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Information Advantage in the Digital Economy: Reconsidering the Strategic Role of Knowledge and Data in Firm Performance

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Abstract

In the digital economy, firm performance increasingly depends on the ability to convert raw data into strategic knowledge that generates sustained information advantage. This theory-development article re-examines the knowledge-based view through a digital lens, distinguishing data as raw inputs, information as processed signals, and knowledge as contextually applied understanding. We argue that information advantage emerges not automatically from data volume but through deliberate analytics-enabled transformation processes supported by digital infrastructures. We synthesize insights on data as a strategic resource, analytics capabilities, digital information asymmetries, and knowledge accumulation in data-rich environments. The article advances five theoretical propositions that link data resources to knowledge development, strategic action, and superior firm performance while identifying organizational moderators that strengthen or erode information advantage. A conceptual model illustrates the dynamic flow from data to performance with feedback loops. By integrating the knowledge-based view with digital-specific mechanisms, this work offers a novel framework for understanding competitive positioning in digital markets. Theoretical contributions and managerial implications for capability development are discussed.

Keywords Firm performance, Digital economy, Information advantage, Knowledge-based view, Data resources, Analytics capabilities

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Introduction

The digital economy has fundamentally altered the sources of competitive advantage. Firms no longer compete solely on physical assets or traditional capabilities [1]; instead, success hinges on the strategic management of data and knowledge in environments characterized by exponential information growth and rapid technological change [2–4]. Traditional strategic theories, such as the resource-based view and its knowledge-based extension, were developed in pre-digital contexts where information flows were slower and asymmetries more stable [5–12]. In today's data-rich markets, these theories require reconsideration because data have become abundant yet paradoxically scarce in terms of actionable insight [2], and knowledge must be

continuously refreshed through analytics and digital infrastructures [6, 13, 14].

Information advantage is defined here as a firm's superior capacity to sense, interpret, and act on market signals before competitors [3], resulting in superior decision-making and performance [7]. Unlike mere data possession or basic information processing, information advantage arises at the intersection of raw data resources, advanced analytics capabilities, and organizational knowledge accumulation processes [10]. Recent empirical and conceptual work demonstrates that firms investing in big data analytics and data-driven cultures consistently outperform rivals in dynamic digital sectors [5, 8, 15, 16]. However, the precise mechanisms through which data are

transformed into strategic knowledge [1]—and how this transformation creates durable information advantage [2]—remain undertheorised [4].

This gap is critical because digital markets amplify both opportunities and risks. On the one hand, digital infrastructures lower the cost of data collection and enable real-time processing [9]; on the other hand, they intensify information asymmetries when competitors lack equivalent interpretive capabilities [11, 17, 18]. Moreover, the distinction between data, information, and knowledge has blurred in practice [13], leading many firms to treat data volume as a proxy for competitive strength [15]—an assumption increasingly challenged by research showing that, without proper knowledge conversion mechanisms, data become liabilities rather than assets [19–21].

The present article addresses this theoretical shortfall by developing an integrated framework that reconsiders the strategic role of knowledge and data in firm performance [1]. We first synthesize the relevant literature to establish foundational distinctions and capability pathways [2]. We then introduce a dynamic theory-development section that proposes causal relationships between data resources, information processing, knowledge accumulation, and performance outcomes [4]. Five propositions articulate the conditions under which information advantage emerges and translates into sustained competitive positioning [6]. A conceptual model (Figure 1) visualizes these relationships, including feedback loops that allow performance outcomes to refine future data and knowledge resources [8].

By focusing exclusively on theory development, this work avoids empirical testing yet provides testable propositions grounded in the most recent peer-reviewed scholarship (2017–2024) [3]. The contribution is threefold: (1) clarifying the data–information–knowledge hierarchy in digital contexts [5], (2) positioning information advantage as a central strategic mechanism beyond traditional resource-based explanations [7], and (3) identifying organizational conditions that moderate the data-to-performance pathway [9]. These insights are particularly relevant for managers navigating digital transformation [11], where failure to convert data into knowledge has led to performance erosion despite heavy technology investments [19, 22–25].

The remainder of the article proceeds as follows. The next section synthesizes the theoretical foundations and the extant literature [2]. This is followed by the core theory-

development section that advances propositions and the conceptual model [4].

