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Research Paper

The Ontology of Digital Transformation in the Perspective of Resource-Based Theory

Adi Munandir*, Reza Ashari Nasution, Prawira Fajarindra Belgiawan, Aurik Gustomo
Institut Teknologi Bandung, Indonesia

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Abstract

Digital transformation research lacks theoretical coherence while practitioners experience high failure rates, questioning the field's knowledge completeness. Given digital transformation's nature as a resource-driven process, this study assesses whether decade-long research has addressed all essential elements defined by resource-based theory. We constructed a conceptual blueprint incorporating resource-based theory's core principles, drawn from theoretical critiques, empirical validations, and extensions, to evaluate research comprehensiveness. Using a systematic literature review and keyword analysis across 46 studies (2012-2024), we mapped digital transformation scholarship against our blueprint. Results show substantial coverage of environmental contexts and resource domains, yet reveal a critical gap in digital resource orchestration. Examination of 42 empirical studies confirms zero attention to orchestration concepts, highlighting knowledge deficiencies that may explain transformation failures. To address this limitation, we introduce a digital resources orchestration framework integrating resource-based and dynamic capabilities theories across two dimensions: content (aligning digital assets with transformation phase requirements) and mechanism (adaptive coordination via multi-organizational layers). For practitioners and policymakers, this framework provides actionable guidance on systematically coordinating digital resources across organizational layers, potentially reducing transformation failure rates and enhancing strategic decision-making. This framework offers a holistic resource-based perspective on digital transformation, providing structured ontological mapping to direct future research toward resolving fundamental challenges and improving transformation outcomes.

Keywords: *Digital Transformation, Digital Resources, Digital Resource Orchestration, Resource-Based Theory, Dynamic Capabilities, Firm Performance*

INTRODUCTION

Digital transformation has emerged as a critical strategic imperative for organizations worldwide, with global investments reaching USD 1.91 trillion in 2022 and projected to exceed USD 8.92 trillion by 2030 (Fortune Business Insights, 2023). This phenomenon fundamentally reshapes how organizations create, deliver, and capture value through the strategic deployment of digital technologies (Verhoef et al., 2021). Across industries, digital transformation manifests in distinct yet interconnected patterns. In manufacturing, Industry 4.0 initiatives have driven the integration of cyber-physical systems, Internet of Things, and smart factories, fundamentally altering production paradigms (Lasi et al., 2014; Culot et al., 2020). Financial services have witnessed unprecedented disruption through fintech innovations, compelling traditional institutions to reimagine service delivery models (Gomber et al., 2018). The retail sector has experienced radical shifts toward omnichannel strategies, with e-commerce platforms reshaping consumer expectations and competitive dynamics (Grewal et al., 2017). Healthcare organizations increasingly adopt digital health solutions, electronic medical records, and telemedicine platforms

Corresponding author's email: Adi_Munandir@sbm-itb.ac.id

to enhance patient outcomes and operational efficiency (Agarwal et al., 2010). Geographically, while developed economies lead in digital infrastructure investments, emerging markets face unique challenges in technology adoption, regulatory frameworks, and digital skills development (World Economic Forum, 2023). These sectoral and regional variations underscore the complexity practitioners face when implementing transformation initiatives.

Despite substantial investments and widespread adoption, digital transformation initiatives face a concerning reality, with over 70% reported as unsuccessful (BCG, 2020; KPMG/Harvey Nash CIO Survey, 2021; Saldanha, 2019). This high failure rate signals critical gaps in understanding how organizations can effectively orchestrate digital resources for superior performance. The challenges stem from definitional ambiguity (Haffke et al., 2016, 2017) and a lack of consensus on theoretical foundations (Warner & Wäger, 2019), creating confusion in both research and practice. While many studies have utilized Resource-Based Theory (RBT) to examine digital transformation as a resource-based phenomenon (Díaz-Chao et al., 2021; Gayer et al., 2022; Ghosh et al., 2022), they have mainly focused on identifying digital resources and their direct effects on firm performance, without addressing how these resources should be orchestrated to generate sustained competitive advantage. Recent ontological research has contributed to understanding digital transformation's complexity, with works by Gomes et al. (2019) and Zaoui and Souissi (2018) mapping its components, but these studies remain descriptive and lack strategic guidance for resource orchestration.

This research aims to bridge these theoretical gaps by conducting a systematic ontological analysis of digital transformation through the lens of Resource-Based Theory. Building on the key RBT concepts of environment context, key resources, and resource orchestration (Sirmon et al., 2011; Barney et al., 2021), the study evaluates existing research and identifies gaps in knowledge. The analysis shows that while substantial research exists on digital resources and environmental contexts, the domain of resource orchestration remains significantly underdeveloped, representing a crucial missing piece in understanding digital transformation. To address this gap, this research integrates Resource-Based Theory with Dynamic Capabilities Theory to develop a comprehensive Digital Resources Orchestration framework. This framework explains how digital resources can be aligned with environmental contexts and digital transformation agendas to create superior firm performance, incorporating two critical domains: content (alignment between context, resources, and objectives) and mechanism (dynamic calibration through productive dialogue), as suggested by Salvato and Vassolo (2018). This approach offers a novel, theoretically grounded, and practically applicable framework for resource orchestration in digital transformation.

Given these research imperatives, this study addresses the central question of how existing digital transformation research has comprehensively addressed the key aspects of digital transformation as a resource-based phenomenon. To achieve this objective, this research systematically explores several key inquiries:

1. What are the critical concepts from Resource-Based Theory that must be addressed to comprehensively analyze digital transformation as a resource-based phenomenon?
2. Which areas of the Resource-Based Theory framework have been adequately covered, and which remain underdeveloped in current digital transformation research?
3. How can digital resources be orchestrated to align with environmental context and create superior firm performance in digital transformation initiatives?

By answering these questions, this research contributes to both theoretical advancement and practical guidance for improving digital transformation success rates through systematic resource orchestration.

LITERATURE REVIEW

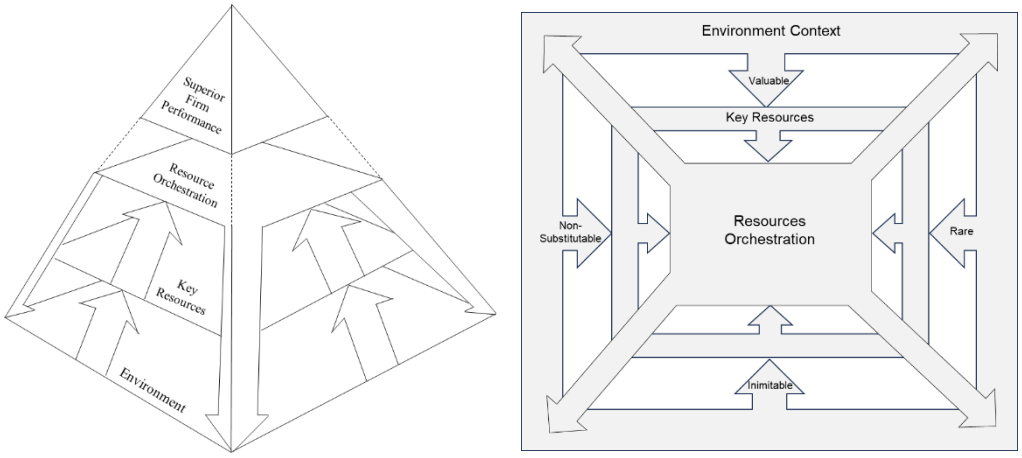
Resource-based theory (RBT) views firms as bundles of resources (Wernerfelt, 1984), based on two key assumptions: resource heterogeneity (firms possess unique resources) and resource immobility (differences persist due to trading difficulties), which together influence firm performance (Penrose, 1959; Peteraf & Barney, 2003). Resources include assets, processes, attributes, information, and knowledge that firms control to implement strategy (Barney, 1991), classified as tangible/intangible, physical/human/organizational capital (Barney, 1991), or passive assets versus active capabilities, where capabilities reflect the firm's ability to deploy resources effectively for competitive advantage (Hitt et al., 2006; Makadok, 2001). Only resources meeting VRIN criteria, Valuable, Rare, Inimitable, and Non-substitutable, create sustained competitive advantage (Barney, 1995), with their value assessed through industry context comparison and co-specialization potential (Barney et al., 2021).

