

Internal Strategic Resource Market and Diversification in the Digital Age

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ABSTRACT

We introduce the concept of Internal Strategic Resource Markets (ISRM)s—firm-level marketplaces for capital, data, and AI that replicate market-like allocation within organizations. Drawing on the resource-based view and transaction cost economics, we theorize how ISRM)s extend internal capital market logic to nonrival digital resources. Our framework identifies value-creation mechanisms such as data recombination and co-insurance of digital infrastructure, alongside governance hazards including influence costs, tunneling, and regulatory exposure. We develop propositions linking ISRM)s to diversification strategies, innovation outcomes, and the diversification discount. Case illustrations from leading technology firms show how ISRM)s magnify both bright and dark sides of internal markets, with outcomes contingent on governance, culture, and regulatory boundary conditions. This analysis advances theories of diversification and resource orchestration for the digital era.

Keywords: digital-era strategy, diversification discount, internal capital markets (ICM)s, resource-based view (RBV), transaction cost economics (TCE)

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1. INTRODUCTION

Diversification remains one of the most enduring puzzles in strategy. Decades of research on the “diversification discount” suggest that multi-business firms often underperform more focused rivals (Campa & Kedia, 2002; Chang, Kogut, & Yang, 2016; Lang & Stulz, 1994), yet many large firms – especially in the digital economy – continue to diversify aggressively. Digital resources – particularly data and artificial intelligence (AI) capabilities – have become pivotal for innovation and competitive advantage in today’s business landscape (Brynjolfsson & Kahin, 2002; DalleMule & Davenport, 2017; Kemp, 2024). Major technology firms and digital platforms are expanding into new services and markets to accumulate and exploit diverse data sets (Hagiu & Wright, 2020). By branching into novel domains, these firms can apply their existing data and AI capabilities in new ways and gather fresh data from these ventures, creating a reinforcing cycle of growth. Traditional diversification theories, however, have not fully accounted for the central role of internal data and AI resource exchanges in enabling such strategies. Understanding this modern diversification paradox requires examining how firms internally govern the allocation of resources when external markets are incomplete or inefficient.

Historically, conglomerates established internal capital markets (ICMs) to counteract failures in external capital markets (Liebeskind, 2000; Stein, 1997). An ICM allows business units within a firm to allocate financial resources more efficiently under a unified governance structure (Almeida & Wolfenzon, 2006). In parallel, the resource-based view (RBV) has long argued that diversification can create value when resources such as technologies, expertise, or brand capabilities are shared across businesses, yielding synergies (Barney, 1991; Lang & Stulz, 1994; Markides & Williamson, 1996; Wernerfelt, 1984). Building on these foundations, we argue that the digital era has introduced new kinds of internal markets for strategic resources –

particularly data, algorithms, and AI – that function analogously to ICMs but operate under distinct economic and governance logics.

More specifically, we argue that today’s data-driven firms respond to external data market inadequacies by internalizing the exchange of data and AI resources. When buying or selling data or AI resources on the open market is costly, risky, or impractical, firms choose to handle these transactions inside the organization (Coase, 1937; Williamson, 1975). As a result, many large technology companies now run internal marketplaces for data, algorithms, and cloud computing resources that mimic external market mechanisms while remaining within the firm’s boundaries. These internal data/AI markets serve as strategic tools to redeploy digital resources dynamically across divisions, allowing the company to pursue diversification opportunities that would be difficult to achieve through external contracting alone (Ke & Sudhir, 2023). We conceptualize these internal exchange systems under a unified framework of Internal Strategic Resource Markets (ISRM).

An ISRM extends the resource-based view to a firm’s internal exchange of key assets, providing a structured internal marketplace for capital, data, and AI resources (Barney & Arikan, 2005; Peteraf, 1993; Wernerfelt, 1984). In other words, if the traditional RBV has focused on explaining competitive advantage through the ownership of rivalrous assets, our paper shows how firms govern the internal exchange of nonrival assets, thereby reflecting more accurately the contemporary shift toward economies dominated by intangible resources. This perspective highlights how a company can orchestrate resources internally to support new ventures and innovation. Prior research on internal markets reveals a dual nature: there is a “bright side” where internal resource allocation can overcome external market frictions and fuel innovation (Belenzon & Tsolmon, 2016; Hsu & Lim, 2014; Khanna & Tice, 2001), and a “dark side” where

agency problems, influence costs, and power struggles lead to inefficient allocations or value destruction (Scharfstein & Stein, 2000). We argue that digital-era internal markets for data and AI will exhibit a similar duality. With effective governance, ISRM can create synergy and spur innovation across a diversified firm by recombining resources in novel ways (Lavie & Drori, 2012). With poor governance, however, they may suffer from wasted data assets, internal conflicts, or ethical lapses in data use that undermine performance (Kim, Arthurs, Sahaym, & Cullen, 2013). These risks are magnified by the *nonrival* nature of data (Jones & Tonetti, 2020) – a unique resource that can be copied and reused at virtually zero cost – which means a single data asset might be leveraged across many divisions, potentially amplifying both the benefits and the pitfalls of internal sharing. In extreme cases, uncontrolled internal resource transfers might even invite regulatory backlash if they enable anti-competitive behavior or privacy abuses.

