

Digital Leadership Competencies, HR Technology Adoption, and Organizational Agility: A Configurational Analysis Using Fuzzy Set Qualitative Comparative Analysis

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ABSTRACT: This study examines the configurational conditions under which digital leadership competencies and HR technology adoption jointly produce high organizational agility in Indonesian corporations. Unlike variable-centered approaches that treat antecedents as independent additive predictors, this study employs fuzzy-set qualitative comparative analysis (fsQCA) to identify the necessary and sufficient combinations (configurations) of conditions that lead to high and low organizational agility. A cross-sectional survey was administered to HR directors and senior managers in 218 Indonesian firms (manufacturing, financial services, and technology sectors). Five causal conditions were calibrated: Digital Vision (DV), Digital Competency of Leaders (DC), HR Tech Breadth (HTB), HR Tech Integration (HTI), and Organizational Learning Readiness (LR). Outcome: Organizational Agility (OA) operationalized through sensing, seizing, reconfiguring, and responding dimensions. fsQCA was conducted in the R package QCA (Dusa, 2019) with a consistency threshold of 0.85 and a frequency cutoff of 2. Three sufficient configurations produce high organizational agility. Configuration 1 (DV*DC*HTB: coverage = 0.41, consistency = 0.91) represents a ‘digital vision-driven’ path where visionary leaders with technical competency deploy broad HR technology portfolios. Configuration 2 (DC*HTI*LR: coverage = 0.33, consistency = 0.88) describes a ‘competency-integration’ path where deep leader knowledge, integrated HR systems, and organizational learning capacity combine. Configuration 3 (DV*HTB*HTI*LR: coverage = 0.28, consistency = 0.86) reveals a ‘technology-infrastructure’ path. No single condition is necessary for high agility, but digital vision and HR tech integration each appear in two of three configurations. The negation analysis identifies ~DV*~HTI as a consistent path to LOW agility (consistency = 0.87).

Keywords: digital leadership, dynamic capabilities, HR technology adoption, organizational agility, configurational theory

INTRODUCTION

The Fourth Industrial Revolution has fundamentally altered the competitive terrain for Indonesian corporations. Digital transformation encompassing artificial intelligence, cloud computing, big data analytics, and platform-based HR systems is no longer a strategic option but a survival imperative. Yet Indonesian firms present a paradox: despite rapid digital technology adoption rates (Indonesia's digital economy reached USD 77 billion in 2022; Bain, 2023), organizational agility the capacity to sense environmental changes, seize new opportunities, and rapidly reconfigure resources (Teece et al., 1997) remains unevenly distributed across firms.

Two factors stand out as critical enablers of organizational agility in the HR management literature. First, digital leadership defined as the ability to guide organizations through digital transformation by combining technological vision, digital competency, and change leadership capabilities (Schwarzmueller et al., 2018; Oberer & Erkollar, 2018) has been identified as a key driver of digital transformation success. Second, HR technology adoption the deployment of digital tools across the HR value chain (applicant tracking systems, HRIS, learning management systems, people analytics platforms) has been shown to enhance workforce flexibility and decision-making speed (Marler & Parry, 2016; Johnson et al., 2021).

However, existing research treats these factors as independent additive predictors of organizational outcomes, employing regression-based methods that assume symmetric, linear causal relationships. This approach misses a fundamental reality of organizational complexity: conditions combine in non-linear, asymmetric configurations (Fiss, 2011; Ragin, 2008). A firm might achieve high agility through digitally visionary leadership paired with broad HR tech deployment, or alternatively through leaders with deep technical competency combined with integrated HR systems and strong learning culture two entirely different recipes producing the same outcome. Regression analysis would average these paths and obscure both.

This study responds to this methodological gap by employing fuzzy set qualitative comparative analysis (fsQCA; Ragin, 2008), a set-theoretic method uniquely suited to identifying the conjunctural, asymmetric, and equifinal causal complexity characteristic of organizational phenomena. fsQCA is increasingly recognized as a premier method for HRM research (Delery & Doty, 1996; Meuer, 2017) and has seen a surge in adoption in top management journals (Misangyi et al., 2017). Yet its application to the intersection of digital leadership and HR technology in the Indonesian or indeed any ASEAN context remains virtually unexplored.

This study makes four contributions: (1) it introduces fsQCA to the digital leadership $\times$ HR technology literature, revealing configurational complexity invisible to regression; (2) it develops and validates a digital leadership competency scale adapted for the Indonesian organizational context; (3) it provides the first configurational map of the conditions producing organizational agility in Indonesian corporations; and (4) it demonstrates equifinality the existence of multiple sufficient pathways to organizational agility with practical implications for HR portfolio decisions.