RBT evolved through addressing criticisms, including the static nature critique, which led to the dynamic capabilities concept (Teece et al., 1997), allowing firms to adapt to changing environments, and the resource possession critique, which highlighted the need for resource orchestration (Priem & Butler, 2001; Sirmon et al., 2007), leading to frameworks integrating search/selection with configuration/deployment (Sirmon et al., 2011). Key elements for analyzing resource-based phenomena include (1) environmental context that defines VRIN criteria through opportunities, threats, and competitor analysis; (2) identification of key resources meeting VRIN criteria; and (3) resource orchestration mechanisms that align resources dynamically with environmental changes to generate superior performance.

Based on the analysis of resource-based theory throughout the critics, empirical test, and refinement, the identified key concepts in Resource-based theory that shall be addressed to analyze any resource-based phenomenon are as follows:

1. The environmental context. It is the understanding of environmental context regarding the opportunities and threats provided and the competitor ownership of resources that influenced the determination of key resources and the process of resources orchestration. It is the context that provides parameterizing the VRIN criteria.
2. Key resources. Resources that meet the VRIN criterion, which are based on appraisal and care evaluation meeting each criterion in the given context. Resources are assets, both tangible and intangible, and capabilities.
3. Resources orchestration. The utilization of resources determines value creation. It might be the case of co-specialization to create value or a case of managing the resources to be aligned with the provided opportunities and threats in the environment, as dynamic capabilities suggest. It needs to define how the resources are being orchestrated to create value better than their peers.

The synthesized key-concepts and their relationship can be illustrated as follows:



a. Three-dimensional illustrations. b. Two-dimensional illustrations

Figure 1. Resource-based theory synthesized key-concepts.

Figure 1 illustrates the key concepts of resource-based theory, where the environment defines the VRIN criteria (Valuable, Rare, Inimitable, Non-substitutable) and provides opportunities and threats that determine resource value—only resources that enable opportunity acquisition and threat mitigation are valuable (Barney & Hesterly, 2006). The framework identifies key resources (assets and capabilities) within this context and demonstrates how resource orchestration—strategically aligning resources—creates value and superior performance (Hansen et al., 2004). The two-dimensional aspect highlights a feedback loop, where resource orchestration influences firm responses that reshape the environment, affecting what constitutes VRIN resources. This framework offers a comprehensive approach to analyzing resource-based phenomena, addressing the environmental context, key resource identification, and orchestration mechanisms. From a managerial perspective, it helps decision-makers evaluate resource portfolios against environmental demands, facilitating informed choices on resource acquisition and deployment (Sirmon et al., 2011). The dynamic interplay between the environment and resource orchestration requires managers to develop sensing and seizing routines that align internal capabilities with external opportunities (Teece et al., 1997), while the feedback loop captures the socio-organizational change dynamics, showing that resource-based decisions are influenced by broader social systems and co-evolve with organizational strategies (Barney et al., 2021).

RESEARCH METHOD

In this study, systematic literature review methods were employed to reveal a comprehensive understanding of digital transformation research from a Resource-Based Theory perspective. Since digital transformation faces definitional ambiguity and lacks theoretical consensus (Haffke et al., 2016, 2017; Warner & Wäger, 2019), a systematic approach was necessary to synthesize existing knowledge and identify theoretical gaps. The research design adopted both evaluative techniques (citation analysis, keyword frequency analysis, and content categorization) and analytical techniques (comparative analysis between research domains and theoretical framework mapping) to assess the comprehensiveness of digital transformation research coverage against Resource-Based Theory key concepts (Tranfield et al., 2003; Denyer & Tranfield, 2009).

The data were obtained from the Scopus database, which provides comprehensive coverage of business and management literature with advanced search capabilities essential for systematic

literature reviews (Falagas et al., 2008; Burnham, 2006). A dual-search strategy was implemented following established protocols (Kitchenham & Charters, 2007): first, examining digital transformation and firm performance research (2012-2024) using extended keywords encompassing various digital technologies (digital transformation OR digital technologies OR machine learning OR artificial intelligence OR big data analytics OR cloud computing OR blockchain OR digital platform AND firm performance), yielding 1,596 articles refined through abstract review to 42 empirical studies (n=1,554 after duplicate removal); second, identifying conceptual frameworks through targeted search (2019-2023) using keywords "digital AND transformation AND literature AND review," producing 31 articles with 4 selected for comprehensive conceptual content (n=27 after duplicate removal), resulting in 46 total articles for qualitative synthesis (see Figure 2).

This selection process reflects a purposive sampling strategy, wherein articles were deliberately chosen based on predetermined criteria aligned with the research objectives rather than statistical representativeness (Kitchenham & Charters, 2007). The purposive approach ensures that selected studies directly address digital transformation as a resource-based phenomenon, enabling focused theoretical analysis while maintaining methodological rigor through transparent inclusion and exclusion criteria.