Another critical factor influencing the success of ISRM (and diversification more broadly) is the regulatory environment. Competition and data-privacy regulations, often rooted in traditional market structures, can inadvertently shape or constrain how firms leverage internal markets and diversification strategies. For example, antitrust authorities may view a data-rich firm's expansion into adjacent markets with suspicion, under the assumption that such diversification could stifle competition. This traditional lens might discourage moves that would otherwise create consumer value through data-driven synergies, thereby potentially stifling innovation that the “bright side” of ISRM could offer. Conversely, if policy measures fail to account for the unique economics of data and AI, they might end up reinforcing the “dark side” – doing little to curtail incumbents' market power or even entrenching it by making it harder for new entrants to compete. Thus, regulatory regimes effectively set the boundary conditions for ISRM, helping determine whether a firm's internal resource markets ultimately foster

innovation or entrench dominance. This tension between business strategy and regulatory policy forms an important backdrop for our analysis.

In light of these developments, this paper develops a theoretical model of the ISRM and examines its implications for corporate diversification in the digital age. We explore how data-driven, AI-enabled firms orchestrate internal resource exchanges to drive innovation and enter new markets, and how these internal market dynamics alter the traditional costs and benefits of diversification. We derive a set of theoretical propositions from this framework and illustrate them with case examples of five digital firms leveraging ISRMs. We also investigate the associated regulatory challenges and argue that a balanced policy approach is needed – one that fosters innovation and efficiency gains from internal markets without entrenching dominant players or compromising ethical standards.

This study makes several key contributions to strategy literature. First, it extends theories of internal capital markets to the digital economy by conceptualizing ISRMs as governance systems for data and AI, thereby integrating insights from the resource-based view and transaction cost economics.

Second, it reframes the diversification discount debate by theorizing how ISRMs alter the costs and benefits of diversification in data-intensive firms. Whereas classic ICM logic emphasizes inefficiencies from scope expansion, the ISRM perspective shows that digital-era diversification can generate superior synergies through data and algorithmic recombination, potentially offsetting or even reversing the discount—conditional on governance quality.

Third, it introduces nonrivalry of digital resources as a novel theoretical mechanism. Unlike capital, data and algorithms can be reused simultaneously across divisions at near-zero marginal cost, amplifying both the bright side (cross-unit innovation, co-insurance, speed of

recombination) and the dark side (duplication, influence costs, regulatory exposure) of internal markets.

Finally, it advances the interface of strategy and institutions by demonstrating how regulatory regimes define the boundary conditions under which ISRMs operate, determining whether they foster cross-business innovation or entrench firm dominance. Together, these contributions position ISRMs as a novel lens for understanding resource orchestration, corporate diversification, and governance in the digital age.

2. THEORETICAL FRAMEWORK³

2.1 Overview of internal strategic resource markets (ISRM)

We define Internal Strategic Resource Markets (ISRMs) as firm-level marketplaces for allocating critical resources—capital, data, and AI—across business units. ISRMs extend the logic of internal capital markets (ICMs) (Liebeskind, 2000; Stein, 1997) into the digital economy, while integrating insights from the resource-based view (RBV) and transaction cost economics (TCE) (Barney & Arikan, 2005; Coase, 1937; Cuypers, Hennart, Silverman, & Ertug, 2021a; Wernerfelt, 1984; Williamson, 1975). By internalizing exchanges when external markets are costly or incomplete, firms redeploy resources to higher-value uses more flexibly. Unlike financial capital, digital assets such as data and algorithms are nonrival—once created, they can be redeployed across multiple divisions at near-zero marginal cost. This distinctive property magnifies both the value-creation potential and the governance hazards of internal markets.

Furthermore realizing the benefits of ISRMs requires sound governance. Well-designed internal markets generate synergies by linking disparate units through shared resources, spurring

³ Please refer to Appendix I for the development of formal models.

innovation beyond what isolated divisions could achieve—the *bright side* (Khanna & Tice, 2001). Conversely, poorly governed systems invite rent-seeking, cross-unit rivalries, or resource misallocation—the *dark side* (Scharfstein & Stein, 2000). The duality of internal markets thus provides the foundation for analyzing how ISRM operate in diversified, data-driven firms.

2.2 Bright side of internal markets

The “bright side” of internal markets is that multi-unit firms can sometimes allocate resources more efficiently than external markets. Stein’s (1997) model depicts corporate headquarters (HQ) as an informed “winner-picker” that channels capital to high-potential projects across divisions using superior inside information. By funding strong projects and swiftly killing weak ones, HQ can overcome allocation failures that external investors might face, improving overall investment efficiency.

A diversified firm also benefits from internal risk-pooling: the variability of one project can be offset by others, stabilizing performance and enabling more aggressive investment strategies than would be possible for stand-alone firms. In addition, HQ’s ability to redeploy funds quickly to seize emerging opportunities gives the firm flexibility that external markets may lack.