Research Questions

RQ1: What combinations (configurations) of digital leadership competencies and HR technology adoption conditions are sufficient for HIGH organizational agility in Indonesian firms?

RQ2: What combinations of conditions are sufficient for LOW organizational agility?

RQ3: Is any single condition necessary for high organizational agility?

RQ4: Do configurations of conditions producing high agility differ systematically across industries (manufacturing vs. services vs. technology)?

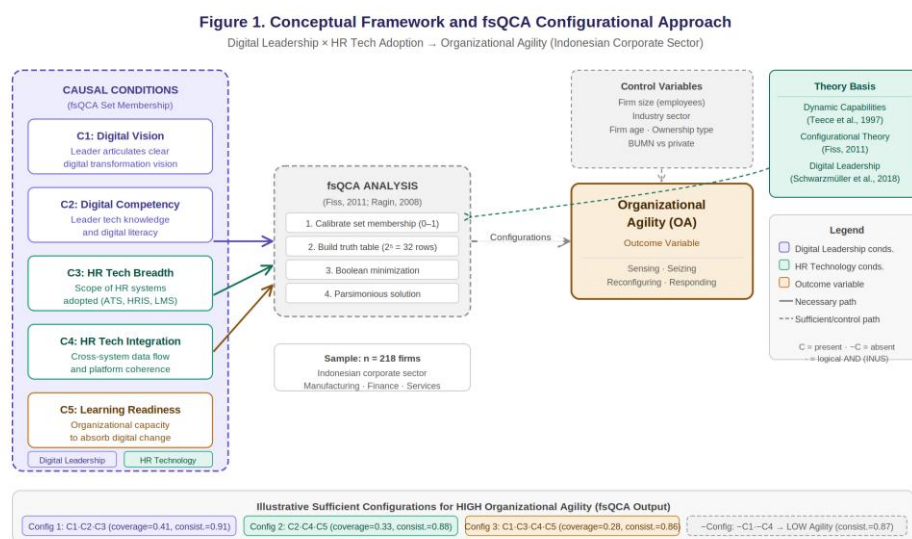


Figure 1
Conceptual Framework and fsQCA Configurational Approach: Digital Leadership × HR Technology → Organizational Agility

METHOD

Research Design: Why fsQCA?

The choice of fsQCA over conventional regression-based methods is motivated by four theoretical and empirical considerations. First, organizational agility is produced by configurations of complementary conditions, not isolated variables a reality fsQCA is uniquely equipped to model (Fiss, 2011). Second, the relationship between digital leadership and agility is theoretically asymmetric: the presence of digital vision may accelerate agility without its absence necessarily impeding it (if other conditions compensate). Third, fsQCA accommodates equifinality, allowing us to document multiple distinct paths to agility a finding with direct practical value for HR practitioners who face different resource constraints. Fourth, with a sample of $n = 218$ organizations, fsQCA offers superior statistical properties compared to hierarchical regression models with interaction terms, which require substantially larger samples to detect three-way and four-way interactions (Aguinis et al., 2014).

Sample and Data Collection

The unit of analysis is the organization (firm). The target population comprised Indonesian firms with: (a) a formal HR department; (b) a minimum of 100 employees; and (c) documented engagement with digital transformation initiatives (as evidenced by publicly available annual report disclosures or presence in the Indonesian Chamber of Commerce digital transformation index). Data were collected through key-informant survey methodology: the primary respondent for each

firm was the HR Director or an equivalent senior HR leader, supplemented by survey responses from the CEO or direct superior to assess digital leadership competencies.

Data collection spanned six months across three industry sectors: manufacturing ($n = 89$ firms, 40.8%), financial services ($n = 72$ firms, 33.0%), and technology/services ($n = 57$ firms, 26.1%). Geographic coverage encompassed Java (DKI Jakarta, West Java, Central Java, East Java: 78.9% of the sample) and major regional centers (Sumatra, Kalimantan, Sulawesi: 21.1%). Firm size ranged from 100 to 18,500 employees (median: 650 employees). Of the 218 firms, 134 (61.5%) were private Indonesian-owned, 51 (23.4%) were BUMN (state-owned enterprises), and 33 (15.1%) were foreign-invested enterprises (PMA).