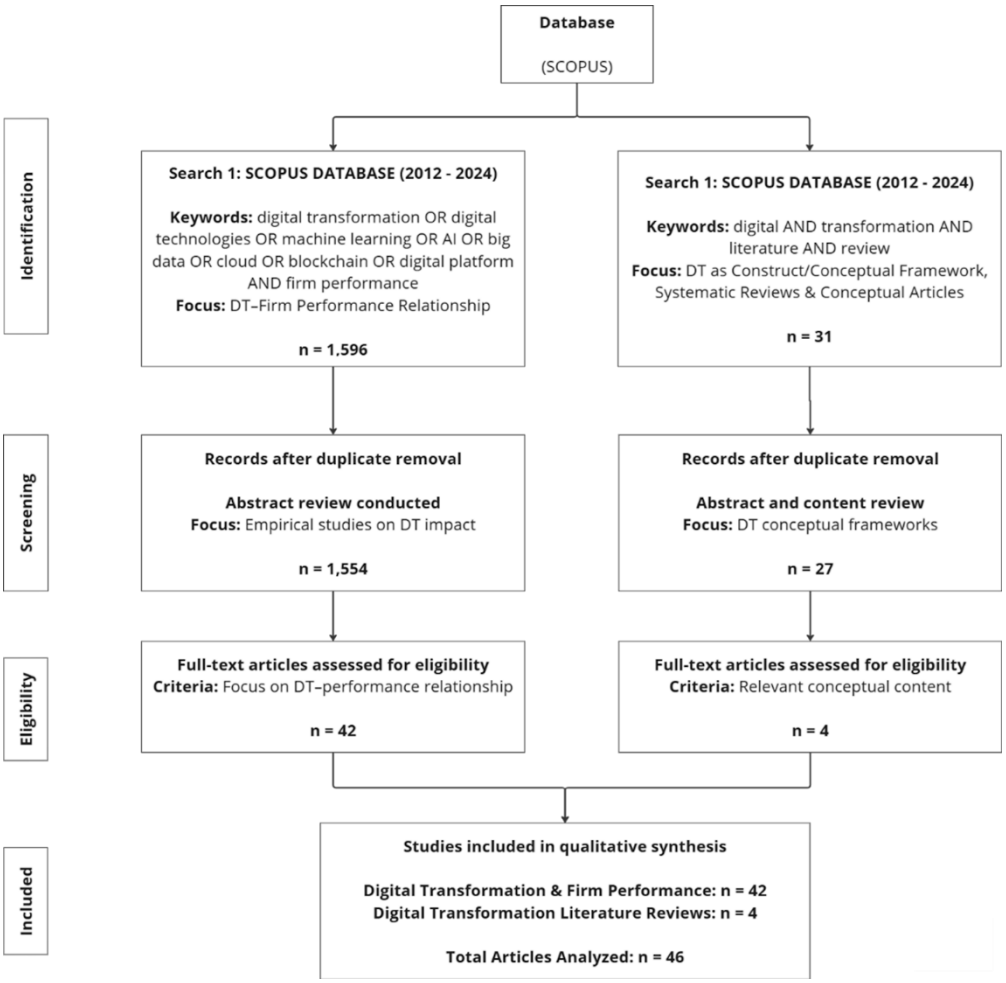


Figure 2. PRISMA Flow Diagram: Digital Transformation Research

VOSviewer software was employed for keyword co-occurrence analysis and network visualization to identify research clusters and thematic relationships (Waltman et al., 2010). Manual content analysis was conducted to categorize research themes according to Resource-Based Theory key concepts: environment context, key resources, and resource orchestration, ensuring accurate classification beyond automated keyword analysis (Hsieh & Shannon, 2005). Finally, comparative analysis techniques were applied to evaluate the comprehensiveness of current research against the theoretical framework, identifying gaps and underdeveloped areas that warrant future investigation (Miles et al., 2014). The combination of keyword co-occurrence analysis, manual content analysis, and comparative framework mapping constitutes methodological triangulation, wherein multiple analytical approaches are applied to the same dataset to cross-validate findings (Denzin, 1978). This triangulation strategy enhances research credibility by compensating for the limitations inherent in any single method—automated keyword analysis captures broad thematic patterns while manual categorization ensures contextual accuracy, and comparative analysis validates the comprehensiveness of identified themes against theoretical benchmarks (Miles et al., 2014).

RESULT

Study Overview

Research Trends

The examination of digital transformation research from a resource-based theory perspective reveals a significant evolution over the past decade, reflecting the growing recognition of digital transformation as a strategic imperative for organizational competitiveness. As demonstrated in Table 1, there has been a notable increase in scholarly interest in this field, particularly in recent years, with the publications showing modest representation in the early period, followed by a substantial surge in the later periods. This acceleration reflects the growing understanding of digital transformation as a resource-based phenomenon rather than merely a technological implementation, particularly pronounced following the COVID-19 pandemic, which accelerated digital adoption globally (Li et al., 2022; Wu et al., 2023).

Table 1. Research Trends in Digital Transformation and Firm Performance

Time Period	Number of Studies	Key Focus Areas	Notable Studies
2012-2016	8	IT capability foundations, Digital technology adoption, Basic digitalization concepts	Nwankpa and Roumani (2016) - RBV perspective, Bharadwaj (2000) framework application
2017-2019	14	Digital capabilities development, Technology-organization-environment frameworks, Dynamic capabilities integration	Lichtenthaler (2019) - Intelligence-based view, Fenech et al. (2019) - HR transformation
2020-2022	16	Pandemic-driven transformation, Digital resilience, Supply chain digitalization, SME adaptation	Chi et al. (2022) - Manufacturing innovation, Pan et al. (2021) - Strategic orientation, Bai et al. (2022) - Platform strategy
2023-2024	8	AI integration, Sustainability convergence, Organizational ambidexterity, Digital maturity frameworks	Heubeck (2023) - Managerial capabilities, Ren et al. (2023) - Manufacturing capabilities

The research focus has evolved significantly during these periods, reflecting the maturation of digital transformation as a strategic discipline. Early studies (2012-2016) primarily concentrated on establishing IT capabilities as strategic resources, building theoretical foundations that connect information technology with firm performance outcomes (Nwankpa & Roumani, 2016). The middle period (2017-2019) witnessed a shift toward understanding digital transformation as a dynamic capability, with researchers exploring how organizations develop and deploy digital resources for competitive advantage (Lichtenthaler, 2019). The pandemic period (2020-2022) accelerated research into digital resilience and adaptation, with studies examining how firms leverage digital transformation for crisis management and operational continuity (Chi et al., 2022; Wu et al., 2023). Recent publications (2023-2024) demonstrate growing sophistication in understanding digital transformation as a comprehensive organizational phenomenon, investigating the integration of artificial intelligence, sustainability initiatives, and organizational learning capabilities (Heubeck, 2023).

Geographical Distribution

The geographical distribution of publications provides valuable insights into how different regions approach digital transformation research and reflects diverse economic development stages, institutional frameworks, and technological readiness across global contexts. The regional analysis reveals distinct research patterns shaped by economic structures, institutional environments, and digital maturity levels. Asian research centers on manufacturing digitalization and emerging market dynamics, reflecting the region's role as a global manufacturing hub and rapidly developing digital economy (Chi et al., 2022; Mai et al., 2024). Chinese studies explore government-led digital transformation initiatives and platform enterprises, consistent with the country's state-directed development model and digital economy leadership. Indian research focuses on banking sector transformation and knowledge management, reflecting the country's service economy strengths and IT capabilities (Sahadevan & Mary, 2025). European contributions focus on industrial applications and sustainability integration, consistent with the region's manufacturing heritage and environmental priorities (Chwiłkowska-Kubala et al., 2023). German studies prominently feature Industry 4.0 and manufacturing transformation, while UK research emphasizes digital leadership and financial services adaptation. North American research demonstrates a strong emphasis on foundational theories and strategic frameworks, reflecting the region's leadership in technology development and management research (Schumm et al., 2022). This regional diversity provides comprehensive insights into how different institutional contexts, economic structures, and cultural factors influence digital transformation strategies and outcomes, contributing to a more nuanced understanding of digital transformation as a resource-based phenomenon across various global contexts.

RQ 1: What are the critical concepts from Resource-Based Theory that must be addressed to comprehensively analyze digital transformation as a resource-based phenomenon?

To establish the critical concepts from Resource-Based Theory for analyzing digital transformation, this study first examined the current state of digital transformation research to understand its complexity and theoretical foundations. The systematic review of digital transformation literature reveals significant diversity in how researchers approach and conceptualize this phenomenon, as demonstrated in Table 2 which maps all digital transformation aspects covered in current research. This mapping demonstrates differences across four key dimensions: (1) utilization of theoretical lenses to analyze the phenomenon, with dynamic capabilities theory being considered as an extension of resource-based theory; (2) perspectives on digital transformation; (3) type of digital transformation, which can be operational or strategic (Yu

et al., 2022); and (4) the form of benefit or impact of digital transformation. This diversity confirms that digital transformation research lacks consensus in several aspects (Warner & Wäger, 2019), necessitating a robust theoretical framework for comprehensive analysis.

Table 2. Digital Transformation Research Aspects Mapping

Research Aspect	Categories/Types	Key Characteristics	Examples/References
Theoretical Lens to CA	Resource-Based Theory (RBV)	Focus on digital resources and capabilities	Penrose (1959), Barney (1991, 2003), Giustiziero et al. (2023)
	Knowledge-Based View (KBV)	Knowledge as a strategic resource	Li et al. (2022)
	Dynamic Capabilities	Extension of RBT, emphasis on adaptation	Ghosh et al. (2022), Warner and Wäger (2019), Wang et al. (2022), Pavlou and Sawy (2006)
Perspectives	Process Perspective	Sequential phases of transformation	Wang et al. (2022)
	Capabilities Perspective	DT facilitates the process of change & innovation in business model, customer system & organization patterns facilitated by digital technologies	Verhoef et al. (2021)
Type Focus Digital Technologies	Operational	Application of digital technologies in the process & system to improve operational excellence	Yu et al. (2022)
	Strategic	Wider change in creating value, change in process, system, business model, organization culture	
	Technology Centric	Focus on digital technologies implementation	Hanna (2016), Hess et al. (2016)
	Actor-Centric	Human-centered approach	Goodwin (2018)
	Mobile Technology	Enhanced connectivity and communication	Zhu et al. (2021), Spil et al. (2017)
	Cloud Computing	Scalable computing resources	Oliver et al, 2020
	Big Data	Data analytics and insights	