Another bright-side mechanism is the transfer of knowledge and talent. Because information and expertise move more easily within a firm than across organizational boundaries, diversified companies can diffuse breakthroughs from one unit to others without the friction of market contracting. Internal labor and idea markets thus generate cross-divisional synergies outsiders cannot easily replicate (Anjos & Fracassi, 2011). Empirical evidence supports these claims: diversified retailers, for example, have out-invested and outmaneuvered focused rivals by

reallocating resources in response to competitive shocks (Khanna & Tice, 2001). Under the right conditions, internal markets therefore overcome external market short-termism and frictions, enhancing innovation and performance (Belenzon & Tsolmon, 2016).

2.3 Dark side of internal markets

Alongside these benefits, internal markets carry a “dark side” of agency costs and political distortions. A classic problem is influence costs (Rajan, Servaes, & Zingales, 2000): divisional managers lobby for larger budget allocations, skewing resources toward political clout rather than strategic merit. Headquarters, unable to credibly commit to never bailing out underperforming units, may over-subsidize weaker divisions to preserve internal harmony, diverting funds away from high-value opportunities.

Empire building compounds these risks: managers expand projects or acquisitions to increase their power and domain, even when returns are poor (Jensen, 1986). CEOs may favor pet projects or loyalists despite low performance, while savvy unit heads game budgeting systems to secure disproportionate resources. In extreme cases, internal transfers border on tunneling—shifting value to certain insiders or divisions at the expense of others (Bertrand, Mehta, & Mullainathan, 2002; Johnson, La Porta, López-de-Silanes, & Shleifer, 2000). Even without outright tunneling, the “bias for internal allocation” can starve external entrepreneurs of capital, dampening innovation beyond the firm.

These distortions explain why diversified firms frequently trade at a discount relative to focused peers (Campa & Kedia, 2002; Chang et al., 2016; Ramanujam & Varadarajan, 1989). Whether internal markets create or destroy value thus depends critically on governance quality. Strong oversight can harness informed allocation and resource synergies; weak oversight

magnifies political gaming and inefficiency.

2.4 Toward a theory of ISRMs

The foundations of internal markets lie in ICMs, which emerged as organizational responses to imperfections in external capital markets. By reallocating funds among divisions, corporate headquarters could overcome information asymmetries, pool risks, and support promising projects more effectively than dispersed investors (Stein, 1997). Yet ICMs also exhibit agency costs and lobbying pressures (Scharfstein & Stein, 2000), establishing the bright–dark duality of internal allocation.

In the digital economy, the most strategically valuable resources are no longer financial but informational. Data and digital capabilities have become core drivers of competitive advantage, yet external markets for data are incomplete and costly. Privacy constraints, valuation problems, and security risks make it difficult to transact data across firm boundaries (Grover, Chiang, Liang, & Zhang, 2018). To overcome these frictions, firms began creating Internal Data Markets (IDMs). Much as ICMs mitigated capital-market failures, IDMs governed the internal allocation of data, typically through APIs, data catalogs, and internal credit systems. We argue that IDMs thus represent the first extension of the internal-market logic beyond finance, enabling divisions to share and reuse data assets under firm-level governance.

As digital capabilities scaled, Internal AI Markets (IAIMs) also emerged. AI models and compute power introduced both new opportunities and new governance challenges. Unlike data, which is easily replicated, GPU hours and training capacity are rivalrous in the short term. Firms developed allocation systems to price compute cycles, ration access to models, and build cross-unit AI libraries. We argue that IAIMs therefore extend internal-market logic into algorithmic,

real-time allocation—blending the efficiency of digital platforms with the political hazards long observed in ICMs.

These developments set the stage for the broader construct of ISRM. ISRM integrates the logics of ICMs, IDMs, and IAIMs into a unified governance framework for allocating both rivalrous and nonrivalrous resources. Nonrivalry is pivotal: unlike financial capital, a dataset or algorithm can be redeployed simultaneously across multiple divisions at negligible cost. This unique property amplifies the bright side of internal markets—greater recombination, co-insurance, and speed of innovation—while intensifying the dark side—duplication, lobbying, tunneling, and regulatory exposure. Figure 1 illustrates the conceptual lineage of ISRM.

INSERT FIGURE 1 HERE

As shown in Figure 1, by tracing this trajectory from ICMs to IDMs to IAIMs, ISRM emerges as more than an analogy: they are a qualitatively distinct governance form. They recast diversification in the digital age as not merely entry into new markets but as the expansion of a firm’s internal resource exchanges and recombination opportunities. The theoretical question thus shifts from *whether diversification creates or destroys value* to *under what governance conditions ISRM turns diversification into a source of sustained advantage*.

2.5 ISRM and diversification in the digital age

As such, an ISRM perspective sheds new light on diversification. Classic theories frame diversification as expansion into related or unrelated product markets (Montgomery, 1994; Wernerfelt, 1984). The ISRM lens emphasizes diversification as broadening the scope of internal resource exchanges. Firms may enter adjacent domains to acquire complementary datasets or expand into unrelated sectors to repurpose existing AI capabilities. Sometimes this process is

bidirectional: diversification into a new industry generates data that strengthens the core business, as when Amazon's entry into health services produced health data that enriched AWS (Amazon Web Services)'s AI systems.