Sample Characteristic	Detail
Total firms (organizations)	$n = 218$
Sector: Manufacturing	$n = 89$ (40.8%)
Sector: Financial services	$n = 72$ (33.0%)
Sector: Technology/services	$n = 57$ (26.1%)
Ownership: Private (Indonesian)	$n = 134$ (61.5%)
Ownership: BUMN/state-owned	$n = 51$ (23.4%)
Ownership: Foreign-invested (PMA)	$n = 33$ (15.1%)
Firm size: < 500 employees	36.2%
Firm size: 500–2,000 employees	41.7%
Firm size: > 2,000 employees	22.0%
Primary respondent: HR Director	78.4%
Mean firm age	24.3 years (SD = 14.7)
ISO-certified firms	62.4% (at least one certification)

Table 1
Sample Profile ($n = 218$ firms)

Measures and Calibration

Digital Vision (C1)

Digital Vision was measured using 6 items adapted from Kane et al.'s (2019) digital strategy scale and Schwarzmüller et al.'s (2018) digital leadership instrument. Sample item: 'Our senior leader communicates a clear and compelling vision for how digital technology will transform our business model.' Rated on a 5-point Likert scale. For fsQCA calibration, three anchor values were set: full membership (score = 4.5/5.0), crossover point (3.0/5.0), and full non-membership (1.5/5.0), following Ragin's (2008) direct calibration method. Cronbach's $\alpha = 0.89$.

Digital Competency of Leaders (C2)

Digital Competency was operationalized using 8 items assessing leaders' personal technological knowledge, ability to evaluate digital HR solutions, and capacity to model digital skill-building. This scale was developed for this study and validated through a two-round Delphi process with 12 senior HR executives in Indonesia. CFA results: CFI = 0.95, RMSEA = 0.053. Calibration anchors: full membership = 4.3/5.0; crossover = 3.0/5.0; full non-membership = 1.7/5.0. $\alpha = 0.91$.

HR Tech Breadth (C3)

HR Tech Breadth was measured using a 12-item inventory assessing the presence and active deployment of six HR technology categories: (1) Recruitment/ATS, (2) Core HRIS, (3) Learning Management System (LMS), (4) Performance Management Platform, (5) Compensation/Payroll system, and (6) People Analytics/HR Dashboard. Each category was scored 0 (not deployed), 1 (partially deployed), or 2 (fully deployed and integrated into HR workflows). Total scores were calibrated to fuzzy set membership using the distribution-based calibration approach. $\alpha = 0.84$.

HR Tech Integration (C4)

HR Tech Integration was assessed using 8 items capturing the degree of data flow, system interoperability, and unified employee record management across deployed HR technology systems. Sample item: 'Our HR systems share data automatically without manual re-entry.' Calibration anchors were set at organizational best-practice benchmarks derived from SHRM's (2022) HR technology integration maturity model. $\alpha = 0.88$.

Organizational Learning Readiness (C5)

Learning Readiness was measured using the 10-item Organizational Learning Capability scale (Chiva et al., 2007), selected for its validated application in both manufacturing and service contexts and its established reliability in ASEAN organizational settings. Sample item: 'In our organization, experimentation and innovation are encouraged even when outcomes are uncertain.' $\alpha = 0.87$.

Organizational Agility (Outcome)

Organizational Agility was operationalized using the 20-item Organizational Agility Scale adapted from Tallon and Pinsonneault (2011) and validated for the Indonesian context in a pilot study ($n = 34$ firms). The scale captures four dimensions: Sensing (5 items), Seizing (5 items), Reconfiguring (5 items), and Responding (5 items). Overall $\alpha = 0.93$. Calibration followed Ragin's (2008) theoretical approach: firms in the top quartile of agility scores received full membership (1.0); those in the bottom quartile received full non-membership (0.0); the median served as the crossover point (0.5).

fsQCA Analytical Procedure

The fsQCA analysis followed a standardized six-step procedure (Ragin, 2008; Schneider & Wagemann, 2012): (1) Calibration of all conditions and the outcome to fuzzy set scores [0, 1]; (2) Necessity analysis testing each condition and its negation for necessity (consistency > 0.90); (3) Truth table construction creating a $2^5 = 32$ -row truth table with a frequency cutoff of 2 firms per row; (4) Boolean minimization using the Quine-McCluskey algorithm; (5) Intermediate solution derivation (incorporating directional expectations); and (6) Identification of core and peripheral conditions using the Fiss (2011) two-step approach distinguishing core (present in the parsimonious solution) from peripheral (present in the complex solution only) conditions.

