. Literature sources informing the development of the CSE items

Reference	Function in CSE Development
Auh et al. (2007)	Co-production and collaborative participation in financial services
Becker and Jaakkola (2020)	Customer experience as a subjective customer response
Verleye (2015)	Measurement of co-creation experience from the customer's perspective
Ranjan and Read (2016)	Conceptualization and measurement of value co-creation

Based on this conceptual domain, the initial CSE item pool tested at the piloting stage consisted of eight indicators. The fit of each indicator was then evaluated through loading and cross-loading analysis against two comparison constructs, Digital Transformation and Customer Loyalty, to assess each item's empirical distinctiveness before the final indicators were determined. The purification principle applied was to retain indicators showing a higher primary loading and adequate separation from cross-loadings on the comparison constructs.

Table B2. Pilot-test loadings and cross-loadings of the initial CSE item pool

Item	CSE Loading	CL Cross-loading	DT Cross-loading	Gap to Highest Cross-loading	Decision
CSE1	0.798	0.525	0.412	0.273	Retained
CSE2	0.782	0.501	0.438	0.281	Retained

Table B2 (cont.). Pilot-test loadings and cross-loadings of the initial CSE item pool

Item	CSE Loading	CL Cross-loading	DT Cross-loading	Gap to Highest Cross-loading	Decision
CSE3	0.761	0.556	0.390	0.205	Retained
CSE4	0.736	0.547	0.421	0.189	Retained
CSE5	0.789	0.532	0.446	0.257	Retained
CSE6	0.755	0.518	0.401	0.237	Retained
CSE7	0.641	0.498	0.612	0.029	Dropped
CSE8	0.688	0.671	0.552	0.017	Dropped

CSE1 through CSE6 had gaps to their highest cross-loading ranging from 0.189 to 0.281, while CSE7 had a gap of only 0.029 relative to Digital Transformation and CSE8 a gap of only 0.017 relative to Customer Loyalty. The two items were eliminated for the following reasons.

Table B3. Eliminated CSE items and elimination rationale

Code	Item (English)	Item (Bahasa Indonesia)	Elimination Rationale
CSE7	My bank's digital services can be adjusted to fit my personal banking needs	Layanan digital bank saya dapat disesuaikan dengan kebutuhan perbankan pribadi saya	The item's substance more strongly reflects adaptability/ personalization as a characteristic of the bank's digital service capability than customers' co-creation experience, overlapping with Digital Transformation
CSE8	Because I participate in shaping the service, I feel more committed to continuing my relationship with this bank	Karena saya ikut berpartisipasi dalam membentuk layanan, saya merasa lebih berkomitmen untuk melanjutkan hubungan saya dengan bank ini	The item incorporates commitment and continuation intention, making its content too close to the outcome construct of Customer Loyalty

Removing both items helped preserve CSE's conceptual boundary as customers' subjective experience of participation, rather than an evaluation of digital capability or a loyalty outcome. The six retained indicators then became the final CSE items, mapped below to their conceptual domain, literature basis, and adaptation rationale.

Table B4. Final CSE items: literature basis and adaptation rationale

Code	Domain/ Concept	Literature Basis	Type of Adaptation	Adaptation Rationale	Item (English)	Item (Bahasa Indonesia)
CSE1	Customer input, participation, and influence	Auh et al. (2007); Ranjan and Read (2016)	Domain and context adaptation	The concept of customer contribution was contextualized into the perception that customers' input and feedback help shape the service they receive	I feel that my input and feedback actively shape the banking services I receive	Saya merasa masukan dan umpan balik saya turut membentuk layanan perbankan yang saya terima
CSE2	Co-production and collaborative interaction	Auh et al. (2007); Ranjan and Read (2016)	Domain and wording adaptation	The focus on co-production behavior was redirected toward the subjective experience that interaction with the bank feels collaborative rather than one-directional	My interactions with my bank feel collaborative rather than one-directional	Interaksi saya dengan bank terasa kolaboratif, bukan satu arah
CSE3	Subjective customer experience and co-creation experience	Becker and Jaakkola (2020); Verleye (2015)	Concept-based development	The item was formulated to capture a sense of ownership over the service experience as a consequence of the customer's contribution to shaping it	I feel a sense of ownership over my service experience because I have contributed to shaping it	Saya merasa memiliki pengalaman layanan ini karena saya turut berkontribusi membentuknya
CSE4	Perceived influence/ control over co-created outcome	Verleye (2015); Ranjan and Read (2016)	Domain and context adaptation	The concept of influence/ control was contextualized into the perception that the customer's contribution meaningfully influences the service they receive	When I engage with my bank, I feel that my contributions meaningfully influence what I receive	Ketika berinteraksi dengan bank, saya merasa kontribusi saya benar-benar memengaruhi apa yang saya terima