Consistent with TCE, when external markets for data and AI are inefficient, firms internalize exchanges through diversification (Cuypers et al., 2021a; Cuypers, Hennart, Silverman, & Teece, 2021b; Williamson, 1975). A well-functioning ISRM reassures investors that allocations are disciplined and transparent, mitigating the diversification discount (Campa & Kedia, 2002; Chang et al., 2016). In this way, ISRM provide both motive and mechanism for data-driven diversified firms to outperform focused rivals.

2.6 Internal markets as hybrid governance

ISRM also highlight the hybrid nature of governance. Unlike pure markets or hierarchies, ISRM blend decentralized allocation with centralized authority. Headquarters can simulate market-like discipline—through transfer prices, auctions, or quotas—while retaining hierarchical control to align exchanges with corporate strategy (Kogut & Zander, 1992).

In digital firms, this hybrid quality is multiplex: ISRM allocate rivalrous resources such as capital and compute cycles alongside nonrivalrous resources such as data and algorithms. This duality increases both efficiency and complexity. Markets can price GPU hours, but valuing data sets raises ethical and contextual challenges. Hierarchy can enforce access protocols, but excessive centralization risks stifling innovation. ISRM therefore function as hybrid governance systems whose effectiveness depends on balancing decentralized signals with centralized oversight, transparency, and cultural alignment.

3. PROPOSITIONS

Building on our theoretical development, we advance a set of propositions that formalize the mechanisms and boundary conditions of ISRMs in this section. Since detailed rationales are provided in Section 2, we provide a brief description before each proposition in order to avoid repetition.

3.1 Data orientation as an antecedent of diversification

Firms that embed data and analytics into decision-making require increasingly diverse data inputs to fuel learning algorithms. To acquire these inputs, they often expand into new product–market domains, lowering the informational hazards that usually accompany diversification (Brynjolfsson & McAfee, 2011; Grant, 2006).

Proposition 1a. *A stronger organizational orientation toward data analytics increases the likelihood that a firm will diversify.*

This effect is magnified in digital platform firms, where scale and ecosystem advantages allow data, infrastructure, and AI talent to be repurposed across domains (Frost et al., 2019; Giustiziero, Kretschmer, Somaya, & Wu, 2023; Motta & Peitz, 2021).

Proposition 1b. *For data-intensive platform firms, the positive effect in Proposition 1a is amplified by platform scale.*

As firms accumulate more diverse internal datasets, the marginal value of acquiring an additional, distinct dataset rises. This pushes diversification beyond related industries, encouraging entry into unrelated domains where novel data streams can be captured (Kim et al., 2013).

Proposition 1c. *Growth in the diversity of a firm’s internal data assets increases*

its propensity to pursue unrelated diversification.

3.2 ISRM synergies and governance in diversified firms

Digital assets are nonrival: once generated, data and algorithms can be reused across multiple divisions at near-zero cost. An ISRM that prices and reallocates these assets creates cross-unit synergies unavailable to more focused firms ((Lavie & Drori, 2012; Varian, 2018; Wernerfelt, 1984).

Proposition 2a. *The breadth of a firm's diversification is positively related to the rate of AI- and data-driven innovation it produces.*

However, ISRM quality moderates this effect. When governance ensures timely, transparent, and politically low-cost exchanges, heterogeneous resources are more likely to reach their highest-value uses. Where hoarding, lobbying, or misallocation prevails, synergies dissipate (Khanna & Tice, 2001; Scharfstein & Stein, 2000).

Proposition 2b. *ISRM efficiency strengthens the positive relationship in Proposition 2a, whereas inefficiency weakens it.*

3.3 Performance implications: the digital diversification discount

Classic studies suggest that diversified firms often trade at a “diversification discount” because of coordination costs and agency problems (Campa & Kedia, 2002; Chang et al., 2016; Ramanujam & Varadarajan, 1989). Yet, in data-intensive firms, an effective ISRM reallocates digital resources with fewer frictions than markets, generating synergies that can offset those costs (Belenzon & Tsolmon, 2016; Stein, 1997).

Proposition 3. *As data and AI grow in strategic importance, the market-to-assets*

discount for diversified firms narrows with the effectiveness of their internal data/AI markets.

3.4 Regulatory boundary conditions

Antitrust measures that restrict data integration are often justified as pro-competition (Khan, 2017; Khan, 2019). Yet such restrictions may suppress cross-domain recombination—the very mechanism that drives innovation in diversified digital firms (Fleming, 2001; Kaplan & Vakili, 2015).

Proposition 4a. *Regulatory limits on diversification that restrict data integration reduce innovation output in data-driven firms.*

Meanwhile, incumbents with existing large data pools are less affected by such limits than entrants. If diversification paths are curtailed, incumbents' advantages may solidify, raising barriers for rivals (Hagiu & Wright, 2020; Parker, Petropoulos, & Van Alstyne, 2021).

Proposition 4b. *The same regulatory limits increase incumbent platform firms' market dominance by raising entry barriers for rivals.*

4. ILLUSTRATION OF CASES IN DIGITAL FIRMS

In this section, we present a series of theory-informed case studies of global technology companies that have implemented ISRMs for key digital resources such as data, AI models, or cloud infrastructure. Each case illustrates the mechanisms employed (e.g., internal pricing, APIs, credit systems, data catalogs) and the outcomes observed—highlighting both value creation and potential distortions (e.g., influence costs, rent-seeking, winner-picking, tunneling)—and concludes with a theory integration that explicitly links the illustration to our propositions. We

emphasize how contextual factors such as firm culture, industry, and regulatory environment condition the balance between these bright and dark sides. Appendix II provides detailed information on case selection criteria, data sources, and the scope of limitations.