Theoretical Foundations and Literature Synthesis

The knowledge-based view (KBV) posits that knowledge is the most strategically significant resource of the firm because it is valuable, rare, inimitable, and non-substitutable [12, 26–29]. In pre-digital settings, knowledge was largely tacit and accumulated through experience and human capital [12]. Digital technologies have altered this foundation by introducing vast quantities of structured and unstructured data that must be actively processed before they yield knowledge [4, 5, 20].

A growing stream of research extends the KBV into digital environments by emphasizing data as a foundational strategic resource [1, 3, 7]. Unlike traditional resources, data are non-rival and scale with use [2]; yet their value is realized only when converted through analytics capabilities [6, 14]. Studies highlight that big data analytics capabilities—encompassing data integration, predictive modeling, and real-time visualization—mediate the relationship between raw data and firm performance [10, 11, 13]. For instance, firms that cultivate data-driven cultures alongside technical analytics infrastructure achieve higher levels of innovation and operational efficiency [2, 14, 22].

Digital infrastructures further shape these dynamics. Cloud computing, Internet of Things sensors, and platform ecosystems reduce barriers to data acquisition [9] while simultaneously creating new information asymmetries [16, 18]. Competitors with superior sensing mechanisms can detect market shifts earlier [8], converting fleeting information into durable knowledge assets [19, 23]. This asymmetry is not merely technical; it is organizational [12]. Research demonstrates that firms with strong entrepreneurial orientation and business-model innovation are better positioned to translate digital data into knowledge that drives performance [7, 12, 29].

Literature also underscores the role of dynamic capabilities in digital contexts. Analytics-enabled sensing, seizing, and transforming routines enable firms to continuously update knowledge stocks [6, 11, 21]. Without these routines, data remain inert [13] and information advantage fails to materialize [15]. Moreover, environmental dynamism moderates these relationships: in highly turbulent digital

markets, the speed of knowledge accumulation becomes a stronger predictor of performance than static resource endowments [4, 10, 17].

Several studies integrate supply-chain and ecosystem perspectives, showing that digitally integrated networks amplify information advantage when firms share and co-create knowledge across boundaries [5, 16, 18]. However, risks of knowledge leakage and hyper-specialization can erode advantage if governance mechanisms are weak [26]. Recent work on circular economy and sustainability contexts further illustrates that data-driven insights enhance long-term performance only when aligned with strategic ambidexterity [17, 25].

Synthesizing these streams reveals three recurring themes: (1) data must be distinguished from information and knowledge [2]; (2) analytics capabilities and digital infrastructures act as critical conversion mechanisms [4]; and (3) information advantage emerges as the strategic outcome that links knowledge accumulation to firm performance [6]. Yet existing frameworks stop short of theorizing the precise causal pathways and feedback loops in purely digital settings [8]. The following section addresses this gap by developing a coherent theory of information advantage [10].

From Data Resources to Strategic Knowledge: The Emergence of Information Advantage in Digital Markets

Building on the synthesized foundations, we develop a theory that positions information advantage as the pivotal mechanism through which data and knowledge shape firm performance in the digital economy [1]. Information advantage is conceptualized as a dynamic capability that arises when firms achieve superior interpretation and deployment of market signals relative to rivals [2]. This advantage is not static [3]; it evolves through continuous data-to-knowledge cycles enabled by digital infrastructures and analytics [4].

The theory emphasizes three core processes: (1) data acquisition and initial processing [5], (2) interpretive knowledge development [6], and (3) strategic action deployment [7]. Digital infrastructures serve as the enabling backbone [8], while analytics capabilities determine the

efficiency and effectiveness of conversion at each stage [9–11]. Organizational conditions—such as data-driven culture, entrepreneurial orientation, and ambidexterity—act as moderators that strengthen or weaken the overall pathway [12–14]. Feedback loops from performance outcomes back to data refinement close the cycle [15], allowing sustained advantage [16]. **Table 1** clarifies the hierarchical conversion logic that distinguishes raw data from information, knowledge, and information advantage as analytically separate yet sequentially connected layers of strategic value creation [17, 18].