Research Aspect	Categories/Types	Key Characteristics	Examples/References
	Social Media	Customer engagement platforms	
	IoT	Connected devices and sensors	Narwane et al. (2020)
	Machine Learning/AI	Intelligent automation	Lichtenthaler (2019), Mikalef et al. (2021); Wamba-Taguimdje et al. (2020), Li et al. (2022); Tandon et al. (2022)
	Blockchain	Secure distributed ledger	
Form of Benefit	Intermediate Impact	Customer satisfaction, improve efficiency, and productivity	Zhai et al. (2022), Piepponen et al. (2022)
	Final Impact	Reduction cost, increase revenue	Peng and Tao (2022)
Firm Performance	Financial	ROA, ROE, revenue metrics	Wang et al. (2022), Yasmin et al. (2020)
	Operational	Process efficiency, productivity	
	Market	Market share, competitive position	
	Organizational	Innovation, learning capabilities	
Behavior Science Related	Theory of Resistance Behavior	Employee resistance to change	Li et al. (2022)
	Theory of Perceived Risk	Risk perception in technology adoption	Pillai et al. (2022), Belanche et al (2022)
	Theory of Motivation	Motivation factors for adoption	Hattie et al. (2020)
	Theory of Innovation Resistance	Resistance to innovation adoption	Anshu et al. (2022)
	Theory of Expectancy	Performance expectation	Nikulina et al. (2022)
	Theory of Behavioral Reasoning	Behavioral decision-making	Sahu et al. (2020), Westaby (2005), Yadav et al. (2022), Perera et al. (2021)
Factors	Internal Factors	Organizational capabilities, resources	Digital Resources, Organizational Aspect
	External Factors	Environmental influences	Environment, Chen et al. (2022)
Unit of	Firm Level	Organization-level	Niu et al. (2023), Zhang et al.

Research Aspect	Categories/Types	Key Characteristics	Examples/References
Analysis		transformation	(2022), Xu et al. (2022)
	Individual Level	Employee-level digital capabilities	Denicolai and Previtali (2023), Blanka et al. (2022), Chatterjee et al. (2022), Sedziuviene et al. (2023)

The foundational challenge in establishing theoretical concepts stems from definitional ambiguity, as digital transformation suffers from an unclear definition (Haffke et al., 2017). Table 3 demonstrates this variation in digital transformation definitions across major studies, revealing substantial conceptual differences among researchers. Despite these differences, the definitions converge on four common aspects: (a) digital transformation is considered as a form of response to environmental changes; (b) digital transformation is driven by the utilization of digital technologies; (c) digital transformation impacts value creation through modification of product, process, or business model; and (d) digital transformation is expected to support the development of superior performance. This convergence enables defining digital transformation as "a form of response to environmental dynamics by utilizing digital technologies to acquire new opportunities to create better firm performance," yet significant conceptual differences persist that require theoretical resolution.

Table 3. Example of Difference in Definition of Digital Transformation

No	Authors	Digital transformation definition
1	Verhoef et al. (2021)	*A change* in how a firm employs digital technologies to develop a new digital business model that helps to create and appropriate more value for the firm.
2	Bilgeri, Wortmann, and Fleisch (2017); Haffke et al., 2016; Hartl and Hess (2017); Heilig et al. (2017); Mueller and Renken (2017)	*A major organizational change* driven by, built on, or enabled by digital technology, altering how business is conducted.
3	Vial (2019)	*A process* that aims to improve an entity by triggering significant changes to its properties through a combination of information, computing, communication, and connecting technologies. Process where an organization responds to changes in its environment by using digital technologies to alter its value creation process.
4	Zhu et al. (2021)	*A process* through which an organization responds to environmental changes by using digital technologies such as mobile computing, artificial intelligence, cloud computing, and Internet of Things to change its value creation process.
5	Hanelt et al. (2021)	*Organization change* that is triggered and shaped by the widespread diffusion of digital technologies.
6	Piepponen et al. (2022)	*A means of utilizing digital technologies* to modify value creation. In this research focus is on how digital transformation can transform business models, especially in value proposition development as the core.

No	Authors	Digital transformation definition
7	Kraus et al. (2021); Hermes et al. (2020)	*A process of systematic change* that leverages digital solutions to renew systems, capabilities, and culture within an organization.
8	Ritala et al. (2021); Ghosh et al. (2020); Setia et al. (2013); Bharadwaj et al. (2013); Wessel et al. (2021)	Interchangeable with the term digitalization, which is defined as *leveraging digital technologies* that place new demands and provide new opportunities for organizations and their employees.
9	Osmundsen (2020)	*Leveraging and integrating new digital technologies* in business processes to enable major business improvements.
10	Libert et al. (2016)	*Changes* built in the foundation of digital technologies, ushering in unique changes in business operations, business process and value creation.

These definitional differences manifest in two primary perspectives that fundamentally shape how researchers analyze digital transformation. The process perspective, exemplified by Verhoef et al. (2021), Vial (2019), and Truant et al. (2021), conceptualizes digital transformation through sequential phases from digitization to business model transformation, while the capability perspective, supported by Bharadwaj (2000), Ghosh et al. (2022), and Wessel et al. (2021), views digital transformation as organizational capability to leverage digital technologies for acquiring new opportunities. These perspectives translate into specific capabilities developed by various digital technologies: cloud computing and big data enhance decision-making capabilities (Awan et al., 2021; Chen et al., 2022; Ghasemaghaei, 2021; Mikalef et al., 2019; Wamba et al., 2017; Yasmin et al., 2020), digital platforms and blockchain enable collaboration and resource sharing (Ahmed et al., 2022; Deng et al., 2022), and mobile technologies with IoT facilitate direct communication and information sharing (Liu et al., 2022). Both perspectives demonstrate that digital transformation alters value creation mechanisms and modifies firm internal resources and capabilities, establishing its theoretical foundation as a resource-based phenomenon.

The theoretical complexity extends to measurement and impact assessment challenges. Current research reveals two common measurement approaches: archival data analysis utilizing text analysis with digital transformation keywords (Chen et al., 2022; Heredia et al., 2022; Peng & Tao, 2022; Wang et al., 2022; Zeng et al., 2022; Zhang et al., 2022) and survey-based assessments using questionnaires on implementation features (AlMulhim, 2021; Ferreira et al., 2019; Kristoffersen et al., 2021; Li et al., 2022; Mikalef et al., 2019; Yasmin et al., 2020). Performance measurement also varies between financial indicators (ROA, ROE) and broader organizational metrics, requiring distinction between intermediate impacts (customer satisfaction, productivity, efficiency) and final impacts (cost reduction, revenue increase) as suggested by Peng and Tao (2022) and Du and Jiang (2022). These measurement challenges highlight the critical importance of having clear theoretical concepts to guide both research design and practical implementation.

Based on this comprehensive analysis, three critical concepts from Resource-Based Theory emerge as essential for analyzing digital transformation as a resource-based phenomenon: (1) Environment Context - systematic understanding of environmental factors including opportunities, threats, and competitive dynamics that determine resource value and VRIN criteria parameters; (2) Key Resources - comprehensive identification of digital assets (both tangible and intangible) and capabilities that meet VRIN criteria within specific environmental contexts; and (3) Resource Orchestration - strategic utilization and management of digital resources through both content (resource configuration and sequence as suggested by Sirmon et al., 2011) and mechanism (dynamic processes through productive dialogue as proposed by Salvato & Vassolo, 2018) to create

sustained competitive advantage. These three interconnected concepts provide the theoretical perimeter necessary for comprehensive analysis, ensuring that digital transformation research addresses the fundamental progression from environmental understanding through resource identification to strategic resource deployment.

RQ 2: Which areas of the Resource-Based Theory framework have been adequately covered, and which remain underdeveloped in current digital transformation research?