4.1 Amazon: internal cloud marketplace and the API mandate

Mechanisms. In the early 2000s, Amazon confronted inefficiencies in its fragmented computing infrastructure. Jeff Bezos’s 2002 “API mandate” required all internal services to expose data and functionality via standardized interfaces, forcing teams to interact as if they were external customers. This modular architecture enabled the subsequent creation of Amazon Web Services (AWS), where business units purchased computing and data services at transfer prices comparable to those charged externally. AWS thus became an internal market for digital infrastructure: teams could flexibly acquire capacity on demand, while the infrastructure unit was accountable for cost efficiency and service quality.

Outcomes. The ISRM at Amazon delivered clear benefits consistent with the bright side of internal markets. Shared infrastructure allowed co-insurance of resources, rapid scaling of new ventures, and accelerated innovation—Prime Video, Alexa, and countless other projects launched with far lower frictions. Simultaneously, the model posed hazards: the API mandate provoked cultural resistance, transfer pricing created lobbying risks, and AWS’s dual role as internal provider and external competitor invited regulatory scrutiny.

Theory integration. Amazon’s experience demonstrates how ISRMs can reconfigure the diversification-performance relationship. Classic ICM theory predicts inefficiencies and potential discount from unrelated diversification, but Amazon’s ISRM enabled efficient redeployment of nonrival digital resources, transforming diversification into a source of synergies and innovation.

This case illustrates **Propositions 1a** and **3**, showing that under strong governance, ISRM s allow diversification to generate option value and sustained advantage, while also magnifying dark-side risks if political distortions emerge.

4.2 Google: unified data infrastructure and cross-platform synergies

Mechanisms. By 2012, Google had consolidated data from over 60 services into a unified user account and data infrastructure, enabling cross-service analytics and AI model reuse. Internally, product teams could access this shared data pool and AI libraries (e.g., TensorFlow, Borg cluster system) to develop new features or products. These practices effectively created an internal marketplace for data and algorithms, where resources were openly available subject to permission rather than reinvented in silos.

Outcomes. The bright side of Google’s ISRM has been extraordinary innovation. Services like Google Now and enhanced ad targeting leveraged recombined data from Gmail, Maps, YouTube, and search. AI breakthroughs developed in one division (e.g., image recognition in Photos) were reused across others. However, risks materialized as well: regulators criticized Google’s cross-service data integration as non-consensual, leading to fines and stricter privacy oversight. Internally, teams also lobbied for privileged access to scarce compute time or high-value datasets, illustrating influence costs even in a culture of open sharing.

Theory integration. Google’s case exemplifies how nonrival digital resources amplify both synergies and hazards within ISRM s. Unified data sharing created innovation recombinations consistent with **Proposition 1a**, while Google’s persistent data orientation and pursuit of new data streams illustrate **Propositions 1a** and **1c**. At the same time, regulatory backlash and influence costs illustrate **Propositions 4a** and **4b**, showing how institutional

contexts define ISRM boundary conditions. In contrast to classic ICMs that allocate scarce funds, Google’s ISRM allocates nonrival data assets, demonstrating how digital-era diversification can fuel innovation yet simultaneously trigger external scrutiny.

4.3 Microsoft: one Azure for all and the platform organization

Mechanisms. Historically siloed, Microsoft—under Chairman and CEO Satya Nadella—pursued a “One Microsoft” strategy that required its divisions to migrate to Azure and consume cloud services at full transfer prices, identical to those charged to external customers. This internal pricing discipline created a market-like governance system where each unit held a cloud budget and faced trade-offs. Complementary mechanisms included shared data platforms (e.g., Microsoft Graph), internal marketplaces for AI models, and cross-division committees aligning incentives.

Outcomes. The internal cloud market improved cost discipline eliminated duplicated infrastructure, and accelerated integration of acquisitions (e.g., LinkedIn data into Outlook). Innovation speed increased through reusable data and AI components. At the same time, political distortions did not disappear entirely: divisions continued lobbying for Azure budgets or integration priorities, and strict internal pricing sometimes discouraged experimentation, though mitigated by internal R&D credits.

Theory integration. Microsoft illustrates how ISRM design and culture condition diversification outcomes. By enforcing transfer pricing and embedding collaboration norms, Microsoft amplified cross-unit recombination, consistent with **Proposition 2a and 2b**, and mitigated the diversification discount, consistent with **Proposition 3**. Yet persistent lobbying pressures confirm the dark side of internal markets. The case highlights how organizational

culture and incentive alignment serve as contingencies in determining whether ISRM s deliver bright-side synergies or succumb to politics.