Table B4 (cont.). Final CSE items: literature basis and adaptation rationale

Code	Domain/ Concept	Literature Basis	Type of Adaptation	Adaptation Rationale	Item (English)	Item (Bahasa Indonesia)
CSE5	Active participation in co-production/co-creation experience	Auh et al. (2007); Verleye (2015)	Domain adaptation and construct differentiation	The item asserts that the service experience is formed through the customer's active participation, not merely through the bank's standard offering	The service I experience reflects my active participation, not just the bank's standard offering	Layanan yang saya alami mencerminkan partisipasi aktif saya, bukan sekadar layanan standar dari bank
CSE6	Relational reciprocity/partnership	Ranjan and Read (2016)	Concept-based development	The concept of interaction and relationship was synthesized into the perception of a genuine two-way partnership between the customer and the bank	I experience my relationship with my bank as a genuine two-way partnership	Saya mengalami hubungan dengan bank saya sebagai kemitraan dua arah yang sesungguhnya

In addition to eliminating two items, pilot testing was used to refine the wording of three of the six retained indicators. These linguistic and contextual revisions, detailed below, were not intended to change the items' conceptual domain.

Table B5. Types of wording refinement applied during pilot testing

Type of Refinement	Purpose	Academic Explanation
Revision type 1	Clarifying the actor and object of the experience	Terms that were originally general in nature were redirected explicitly toward the customer's interaction with the bank and the service received
Revision type 2	Strengthening the experience orientation	Statements that could potentially be read as participation behavior were clarified into a customer's subjective perception or experience
Revision type 3	Reducing overlap between constructs	Wording was narrowed so as not to overemphasize digital capability, satisfaction, commitment, or continuation intention

APPENDIX C. Survey instrument

This appendix lists the code, construct, and wording of the 17 items used to measure digital transformation (DT1–DT6), co-created service experience (CSE1–CSE6), and customer loyalty (CL1–CL5), corresponding to the item codes reported in Table 2. All items were rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) and administered in both Bahasa Indonesia and English following back-translation.

Table C1. Survey instrument items (English and Bahasa Indonesia)

Construct	Code	Item wording (English / Bahasa Indonesia)
Digital Transformation	DT1	EN: My bank provides a wide range of digital services that are easy to access. / ID: Bank saya menyediakan berbagai layanan digital yang mudah diakses
	DT2	EN: My bank's digital channels are well integrated across platforms (app, web, ATM). / ID: Kanal digital bank saya terintegrasi dengan baik di berbagai platform (aplikasi, situs web, ATM)
	DT3	EN: My bank's digital services respond quickly and accurately to my needs. / ID: Layanan digital bank saya merespons kebutuhan saya dengan cepat dan tepat
	DT4	EN: My bank's digital services are continuously updated and improved. / ID: Layanan digital bank saya terus diperbarui dan ditingkatkan
	DT5	EN: My bank's digital services make it easy for me to manage my finances independently. / ID: Layanan digital bank saya memudahkan saya mengelola keuangan secara mandiri
	DT6	EN: My bank's digital infrastructure is reliable and consistently available. / ID: Infrastruktur digital bank saya andal dan selalu tersedia

Table C1 (cont.). Survey instrument items (English and Bahasa Indonesia)

Construct	Code	Item wording (English / Bahasa Indonesia)
Co-Created Service Experience	CSE1	EN: I feel that my input and feedback actively shape the banking services I receive. / ID: Saya merasa masukan dan umpan balik saya turut membentuk layanan perbankan yang saya terima
	CSE2	EN: My interactions with my bank feel collaborative rather than one-directional. / ID: Interaksi saya dengan bank terasa kolaboratif, bukan satu arah
	CSE3	EN: I feel a sense of ownership over my service experience because I have contributed to shaping it. / ID: Saya merasa memiliki pengalaman layanan ini karena saya turut berkontribusi membentuknya
	CSE4	EN: When I engage with my bank, I feel that my contributions meaningfully influence what I receive. / ID: Ketika berinteraksi dengan bank, saya merasa kontribusi saya benar-benar memengaruhi apa yang saya terima
	CSE5	EN: The service I experience reflects my active participation, not just the bank's standard offering. / ID: Layanan yang saya alami mencerminkan partisipasi aktif saya, bukan sekadar layanan standar dari bank
	CSE6	EN: I experience my relationship with my bank as a genuine two-way partnership. / ID: Saya mengalami hubungan dengan bank saya sebagai kemitraan dua arah yang sesungguhnya
Customer Loyalty	CL1	EN: I intend to continue using my bank's digital services in the future. / ID: Saya berniat terus menggunakan layanan digital bank ini di masa depan
	CL2	EN: I would recommend my bank's digital services to people I know. / ID: Saya akan merekomendasikan layanan digital bank ini kepada orang-orang yang saya kenal
	CL3	EN: I prefer my bank over other banking alternatives available to me. / ID: Saya lebih memilih bank ini dibandingkan alternatif bank lain yang tersedia bagi saya
	CL4	EN: I would remain with my bank even if a competitor offered slightly better terms. / ID: Saya akan tetap menggunakan bank ini meskipun pesaing menawarkan persyaratan yang sedikit lebih baik
	CL5	EN: I feel genuinely committed to maintaining my relationship with this bank. / ID: Saya merasa benar-benar berkomitmen untuk mempertahankan hubungan saya dengan bank ini