To assess the comprehensiveness of digital transformation research coverage against the Resource-Based Theory framework, this study conducted a systematic analysis through keyword mapping, content evaluation, and gap identification across 46 selected articles. The analysis employs multiple visualization techniques and comparative frameworks to systematically evaluate which RBT domains have received adequate scholarly attention and which remain critically underdeveloped in current literature.

a. Keywords Analysis and Research Domain Mapping

The network visualization analysis in Figure 3 identifies four key clusters in digital transformation research. The blue cluster focuses on data analytics and information systems, including "big data analytics," "data analytics," "information systems," and "business value," highlighting the emphasis on data-driven capabilities (Zhou et al., 2022; Li et al., 2022). The red cluster centers on digital transformation processes and innovation, with terms like "digital transformation," "innovation," "sustainability," and "blockchain technology" (Chi et al., 2022; Ghosh et al., 2022). The green cluster reflects the growing interest in machine learning and artificial intelligence, featuring "machine learning," "artificial intelligence," and "predictive models" (Lichtenthaler, 2019; Heubeck, 2023). The yellow cluster represents firm performance and competitive outcomes, highlighting the consistent focus on measuring transformation effectiveness. However, there are no strong connections to resource orchestration concepts, indicating that while resource identification and environmental contexts are well-covered, the critical domain of resource orchestration remains underdeveloped.

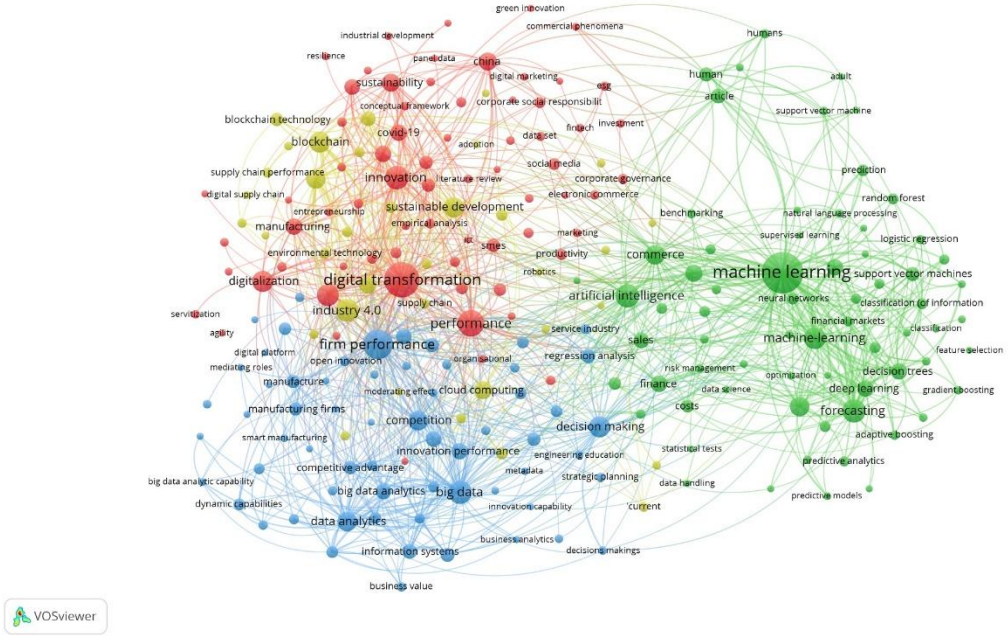


Figure 3. Networks and research domains identified on Digital Transformation

The density visualization in Figure 4 further reveals areas of high and low research intensity within digital transformation. High-density areas focus on key resource identification, such as big data analytics (Zhou et al., 2022; Li et al., 2022), artificial intelligence (Lichtenthaler, 2019), and innovation capabilities (Ghosh et al., 2022; Wessel et al., 2021), corresponding to the "key resources" component of the RBT framework. Conversely, low-density areas highlight the lack of research on resource orchestration and dynamic alignment mechanisms between environmental context and resource deployment.

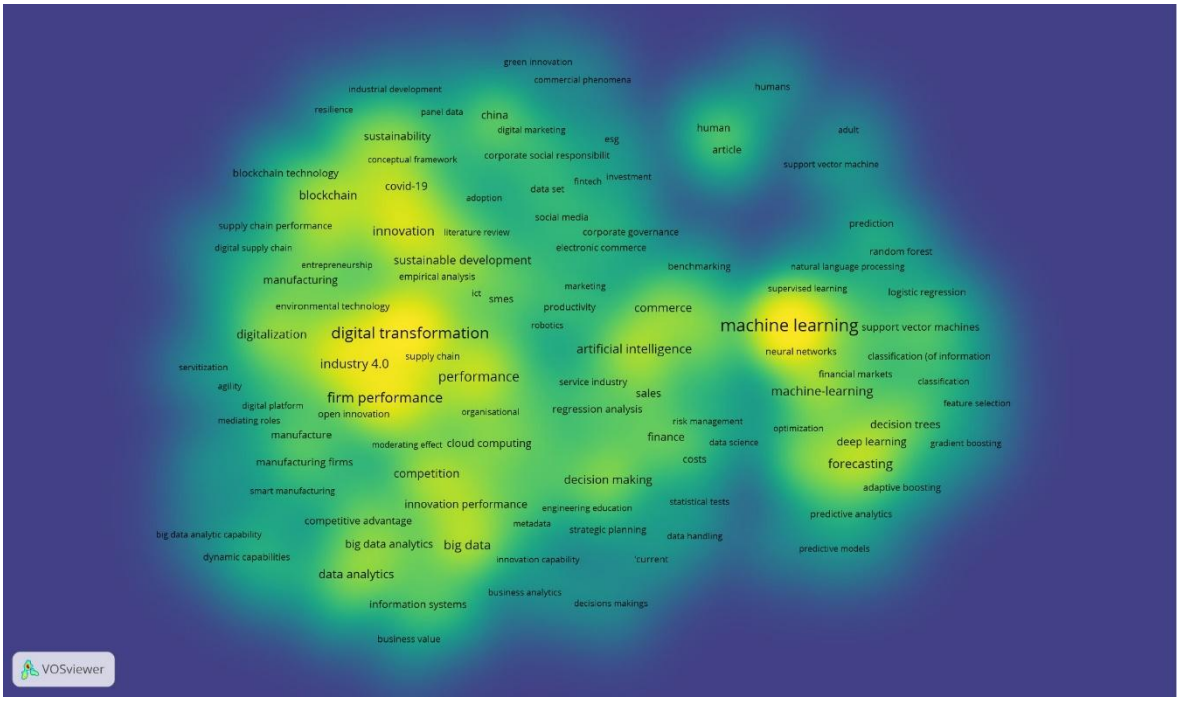


Figure 4. Density visualization.

The temporal analysis in Figure 5 shows an increasing focus on green innovation and blockchain technology, reflecting advancements in digital resource identification (Mai et al., 2024; Nayal et al., 2022). However, while foundational RBT concepts received attention earlier, resource orchestration mechanisms have only been partially addressed, underscoring the need for further theoretical development.