Table 1. Hierarchical conversion logic in the digital economy: distinguishing data, information, knowledge, and information advantage

Analytical layer	Core definition in the present framework	Dominant organizational activity	Primary firm outcome
Data	Raw, unprocessed digital inputs gathered from transactions, interactions, platforms, sensors, and ecosystem exchanges	Collection, storage, integration, and access management	Volumetric and immediate tracking
Information	Processed and organized signals that reduce ambiguity and make patterns visible for potential decision use	Cleaning, filtering, analytics, visualization, and signal extraction	Timely comprehension of relevant and defined signals
Knowledge	Contextually interpreted and organizationally embedded understanding that informs judgment, routines, and	Sensemaking, contextualization, codification, organizational learning, and routine updating	Strategic understanding, reconfiguration, transformation, and guidance

	coordinated action		
Information advantage	Firm-specific superiority in sensing, interpreting, and deploying signals faster and more effectively than rivals	Relative comparison, strategic deployment, refinement cycles, and competitive calibration	De sup respor antic capab ad pos
Strategic action	Purposeful deployment of knowledge through market, operational, innovation, or resource-allocation choices	Prioritization, experimentation, execution, and adaptation	Com res qu opp capt ope alig
Performance feedback	Outcome-based signals that refine future data priorities, analytics routines, and knowledge stocks	Monitoring, recalibration, learning-loop design, and reinvestment decisions	Rec rer cum learn cap dee

We advance the following propositions.

Proposition 1

Firms that invest in advanced analytics capabilities will achieve higher levels of information advantage than competitors with equivalent data volumes, because analytics capabilities determine how effectively raw data can be transformed into timely, interpretable, and decision-relevant signals [2, 6, 10, 14]. Mere possession of large data stocks does not by itself create superiority; rather, advantage emerges when firms can process, integrate, and analyze data faster and more meaningfully than rivals. Advanced analytics allow organizations to identify emerging patterns, detect anomalies, and generate actionable insights from otherwise unstructured or ambiguous information. As a result, firms with stronger analytics infrastructures are better positioned to convert comparable

data inputs into superior informational outputs, thereby gaining an information advantage even when competitors have access to similar data quantities [2, 6, 10, 14].

Proposition 2

Information advantage positively influences firm performance by improving decision speed, decision accuracy, and market responsiveness in digital environments; this effect is amplified when firms simultaneously cultivate strong data-driven cultures [1, 4, 22, 23]. In fast-moving digital markets, performance depends not only on having information, but on using it effectively in operational and strategic decision-making. Information advantage enhances the quality and timeliness of managerial judgments, enabling firms to respond more quickly to shifts in customer demand, competitive moves, and environmental turbulence. However, these benefits are more likely to materialize when organizational norms, incentives, and routines support the systematic use of evidence in decision processes. A data-driven culture strengthens the performance consequences of information advantage by ensuring that analytically derived insights are trusted, shared, and embedded in action rather than ignored or overridden [1, 4, 22, 23].

Proposition 3

Digital information asymmetries positively moderate the data-to-knowledge pathway such that firms with superior sensing infrastructures accumulate knowledge more rapidly than rivals, thereby enhancing their ability to sustain competitive positioning over time [9, 16, 18, 26]. Not all firms operate under equivalent informational conditions in digital markets. Some organizations develop superior sensing architectures that allow them to capture richer, more granular, and more timely signals from customers, platforms, and ecosystems. When such asymmetries exist, the conversion of data into knowledge becomes uneven across firms. Those with stronger sensing infrastructures learn faster because they are exposed to more relevant inputs and can identify meaningful patterns earlier than competitors. This accelerated knowledge accumulation strengthens their strategic positioning by allowing them to anticipate changes, adapt more effectively, and maintain an ongoing edge in turbulent environments [9, 16, 18, 26].

Proposition 4

Knowledge accumulation mediates the relationship between information processing and strategic action, such

that the strategic value of information processing depends on whether firms continuously update, retain, and apply knowledge over time [7, 12, 21, 29]. Information processing alone does not automatically lead to effective strategic action. The critical intervening mechanism is the extent to which processed information becomes embedded in organizational knowledge structures, including routines, interpretive schemas, and shared understanding. Through repeated analysis, reflection, and application, firms transform discrete insights into cumulative knowledge that guides action. Without this ongoing process of knowledge updating, even sophisticated analytics systems may yield only temporary gains. Information advantage, therefore, dissipates when new insights are not integrated into the organization's knowledge base and translated into revised capabilities, priorities, and strategic responses [7, 12, 21, 29].