4.4 Alibaba: data middle office and ecosystem synergies

Mechanisms. Alibaba pioneered the concept of a “Data Middle Office”, a centralized internal marketplace cataloging datasets, algorithms, and AI services for use across its diverse businesses—e-commerce, finance, logistics, cloud, and entertainment. Business units could “check out” data or models with internal credits or transfer pricing, effectively treating data as a tradable internal commodity. In parallel, AliCloud served as the backbone for all divisions, charging units for computing resources while ensuring scalability during demand surges such as Singles’ Day.

Outcomes. This internal market produced powerful synergies. Ant Group, for example, leveraged e-commerce transaction data to enhance credit scoring, while logistics data fed back into retail operations, and cloud capacity was flexibly shared across businesses. These exchanges yielded bidirectional innovation loops, where diversification into finance and logistics generated data that enriched core commerce operations. Yet, the model also created hazards. Alibaba’s tight integration of Ant Group’s access to consumer data drew regulatory scrutiny in 2020–21, with authorities forcing data-sharing into a state-controlled bureau. Internally, critics argued that cash flows from highly profitable units subsidized executive-favored ventures, echoing tunneling and influence costs.

Theory integration. Alibaba’s case demonstrates both the bright side and dark side of ISRM s. Bidirectional recombination of data illustrates **Propositions 1a, 1b, and 1c**, showing how data-oriented diversification and platform scale feed back into the resource pool. At the

same time, regulatory intervention underscores **Proposition 4b**, as boundary conditions imposed by institutions determine whether ISRM synergies are sustainable or curtailed.

4.5 Tencent: from siloed rivalries to a shared AI platform

Mechanisms. Tencent historically relied on an internal competition model, where small teams independently developed products with minimal resource sharing—a form of internal capital allocation resembling venture-style markets. Iconic successes like WeChat emerged from this “horse-race” system. From 2018 onward, Tencent shifted toward integration by establishing a central Technology Committee and launching the Cloud & Smart Industries Group (CSIG). These initiatives created an internal marketplace for cloud capacity, AI models, and even advertising slots within WeChat, governed by pricing and quota systems.

Outcomes. The shift delivered efficiency and synergy gains. Cloud services were standardized across divisions, AI research became accessible firm-wide, and data collaboration platforms allowed recombination of information streams once siloed. This supported enterprise innovation and cross-business integration. However, challenges persisted. Formerly autonomous teams resisted central oversight, sparking new influence activities as units lobbied for priority access to the AI platform. The dismantling of entrenched “mountain strongholds” (powerful silos) exposed cultural frictions, while reduced redundancy curtailed the entrepreneurial experimentation that once fueled breakthrough products.

Theory integration. Tencent’s trajectory illustrates the contingencies shaping ISRM performance. Its early silo competition validated the idea of internal Darwinism, but also wasted resources through duplication. The post-2018 pivot aligns with **Proposition 2b**, showing how ISRM efficiency strengthens synergies, while the persistence of lobbying confirms the durability

of dark-side influence costs. Tencent’s relative avoidance of regulatory backlash highlights institutional variation, indirectly linking to **Proposition 4a**. Overall, Tencent exemplifies how ISRM design must balance competition and integration to capture the bright side of internal markets without erasing entrepreneurial dynamism.

4.6 Cross-case synthesis

Across the five cases, ISRMs emerge not as isolated corporate experiments but as a general governance form for digital-era diversification. Despite distinct histories, Amazon, Google, Microsoft, Alibaba, and Tencent all developed quasi-market mechanisms—transfer pricing, API mandates, data credits, or internal cloud quotas—that simulate external exchange inside the firm. This convergence indicates that ISRMs represent a repeatable organizational response to the challenge of allocating nonrival data and AI resources across divisions.

Common mechanisms. Three recurring channels of value creation mirror, but extend, classic internal market theory. First, co-insurance arises when costly infrastructure is pooled and redeployed—Amazon and Microsoft dynamically shifted surplus cloud capacity across units, reducing average costs (Stein, 1997). Second, recombination synergies emerge when heterogeneous datasets are fused into new products—Google’s integration of search and YouTube data, or Alibaba’s linkage of e-commerce and fintech data, illustrate the innovation gains from internal recombination (Fleming, 2001; Kaplan & Vakili, 2015). Third, forms of internal Darwinism replace top-down bargaining: projects that attract the highest “internal price” gain priority in GPU hours, analyst attention, or promotional slots, echoing Tencent’s app-competition culture (Cuypers et al., 2021b; Khanna & Tice, 2001). Collectively, these mechanisms show that when information asymmetries are reduced and transactions internalized,

ISRM migrate resources to higher-valued uses more effectively than arm's-length markets.

Governance hazards. Yet the same mechanisms magnify classic dark-side problems. Influence costs arise when divisions lobby to adjust transfer prices or secure exemptions, as seen in Amazon's API mandate enforcement and Microsoft's Azure budget allocations (Rajan et al., 2000). Tunneling analogues appear when one affiliate extracts disproportionate benefits from shared data—Alibaba's preferential sharing with Ant Group closely parallels cash tunneling in diversified groups (Bertrand et al., 2002; Johnson et al., 2000). Regulatory backlash also follows when internal efficiencies resemble external self-preferencing: Google's bundling of search data with advertising drew EU sanctions, while Chinese regulators ring-fenced Alibaba's data flows to Ant Group. These hazards demonstrate that ISRM intensify, rather than eliminate, the classic dilemmas of internal markets.