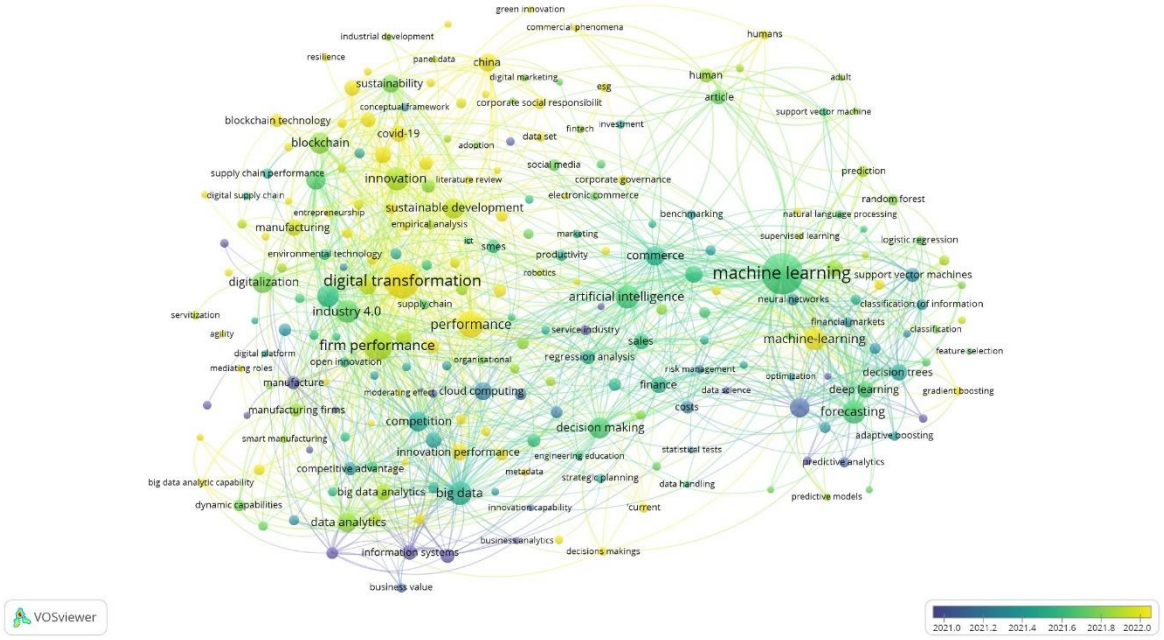


Figure 5. Visualization of the research year

A systematic keyword refinement process followed procedures similar to open, axial, and selective coding by Glasser (1992). Starting with 230 keywords, the grouping process reduced them to 117, and after increasing the occurrence criteria to a minimum of 20, 58 keywords remained. Figure 6 illustrates this reduction process. The most significant occurrence keywords—including firm performance, machine learning, big data analytics, and innovation—align with cluster patterns identified in the network analysis (Figure 3), confirming that key resources identification dominates current research while resource orchestration remains underdeveloped.

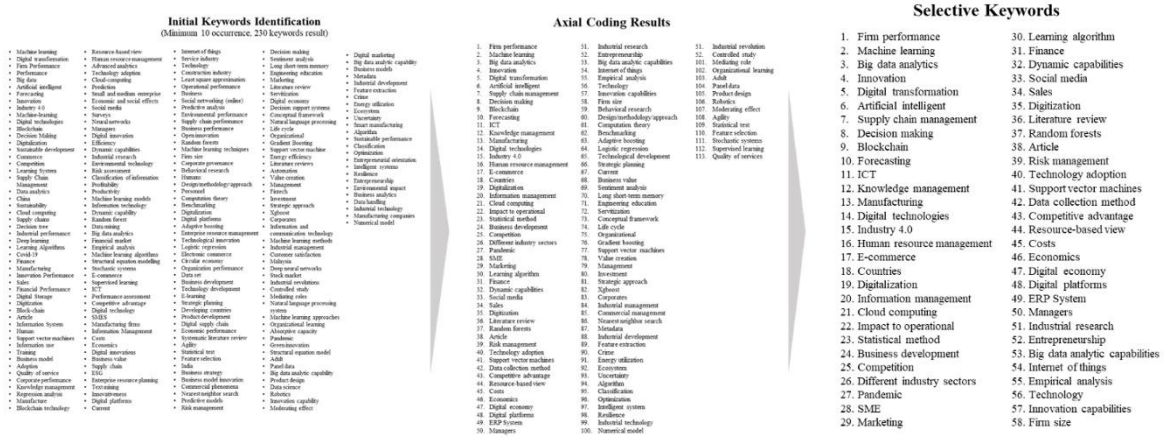


Figure 6. Keywords reduction analysis

b. Comparison Analysis to Map Research Coverage

The systematic mapping of identified keywords against Resource-Based Theory key concepts, presented in Table 4, reveals that extensive research has discussed resources in both asset and capabilities categories, predominantly analyzing effects or relationships between these resources and firm performance through mediating capabilities, such as blockchain and digital

platforms affecting resource sharing and innovation capabilities (Li et al., 2022; Ahmed et al., 2022; Deng et al., 2022).

Table 4. Keywords mapping in the Resource-based theory key-concepts.

Environmental Context	**Key Resources Identification**	**Resources Orchestration**	**Firm Performance**
Countries (55) Different Industry Sectors (77) Manufacturing (131) SME (62) E-Commerce (105) Competition (77) Pandemic (64) Digital economy (31) Firm size	**Asset** Big Data Analytics (303) Machine Learning (509) Artificial Intelligence (223) Blockchain (168) ICT (136) Digital Technologies (128) Cloud Computing (91) Social media (49) Digital platforms (29) ERP System (28) Internet of things (22)		Financial performance (541) Impact to Operation (91) Competitive advantage (35)
	Capabilities Innovation (248) Digital transformation (238) Supply Chain Management (182) Decision Making (170) Forecasting (167) Knowledge Management (132) Industry 4.0 (in the sense of utilization of digital technologies to transform processes) Human resources management (118) Digitalization (104) Information management (96) Business Development (88) Marketing (56) Finance (52) Dynamic Capabilities (49) Sales (49) Digitization (46) Risk management (39) Technology adoption (39) Entrepreneurship (24) Big data analytic capability (22) Innovation capability (20)		

The mapping indicates comprehensive coverage of environmental context and key resource domains, as evidenced by substantial keyword occurrences across geographical, sectoral, and contextual categories (Table 7). However, while understanding environmental context is important

for identifying key resources that fulfill the VRIN criterion, "the environmental context did not derive the identification of key resources criterion," and most critically, none of the research has covered the resources orchestration area despite its importance for superior firm performance (Hansen et al., 2020). Resource orchestration encompasses content (resource configuration and sequence as suggested by Sirmon et al., 2011) and mechanism (processes such as productive dialogue as proposed by Salvato & Vassolo, 2018), representing a fundamental gap because analyzing resource-based phenomena should progress systematically from understanding environmental context through resource identification to explaining how key resources are orchestrated to create superior firm performance.

c. Analysis to Develop Digital Transformation Ontology in Resource-based Theory Perspective

The analysis of digital transformation research reveals a significant gap in addressing resource orchestration concepts. While studies extensively cover key resources and environmental context, none of the 42 reviewed studies examined how these resources should be orchestrated. This gap highlights the critical need for a more comprehensive understanding of how digital resources should be strategically managed to achieve superior performance. Despite a focus on the identification of digital resources and capabilities, the process of aligning these resources with the environmental context to drive better performance remains largely unexplored.

This gap becomes more apparent when analyzing the capabilities created by digital technologies. As shown in Figure 7, digital technologies enable three main capabilities: (1) increased connectivity (faster data transfer and larger data sizes); (2) increased data processing or analytics (handling larger data sets with faster processing); and (3) increased resource sharing (broader access to platforms and data). These capabilities drive innovation in products, processes, and business models, with enhanced data processing providing actionable insights for identifying new opportunities, while improved connectivity and resource sharing foster more effective innovation. However, the concept that “the capability to orchestrate those resources aligned with the environmental context leads to better performance” remains largely unexplored, emphasizing the missing link between resource identification and performance outcomes. This underscores the need for further theoretical development in resource orchestration to bridge the gap in digital transformation research.