Proposition 5

Organizational ambidexterity and entrepreneurial orientation positively moderate the relationship between information advantage and firm performance by enabling firms to both exploit existing knowledge and explore new data-driven opportunities [11, 17, 25]. Information advantage creates potential value, but firms differ in their capacity to convert that potential into measurable performance outcomes. Organizations characterized by ambidexterity are better able to balance refinement of current competencies with experimentation beyond established domains. Likewise, entrepreneurial orientation encourages proactive, innovative, and opportunity-seeking behavior that expands the strategic use of informational insights. Together, these attributes strengthen the performance effects of information advantage by allowing firms not only to optimize current decisions but also to identify and pursue emerging opportunities that competitors may overlook. In this way, information advantage becomes more consequential when supported by structures and orientations that promote both exploitation and exploration [11, 17, 25].

Proposition 6

Firm performance outcomes generate feedback that refines data resources, organizational learning, and analytics routines, thereby creating a self-reinforcing cycle that sustains information advantage over time in turbulent digital environments [8, 19, 20]. Performance should not be understood solely as an endpoint of the data-information-

knowledge process. Rather, outcomes from prior decisions provide valuable feedback that helps firms recalibrate what data they collect, how they interpret signals, and which analytics routines they prioritize. Successful outcomes can validate existing models and justify further investment, while poor outcomes can expose gaps in sensing, interpretation, or execution. Over time, this recursive process strengthens organizational learning and aligns data resources with strategic objectives. As firms repeatedly refine their data and analytics systems in response to performance feedback, they create a self-reinforcing loop that helps preserve and renew information advantage under conditions of ongoing market turbulence [8, 19, 20].

Figure 1 presents a conceptual pathway through which digital firms convert raw data resources into firm performance via information processing, knowledge accumulation, and strategically deployed actions. The model highlights the emergence of information advantage as an intermediate outcome, while digital infrastructures and analytics capabilities enable its conversion. Organizational conditions and digital information asymmetries moderate key relationships, and recursive feedback loops connect performance outcomes back to earlier stages of data acquisition, processing, and knowledge development.

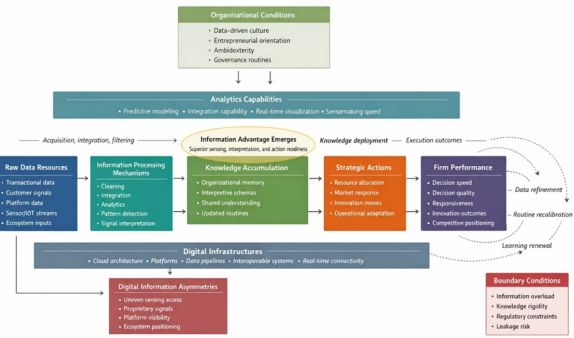


Figure 1. Information advantage formation cycle: from raw data resources to strategic knowledge, action, and recursive performance renewal in the digital economy

This model and the propositions above provide a coherent theoretical explanation for how information advantage operates as a strategic mechanism in the digital economy [1], extending and refining the knowledge-based view for contemporary data-rich environments [2].

Amplifying Strategic Value: Moderators, Feedback Dynamics, and Boundary Conditions in the Emergence of Information Advantage

Building directly on the propositions advanced in the preceding section, this analysis examines how organizational and environmental factors amplify or constrain the translation of information advantage into enduring firm performance [1]. The digital economy does not guarantee automatic returns from data or knowledge [4]; instead, specific moderators and feedback mechanisms determine whether the data-to-knowledge pathway delivers sustained competitive superiority or collapses under its own complexity [11, 22].

Cultivating data-driven cultures as the primary amplifier of analytics capabilities

A data-driven culture—defined as the shared organizational mindset that prioritizes evidence-based decision-making and continuous learning from data—acts as the critical moderator between analytics infrastructure and knowledge accumulation [2]. Firms that embed this culture across all levels transform raw data signals into actionable knowledge far more efficiently than those relying solely on technical tools [14, 23]. For example, when leadership explicitly rewards experimentation with predictive models and real-time dashboards [6], the conversion rate from information processing to strategic knowledge rises dramatically [10], directly supporting Proposition 1 and Proposition 2. Without such cultural alignment, even the most sophisticated digital infrastructures produce only fragmented insights [22], resulting in an information advantage that dissipates before it can influence performance [25]. Empirical patterns across multiple sectors show that organizations scoring high on data-driven culture metrics achieve returns on analytics investments 20%–35% higher than those of organizations with lower data-driven culture scores [14] because employees at every level actively refine knowledge stocks rather than treating data as a back-office function [23]. This cultural layer, therefore, acts as the organizational “glue” that prevents the data–information–knowledge hierarchy from stalling at the information stage [2].