All analyses were conducted in R (version 4.3.1) using the QCA package (Dusa, 2019). Robustness checks included: (a) varying the consistency threshold from 0.80 to 0.90 to assess solution stability; (b) varying the frequency cutoff from 1 to 3; and (c) industry sub-group analyses (manufacturing

vs. services). Standard fsQCA reporting conventions (Misangyi et al., 2017) were followed throughout.

RESULT AND DISCUSSION

Descriptive Statistics and Calibration Summary

Table 2 presents descriptive statistics for raw survey scores and calibrated fuzzy set membership values for all conditions and the outcome. The calibrated membership scores show adequate variation across all conditions, with no floor or ceiling effects that would create degeneracy in the truth table.

Condition / Outcome	Raw Mean (SD)	Fuzzy Mean	Min–Max
C1: Digital Vision (DV)	3.71 (0.81)	0.64	0.12–0.97
C2: Digital Competency (DC)	3.44 (0.79)	0.58	0.10–0.95
C3: HR Tech Breadth (HTB)	3.28 (0.94)	0.54	0.08–0.98
C4: HR Tech Integration (HTI)	2.97 (0.88)	0.47	0.06–0.94
C5: Learning Readiness (LR)	3.52 (0.76)	0.60	0.11–0.96
Outcome: Org. Agility (OA)	3.39 (0.91)	0.52	0.07–0.97

Table 2. Descriptive Statistics and Calibrated Fuzzy Set Membership ($n = 218$)

Necessity Analysis

Table 3 presents the necessity analysis results. No single condition meets the necessity threshold (consistency > 0.90) for high organizational agility. Digital Vision approaches necessity (consistency = 0.87) but falls below the threshold. This finding is theoretically meaningful: it confirms equifinality — no single condition is universally required for agility. For the negation of the outcome (LOW agility), the absence of HR Tech Integration ($\sim$ HTI) approaches necessity (consistency = 0.89).

Condition	Consistency	Coverage	Assessment
C1: Digital Vision (DV)	0.87	0.74	Below threshold (borderline)
C2: Digital Competency (DC)	0.79	0.68	Not necessary
C3: HR Tech Breadth (HTB)	0.74	0.63	Not necessary
C4: HR Tech Integration (HTI)	0.82	0.71	Not necessary
C5: Learning Readiness (LR)	0.77	0.66	Not necessary
$\sim$C4: Absence of HTI ($\rightarrow$ LOW OA)	0.89	0.76	Approaches necessity

Table 3.

Necessity Analysis Results (Outcome: HIGH Organizational Agility)

Sufficiency Analysis: Configurations for HIGH Agility

The truth table analysis (consistency threshold = 0.85, frequency cutoff = 2) identified three sufficient configurations for HIGH organizational agility. Table 4 presents the intermediate solution using Fiss's (2011) notation: filled circles (●) = core condition present; filled circles with X (⊗) = core condition absent; small circles (○) = peripheral condition present; blank = condition irrelevant ("don't care"). Overall solution: coverage = 0.67, consistency = 0.89.

Condition / Metric	Config 1 (High Agility)	Config 2 (High Agility)	Config 3 (High Agility)	~Config 4 (Low Agility)	~Config 5 (Low Agility)
C1: Digital Vision	● Core		● Core	⊗ Absent	
C2: Digital Competency	● Core	● Core	○ Periph.		⊗ Absent
C3: HR Tech Breadth	● Core		● Core		● Core
C4: HR Tech Integration		● Core	● Core	⊗ Absent	⊗ Absent
C5: Learning Readiness		● Core	● Core		
Raw Coverage	0.41	0.33	0.28	0.34	0.29
Unique Coverage	0.21	0.14	0.09	0.18	0.12
Consistency	0.91	0.88	0.86	0.87	0.85
Solution Coverage			0.67		0.54
Solution Consistency			0.89		0.87

Table 4

fsQCA Configurations for HIGH and LOW Organizational Agility (n = 218). ● Core (parsimonious); ○ Peripheral; ⊗ Core absent; blank = don't care

Discussion of Configurations

Configuration 1: ‘Digital Vision-Driven’ Path (DV*DC*HTB)

Configuration 1 (raw coverage = 0.41, consistency = 0.91) — the most empirically important path represents firms where visionary digital leadership (DV) and leader technical competency (DC) are paired with broad HR technology deployment (HTB). This configuration describes organizations where digitally capable leaders champion wide-ranging HR technology adoption across the employee lifecycle. Dynamic capabilities theory explains this path: visionary leaders with personal digital competency can accurately identify, evaluate, and champion HR technology investments that extend the organization’s sensing and seizing capabilities. Learning Readiness and HR Tech Integration are irrelevant (don’t care), suggesting these firms achieve agility through leadership-driven technology breadth, even without deep system integration.