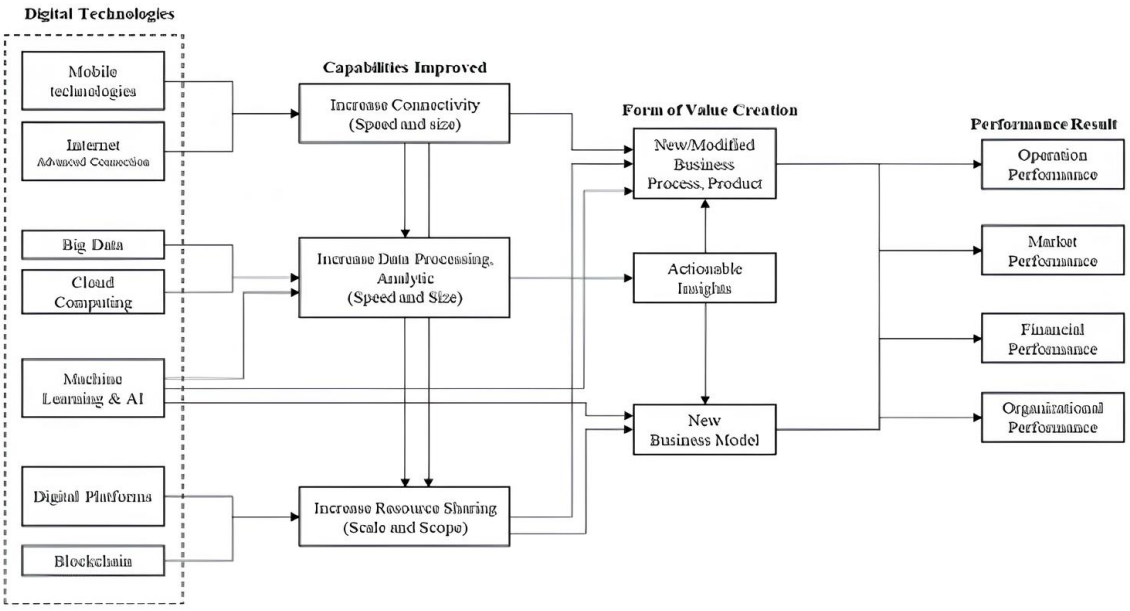


Figure 7. Capabilities development mapping was synthesized from a volume of articles.

To address this gap, it is crucial to understand how digital technologies have fundamentally reshaped the business environment, creating new contexts that require systematic resource orchestration approaches. Digital technologies have altered the opportunities and competition landscapes, as well as customer expectations, establishing a digital economy context where resources must be strategically orchestrated for competitive advantage. Figure 8 illustrates this digital transformation ontology within a resource-based theory framework, showing how digital transformation involves modifying internal resources to align with new environmental contexts. The digital economy determines the VRIN criteria for digital resources, which include digital assets, agility capability, networking capability, and big data analytic capability, as outlined by Verhoef et al. (2021).

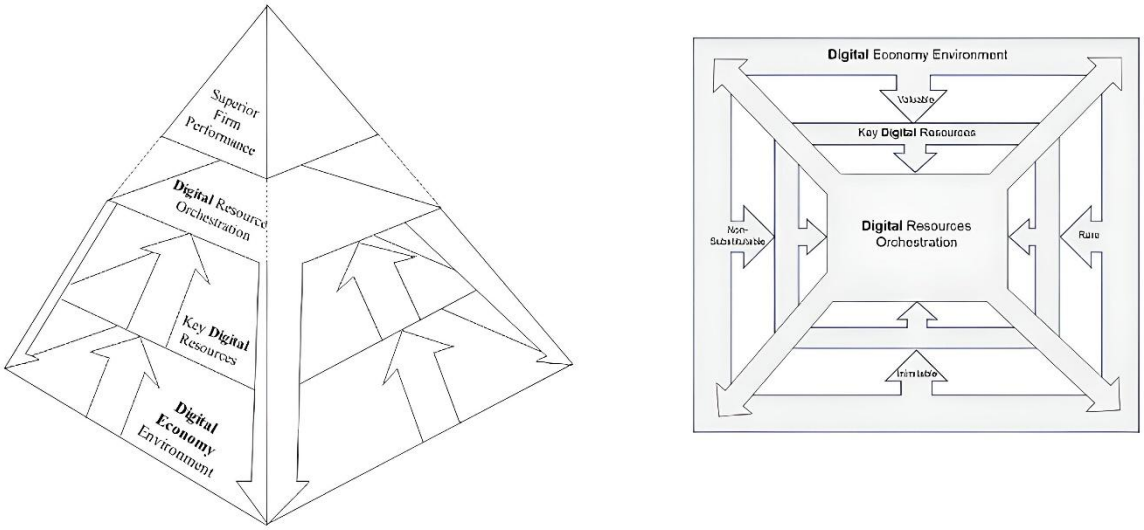


Figure 8. Digital transformation in resource-based theory perspective illustration

Expanding on this conceptual framework, Figure 9 provides a detailed operational structure of the digital transformation ontology, illustrating the mechanisms through which digital resources must be orchestrated to foster innovation and create competitive advantage. This framework underscores that while firms may have similar digital technologies or capabilities, "the utilization or orchestration of digital resources will define firm performance," confirming that resource orchestration is the critical underdeveloped area requiring further theoretical exploration. The analysis highlights that digital transformation research must cover all key resource-based theory concepts to achieve a comprehensive understanding, with resource orchestration being the most urgent priority for bridging theoretical and practical gaps.

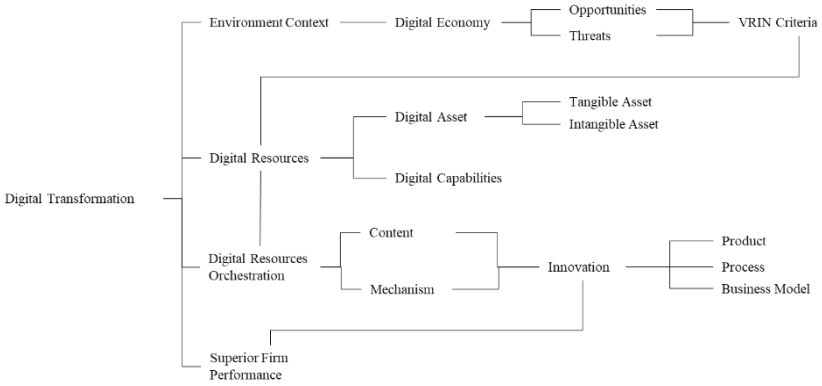


Figure 9. Illustration of digital transformation ontology from the perspective of resource-based theory

RQ 3: How can digital resources be orchestrated to align with environmental context and create superior firm performance in digital transformation initiatives?

Digital resources orchestration represents the core concept in the resource-based phenomenon, focusing on the strategic utilization of digital resources to create value through two critical domains: content and mechanism. The content of digital resources orchestration involves aligning the environmental context (which determines resource significance based on opportunities and threats), digital resources, and the specific agenda of digital transformation stages—ensuring that the right digital resources are used at the right time. Figure 10 illustrates this digital orchestration content framework, integrating digital transformation in the process perspective proposed by Verhoef et al. (2021). Each stage has a specific agenda: the digitization phase focuses on digital asset creation or acquisition, requiring tangible, intangible, or personal-based assets to convert analog assets to digital ones, with impact measured by capabilities developed (such as increasing operational visibility) rather than directly influencing financial performance.