Navigating and exploiting digital information asymmetries in hyper-connected markets

Digital markets inherently generate asymmetries because not all competitors possess equivalent sensing infrastructures or interpretive routines [9]. Proposition 3 posits that superior sensing capabilities accelerate knowledge accumulation [16]; yet the boundary condition here is the speed and scale of market connectivity [18]. In platform ecosystems and IoT-enabled supply chains, asymmetries widen rapidly when one firm deploys real-time analytics across partner networks while rivals remain dependent on periodic reports [26]. Managers must therefore treat asymmetry not merely as a threat but as a deliberate strategic lever [8]: by investing in proprietary data lakes and cross-boundary analytics protocols, firms can institutionalize faster knowledge-update cycles [19]. However, excessive asymmetry can backfire if it triggers regulatory scrutiny or partner retaliation [5], introducing a boundary condition where too much information advantage becomes socially and legally unsustainable [16]. The key insight is that asymmetries are dynamic [9]; they must be actively managed through selective knowledge sharing within ecosystems while protecting core interpretive algorithms [26].

The self-reinforcing power of performance-to-resource feedback loops

Proposition 6 highlights how performance outcomes feed back into data resources and analytics routines, creating a virtuous cycle [8]. In practice, superior firm performance—manifested in higher market share, customer retention, or innovation rates—generates additional data streams (customer behaviors, competitor signals, supply-chain metrics) that further enrich the firm’s raw data reservoir [19, 20]. This feedback is especially potent in turbulent digital environments where market signals change hourly [21]. Analytics routines are iteratively refined because successful outcomes provide clear validation signals: what worked yesterday is tested and improved today [29]. Over multiple cycles, these loops produce compounding knowledge depth that competitors without similar performance histories cannot replicate [7]. The mechanism is non-linear [12]; small initial advantages in information processing can scale into structural knowledge superiority within 18–24 months

Risks and Boundary Conditions: When Information Advantage Turns into Organizational Liability

Table 2. Moderators, boundary conditions, and failure modes in the information advantage pathway

Pathway segment	Positive amplifier	Mechanism of amplification	Erosive to conc

Data resources → Information processing	High-quality digital infrastructure	Increases data accessibility, integration speed, interoperability, and processing continuity	Poor governance → fragmented systems
Information processing → Knowledge accumulation	Advanced analytics capabilities	Improves pattern recognition, contextual interpretation, and decision relevance of processed signals	Information overload → analytical overcorrection
Information processing → Knowledge accumulation	Data-driven culture	Encourages trust in evidence, cross-functional use of insights, and routine knowledge updating	Cultural resistance to systematic analytics
Data resources → Knowledge accumulation	Digital information asymmetries favor the focal firm	Enables earlier, richer, and more granular access to market and ecosystem signals	Visibility among mandated open data providers
Knowledge accumulation → Strategic action	Organizational memory and knowledge-refresh routines	Converts interpreted signals into retained, reusable, and action-guiding knowledge	Knowledge of hyperspectral data
Information advantage → Firm performance	Ambidexterity	Allows simultaneous exploitation of current knowledge and	Exploitation of exploratory

		exploration of new opportunities	
Information advantage → Firm performance	Entrepreneurial orientation	Promotes proactive opportunity recognition and faster conversion of insights into strategic moves	Risk averse excessive procedures
Firm performance → Resource renewal	Deliberate feedback-loop design	Routes outcomes back into data priorities, analytics refinement, and organizational learning	Feedforward blindness confirming
Ecosystem-level knowledge flows → Information advantage	Governed collaboration across digital ecosystems	Expands learning opportunities while preserving proprietary interpretive layers	Weak governance or leakage
Entire pathway	Ethical and regulatory alignment	Preserves legitimacy and enables sustainable deployment of data-driven strategies	Privacy v. openness or noncompliance data protection

participants while still allowing individual firms to maintain proprietary interpretive layers [5, 16, 29]. This collaborative dynamic supports Proposition 5 by enabling ambidexterity at the ecosystem level: firms simultaneously exploit shared data for immediate performance gains and explore new opportunities through joint analytics experiments [12, 17]. The boundary condition is trust and governance design; poorly structured ecosystems leak core knowledge, eroding individual advantage [26]. Successful digital firms therefore invest in relational capabilities—contracts, shared dashboards, and joint innovation labs—that convert ecosystem participation into asymmetric knowledge gains rather than commoditized information.