Contingencies and variation. The performance of ISRM depends on contextual factors. Institutional regimes shape design: Europe's privacy strictures constrained Google's cross-unit data sharing, while China's antitrust actions curtailed Alibaba's ecosystem integration. Organizational culture conditions compliance: Microsoft's collaborative post-2014 ethos eased adoption of shared platforms, whereas Tencent's dismantling of entrenched silos generated political resistance. Resource fungibility matters as well: cloud cycles are easily metered, but valuing datasets or algorithms is context-dependent and ethically sensitive. Finally, strategic tempo varies: consumer platforms tolerate duplication for speed, while enterprise businesses favor reliability and integration. These contingencies underscore that ISRM are not plug-and-play templates but contingent systems requiring continuous tuning.

Theoretical implications. Synthesizing across the cases highlights how ISRM extend classic ICM logic into the digital age. Unlike financial capital, data and algorithms are nonrival

and can be redeployed simultaneously, amplifying both synergy and hazard. This nonrivalry alters the diversification-performance relationship: diversification can offset or even reverse the traditional discount if ISRM governance ensures disciplined allocation and transparent pricing. At the same time, institutional boundaries determine whether ISRM foster innovation or entrench dominance. Thus, ISRM should be theorized as strategic control systems, not static structures. Their efficacy hinges on transparent interfaces, credible prices, supportive cultures, and vigilant regulatory scanning. When those pillars hold, ISRM deliver agility, innovation, and scope economies; when they fail, the same mechanisms magnify politics and invite external scrutiny.

5. DISCUSSION

5.1 Managerial implications

The ISRM framework underscores that managers of diversified, data-intensive firms must actively design and govern their internal markets to realize strategic benefits. This aligns with TCE (Williamson, 1975), which explains why firms internalize exchanges when external markets are inefficient, and with the RBV (Barney & Arikan, 2005; Wernerfelt, 1984), which emphasizes the value of unique resources.

First, to harness the *bright side* of ISRM, managers should establish internal platforms and protocols that enable cross-unit sharing of data and AI tools. Well-structured internal marketplaces with transparent pricing, clear accountability, and usage metrics allow firms to redeploy nonrival resources efficiently, echoing the logic of internal capital markets (Stein, 1997). Without these safeguards, however, ISRM risk devolving into *dark-side* inefficiencies such as data hoarding, influence costs, and wasted analytic effort (Rajan et al., 2000; Scharfstein

& Stein, 2000).

Second, diversification moves should be guided by resource relatedness. Consistent with RBV arguments, firms should pursue new ventures only when existing data and AI capabilities confer an advantage in the target domain and the new business reciprocally enriches the overall resource pool (Montgomery, 1994; Markides & Williamson, 1996; Giustiziero et al., 2023). This avoids the performance penalties of unrelated diversification (Campa & Kedia, 2002) and ensures ISRM reinforce rather than dilute the firm's competitive advantage.

Third, managers must treat governance and ethical standards as strategic capabilities. As internal exchanges of data and AI expand, risks of bias, misuse, and regulatory noncompliance intensify (Jones & Tonetti, 2020). Establishing robust data stewardship committees, AI ethics guidelines, and compliance audits not only mitigates risks but also strengthens the functioning of the ISRM as a governance system. In this way, managers can balance agility in resource redeployment with legitimacy and trust—turning ISRM into engines of sustained innovation and competitive agility.

5.2 Policy implications

From a strategy perspective, regulation sets the boundary conditions under which ISRM operate. Institutional design determines whether internal markets for data and AI become engines of innovation or sources of anticompetitive harm.

Structural remedies such as line-of-business bans or forced breakups, often advocated in recent antitrust debates (Khan, 2017; Khan, 2019), directly target the dark side of ISRM—self-preferencing, concentration, and entry barriers. Yet our analysis indicates such blunt interventions risk dismantling the bright side as well: cross-unit data recombination, AI reuse,

and dynamic experimentation. By freezing incumbents into their current configurations, structural restrictions may unintentionally entrench advantages and raise barriers for start-ups, reducing rather than enhancing long-term competitiveness (Giustiziero et al., 2023).

A more effective approach lies in conduct-based and adaptive regulation. Targeting harmful practices—such as exclusionary data policies or opaque algorithmic allocation—preserves firms’ ability to reconfigure resources internally while curbing abuses. Outcome-focused oversight through transparency requirements, interoperability mandates, and periodic competitive reviews can discipline ISRM without dismantling them. Adaptive tools such as regulatory sandboxes or rolling thresholds allow authorities to respond as technologies and markets evolve, mirroring the flexibility firms require in dynamic environments.

Taken together, these implications highlight that both managers and policymakers jointly determine ISRM effectiveness. Managers design internal governance to realize bright-side synergies, while regulators set institutional guardrails that prevent dark-side distortions. For strategy scholars, this underscores ISRM as context-dependent governance mechanisms: their success depends as much on regulatory architecture as on organizational design.