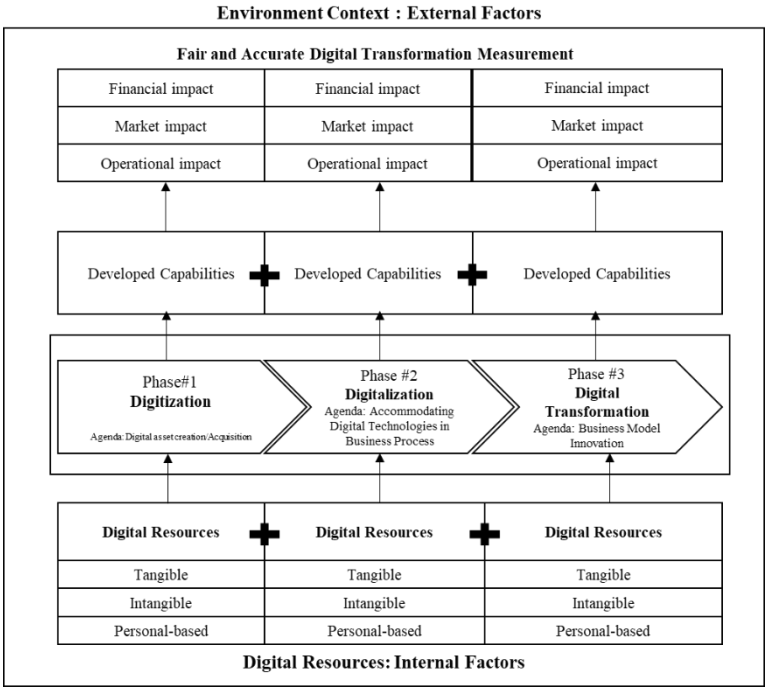


Figure 10. Digital resources orchestration content

The second stage, digitalization, aims to integrate digital technologies into business processes by exploiting digital capabilities, requiring digitalization agility capabilities (Verhoef et al., 2021) to enable adoption of new processes. The third stage, digital transformation, focuses on business model innovation where digital technologies create new value, requiring digital platforms and networking capabilities (Verhoef et al., 2021) to facilitate resource sharing and co-creation with multiple stakeholders—the alignment between environmental context, specific digital resources, and transformation agenda constitutes the content of digital resources orchestration. The mechanism domain addresses the dynamic nature of this orchestration, recognizing that environmental changes may alter opportunities, threats, and criteria for digital resources, thus requiring dynamic calibration derived from the dynamic capabilities concept, where organizations must sense environmental changes and restructure resources accordingly. Salvato and Vassolo (2018) suggest that the source of this dynamism comes from productive dialogue across multiple organizational layers, requiring involvement from top management, leadership (such as Chief Digital Officers), and all employees. Figure 11 illustrates this mechanism framework, integrating dynamic managerial capabilities across personal, interpersonal, and organizational levels, emphasizing a safe environment where employees can contribute ideas and concerns to enable dynamic adjustments in resource utilization for better firm performance.

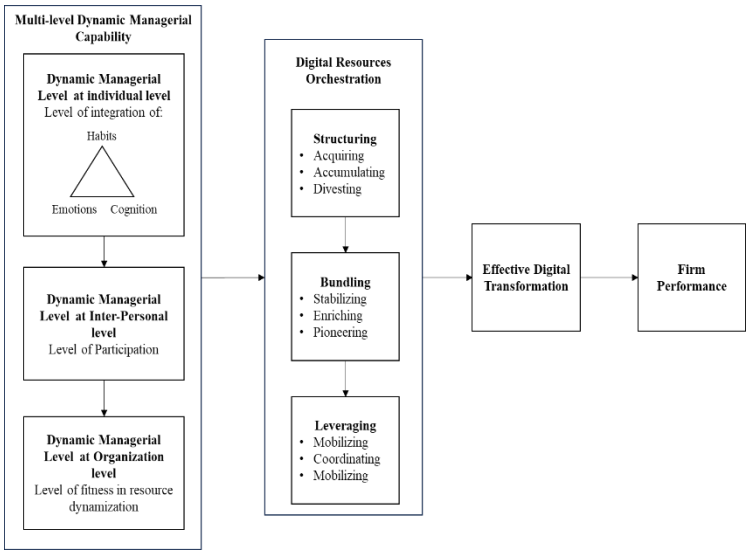


Figure 11. Digital resources orchestration mechanism framework

Translating this framework into practice, organizational leaders can operationalize digital resources orchestration through several actionable mechanisms. At the strategic level, executives and Chief Digital Officers should establish governance structures that systematically evaluate digital resource portfolios against environmental demands, ensuring investment decisions align with specific transformation stage agendas—whether digitization, digitalization, or business model innovation (Verhoef et al., 2021). Managers at the operational level should implement iterative review cycles that assess alignment between deployed digital resources and expected outcomes, distinguishing intermediate impacts such as capability development and process efficiency from final impacts, including financial performance and competitive positioning (Peng & Tao, 2022; Du & Jiang, 2022). Creating psychological safety environments where employees across organizational layers can voice concerns and propose resource reconfigurations without judgment becomes essential for activating the productive dialogue mechanism (Salvato & Vassolo, 2018). For policymakers, particularly in emerging economies facing unique digital infrastructure and regulatory challenges, the framework suggests prioritizing ecosystem-level interventions that

enhance digital resource accessibility and facilitate capability development across industry sectors. These practical applications demonstrate that the digital resources orchestration framework provides not only theoretical coherence but also structured guidance for improving transformation success rates in diverse organizational contexts.

CONCLUSIONS

This systematic ontological analysis of digital transformation through the Resource-Based Theory (RBT) lens highlights critical insights into the gaps contributing to the high failure rates of digital transformation initiatives. The study identifies three essential RBT concepts for comprehensive analysis: (1) Environment Context, which systematically evaluates environmental factors determining resource value and VRIN criteria; (2) Key Resources, which focuses on identifying digital assets and capabilities meeting VRIN criteria; and (3) Resource Orchestration, which refers to the strategic utilization and management of digital resources across content and mechanism domains. The assessment reveals significant imbalances, with substantial scholarly attention on environment context and key resources, while resource orchestration remains underdeveloped. A review of 42 empirical studies confirms none addressed resource orchestration concepts, representing a critical gap explaining why many initiatives fail despite significant investments in digital technologies.

To address this gap, the study proposes a Digital Resources Orchestration framework that includes content (aligning environmental context, digital resources, and transformation agendas) and mechanisms (dynamic calibration through multilevel organizational dialogue). This framework provides practical guidance for orchestrating digital resources according to transformation stages and environmental dynamics, potentially improving implementation success rates. Three key takeaways emerge: (1) acquiring digital technologies alone is insufficient—resource orchestration determines competitive outcomes; (2) managers must align resource deployment with transformation stage agendas; and (3) organizations should establish multilevel dialogue mechanisms to create adaptive capacity. The study contributes to digital transformation ontology from an RBT perspective and offers actionable frameworks for resource orchestration. Limitations include a focus on Scopus-indexed publications and the conceptual nature of the framework, with future research needed to empirically validate the proposed framework and examine how orchestration mechanisms differ across transformation phases.

LIMITATIONS AND FURTHER RESEARCH

This study has several limitations that warrant acknowledgment. First, the systematic review relied exclusively on Scopus-indexed publications, potentially excluding relevant studies from other databases such as Web of Science or Google Scholar. This scope restriction may have omitted valuable insights from non-indexed journals or conference proceedings that address digital resource orchestration in different contexts. Second, the proposed Digital Resources Orchestration framework remains conceptual. While the framework integrates Resource-Based Theory with Dynamic Capabilities Theory and provides structured guidance for resource orchestration across transformation phases, it has not been empirically tested. The relationships between multi-level dynamic managerial capabilities, orchestration processes (structuring, bundling, leveraging), and firm performance outcomes require validation through quantitative or qualitative empirical studies. Third, the review period (2012-2024) captured the evolution of digital transformation research but may not fully reflect the most recent developments in emerging technologies such as generative artificial intelligence, which are rapidly reshaping organizational capabilities and resource requirements.

Building on these limitations, several directions for further research emerge. Future studies should empirically validate the Digital Resources Orchestration framework across different industry sectors and organizational sizes, examining whether the orchestration mechanisms differ between manufacturing, service, and knowledge-intensive industries. Longitudinal research designs would be particularly valuable for understanding how resource orchestration evolves as organizations progress through digitization, digitalization, and digital transformation stages. Additionally, comparative studies across developed and emerging economies could reveal how institutional contexts and digital infrastructure maturity influence orchestration effectiveness. Finally, researchers should investigate the specific managerial practices and organizational routines that enable productive dialogue across organizational layers, operationalizing the mechanism component of the proposed framework.

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