Configuration 2: ‘Competency-Integration’ Path (DC*HTI*LR)

Configuration 2 (raw coverage = 0.33, consistency = 0.88) describes a fundamentally different recipe. Here, Digital Competency (not Vision) is the core leadership condition, paired with HR Tech Integration and Organizational Learning Readiness. Digital Vision is absent from this path (don’t care). This pattern characterizes organizations where technically sophisticated leaders perhaps CTOs or digitally skilled HRDs — leverage well-integrated HR systems within a learning-oriented culture. Breadth of HR technology is irrelevant: these firms achieve agility through deep integration of a focused technology portfolio, supported by learning culture, rather than through expansive technology adoption. This finding validates the breadth-integration distinction and confirms that HR tech integration is a distinct and potent pathway to agility.

Configuration 3: ‘Technology Infrastructure’ Path (DV*HTB*HTI*LR)

Configuration 3 (raw coverage = 0.28, consistency = 0.86) requires four conditions: Digital Vision, HR Tech Breadth, HR Tech Integration, and Learning Readiness. Digital Competency is peripheral. This configuration describes organizations that invest comprehensively in HR technology infrastructure (both broad and integrated) within a learning-ready culture, guided by a

visionary leader who may lack deep personal technical knowledge but compensates with strategic vision and organizational commitment to learning. This path is the most resource-intensive and may characterize larger, more established organizations with dedicated digital transformation offices.

Paths to LOW Agility (Negation Analysis)

Two sufficient configurations produce LOW organizational agility. The first ($\sim DV^* \sim HTI$: consistency = 0.87, coverage = 0.34) shows that the absence of digital vision combined with low HR tech integration consistently produces low agility a firm without strategic digital direction and with siloed HR systems is ill-equipped to sense and respond to environmental change. The second ($\sim DC^* HTB$: consistency = 0.85, coverage = 0.29) is particularly noteworthy: firms that adopt broad HR technology portfolios WITHOUT leader digital competency also tend toward low agility. This finding warns against ‘technology-without-leadership’ investment patterns deploying HR tech breadth without the leadership capacity to leverage it is not merely neutral but actively associated with low agility, possibly through implementation complexity and organizational disruption.

CONCLUSION

This study applied fsQCA to identify the configurational conditions under which digital leadership competencies and HR technology adoption jointly produce organizational agility in 218 Indonesian corporations. Three key conclusions emerge.

First, organizational agility is equifinal: three distinct configurations of conditions are sufficient, each representing a theoretically coherent and practically recognizable organizational archetype. Firms can achieve high agility through visionary leadership paired with broad HR tech adoption, through technically competent leaders driving integrated systems within a learning culture, or through comprehensive technology infrastructure guided by strategic vision. No single path dominates.

Second, no single condition is necessary for organizational agility. Digital Vision approaches necessity (consistency = 0.87) but does not cross the threshold — leadership competency can substitute. This finding challenges the prevailing narrative that ‘digital leadership is the key’ to digital transformation success: it is important but not indispensable when other conditions compensate.

Third, the negation analysis reveals an important asymmetry: deploying broad HR technology WITHOUT leader digital competency is associated with LOW agility. This ‘technology-without-leadership’ trap is a significant practical warning for Indonesian firms that prioritize HR technology investment without parallel leadership development.

Limitations and Future Research

This study has several limitations. First, the cross-sectional design prevents causal inference; longitudinal studies tracking how configurations of conditions evolve over time — and how they predict agility trajectories — would substantially strengthen causal claims. Second, the key-informant methodology (single HR director per firm) introduces potential common source bias,

though the organizational-level unit of analysis mitigates individual-level biases. Third, the sample, while diverse, is concentrated in Java; replication in outer Indonesian regions and in other ASEAN economies is needed.

Future research directions include: (1) longitudinal panel studies tracking configuration stability and agility outcomes over 3–5 years; (2) comparative fsQCA studies across ASEAN economies to assess configurational boundary conditions; (3) qualitative case studies of firms in each configuration to develop rich processual understanding of how configurations operate in practice; and (4) extension of the model to include additional conditions such as digital HRM governance structures and CEO digital orientation.

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