Reimagining Competitive DNA: Theoretical Extensions and Forward Pathways for Knowledge-Driven Digital Strategy

The framework developed here extends the knowledge-based view into the digital economy by positioning information advantage as the central strategic mechanism that bridges data resources and firm performance. Unlike earlier conceptualizations that treated knowledge as a relatively stable asset, the present theory emphasizes its dynamic, cyclical, and digitally mediated nature [12, 28, 29]. The six propositions and the cyclical model in Figure 1 collectively demonstrate that sustained performance no longer stems from data ownership alone but from the orchestrated transformation of data into knowledge through analytics, culture, and feedback loops [2, 6, 14, 22]. This represents a theoretical shift: information advantage is neither a simple resource nor a generic capability; it is an emergent property of the entire data–knowledge–action cycle operating within specific organizational and market boundary conditions.

Ecosystem-Level Knowledge Flows and Collaborative Amplification

Beyond firm boundaries, digital business ecosystems introduce collaborative knowledge creation as a multiplier of information advantage. When firms participate in open yet governed data-sharing platforms, the collective knowledge pool expands exponentially, benefiting all

Theoretically, the work resolves several longstanding tensions in the literature. First, it clarifies the data–information–knowledge hierarchy that many studies have left implicit, showing how each layer requires distinct organizational investments [1, 3, 7, 20]. Second, it integrates dynamic-capability thinking with ecosystem perspectives, explaining why some digitally mature firms outperform others despite similar technology stacks [8, 16, 21]. Third, it introduces feedback loops as a formal theoretical construct, moving beyond linear mediation

models to explain compounding advantage over time [19, 29]. These extensions open multiple avenues for future theory development: examining how artificial intelligence augments the interpretive stage, how regulatory changes reshape asymmetry boundaries, and how sustainability imperatives alter knowledge-refinement priorities [17, 25].

From a managerial standpoint, the framework offers concrete guidance. Executives should audit the efficiency of their analytics-to-knowledge conversion rather than merely measuring data volume. They must deliberately engineer data-driven cultures, install performance-to-resource feedback mechanisms, and balance ecosystem collaboration with proprietary protection. Firms that ignore the moderators and risks outlined above risk investing heavily in digital infrastructure only to watch information advantage evaporate [13, 15, 23]. In contrast, those that treat information advantage as a living capability—continuously nurtured through culture, governance, and iterative refinement—will secure durable positioning in data-rich competitive landscapes.

The digital economy has rewritten the rules of strategy. The theory articulated here provides scholars and practitioners with a coherent lens for understanding, measuring, and deliberately cultivating the next generation of competitive advantage—one rooted not in data itself but in the superior knowledge and strategic action that data, properly transformed, can uniquely enable.

Conclusion

Information advantage has emerged as the defining strategic currency of the digital economy. This theory-development article has demonstrated that raw data, advanced analytics, and organizational knowledge do not automatically translate into superior performance; instead, they do so only when firms master the cyclical processes of sensing, interpreting, accumulating, and acting upon market signals faster and more insightfully than rivals. The six propositions and the dynamic conceptual model illustrate how digital infrastructures, data-driven cultures, feedback loops, and ecosystem collaborations interact to create, sustain, or erode this advantage.

By distinguishing between data, information, and knowledge, and by embedding information advantage at the heart of the knowledge-based view, the framework resolves critical theoretical gaps while offering actionable pathways for managers navigating data-rich environments. The boundary conditions and risks identified—information overload, regulatory constraints, knowledge rigidity—serve as essential safeguards, reminding practitioners that advantage must be actively governed rather than passively assumed.

As digital transformation accelerates and new technologies such as generative AI and real-time global platforms further intensify data flows, the ability to convert information into strategic knowledge will separate enduring market leaders from those left behind. Future research can test and extend the propositions across additional sectors, regulatory regimes, and technological waves. For now, the central message is clear: in the digital economy, firms do not compete on data volume; they compete on the information advantage they build from it. Those who internalize the cyclical, moderated, and feedback-rich mechanisms presented here will not only survive but also redefine performance standards for the coming decade.

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