6. CONCLUSION

This study positions ISRM as a novel governance system that extends classic theories of internal capital markets to the allocation of data, algorithms, and AI. By showing how data-rich firms reallocate nonrival resources across divisions, the analysis advances the resource-based view by reframing the firm from a bundle of owned resources to a governed marketplace for their internal exchange. By integrating non-rival digital resources and internal market

governance, the ISRM framework introduces a dynamic, institutionally embedded version of RBV suited to the digital economy.

A central insight is that regulatory design defines the boundary conditions under which ISRM operate. Structural remedies such as blanket diversification bans may dismantle the efficiency and innovation synergies of ISRM—cross-unit data sharing, AI reuse, and option-value experimentation—while simultaneously entrenching incumbents. In contrast, a balanced regulatory mix emphasizing transparency, interoperability, and outcome-based oversight can mitigate risks without suppressing the bright side of ISRM.

Finally, the framework opens several research avenues. First, future work should examine how internal pricing and algorithmic allocation affect resource recombination, dynamic capabilities, and intra-firm politics. Second, comparative studies across related and unrelated diversifiers can test whether ISRM substitute for or complement traditional integration mechanisms. Third, cross-country analyses can reveal how privacy, competition, and AI-governance regimes condition ISRM adoption and performance. Diverse methods—longitudinal designs, field experiments, and proprietary transaction data—can help uncover when ISRM act as engines of sustained advantage versus sources of organizational friction.

Overall, this study provides a coherent framework linking internal markets, diversification, and institutional governance in the digital era. By theorizing ISRM as digital-era control systems, it offers actionable insights for managers designing internal governance, for regulators shaping institutional contexts, and for scholars seeking to explain how firms orchestrate resources for innovation and advantage.

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Appendix I. Formal Models

This appendix develops formal models that support the mechanisms, propositions, and case-based intuitions in the manuscript. The appendix is self-contained but is designed to be read alongside the manuscript’s theoretical framework and propositions (Sections 2 and 3) and its cross-case integration.

A. Preliminaries and notation

A multi-business firm consists of divisions $i = 1, \dots, n$. Headquarters (HQ) allocates rival resources—financial capital K and compute C —and governs access to nonrival resources—datasets D and model libraries A . Nonrival resources are technically re-usable at near-zero marginal cost but generate firm-level risk that rises with breadth of reuse due to privacy, security, and regulatory exposure.

Let $k_i \geq 0$ and $c_i \geq 0$ denote rival allocations. Division i ’s use intensity of dataset $s \in \{1, \dots, S\}$ is $x_{is} \in [0, 1]$; use intensity of model $m \in \{1, \dots, M\}$ is $y_{im} \in [0, 1]$. Reuse breadth at the firm level is $m_s = \sum_i x_{is}$ and $u_m = \sum_i y_{im}$. Rival constraints are $\sum_i k_i \leq K$ and $\sum_i c_i \leq C$.

Division i ’s one-period operating profit is

$$\pi_i = \theta_i f(k_i, c_i) [1 + \gamma H_i(x_i, y_i)] - F_i \quad (\text{A.1})$$

with f strictly concave and increasing in (k_i, c_i) , $\gamma > 0$, and H_i increasing and concave in (x_i, y_i) . A convenient specification used for transparency in the derivations is $f(k, c) = k^\alpha c^\beta$, $\alpha, \beta \in (0, 1)$, and

$$H_i(x_i, y_i) = \sum_s \rho_{is} x_{is} + \sum_m \eta_{im} y_{im} + \lambda \sum_{s, m} \rho_{is} \eta_{im} x_{is} y_{im} \quad (\text{A.2})$$

where $\rho_{is}, \eta_{im} \geq 0$ capture asset-task relevance and $\lambda \geq 0$ captures recombination complementarities emphasized in the main text.

Firm-level costs of nonrival reuse are modeled as

$$\Psi_D(m) = \sum_s \psi_s(m_s), \quad \Psi_A(u) = \sum_m \varphi_m(u_m) \quad (\text{A.3})$$

with $\psi', \phi' > 0$ and $\psi'', \phi'' \geq 0$, reflecting convex exposure to breadth of reuse. Political frictions and governance costs are summarized by a scalar $e \in [0, 1]$ where higher e denotes more effective ISRM governance. We treat the deadweight loss from influence as

$$L(e, \mathbf{k}, c) = \left(\frac{\tau}{2}\right)(1 - e)(\sum_i (k_i - \tilde{k}_i)^2 + \sum_i (c_i - \tilde{c}_i)^2) \quad (\text{A.4})$$

where $(\tilde{k}_i, \tilde{c}_i)$ denote planner allocations. This nests the bright–dark duality in the manuscript by letting e continuously attenuate misallocation.

Assumption A.1 (Technological and governance regularity). *For all i , f is twice continuously differentiable, strictly concave, and satisfies Inada conditions; H_i is concave and separably supermodular in (x_i, y_i) when $\lambda > 0$. The penalty functions ψ_s and ϕ_m are convex and differentiable. The political-loss parameter $\tau \geq 0$ and efficiency $e \in [0, 1]$ are given.*

Economic and Strategic Intuition. Rival inputs such as capital and GPU-hours follow standard concave productivity with scarcity. Datasets and models are internal public goods: their *technical* marginal cost of reuse is negligible, but their *organizational* marginal cost rises in breadth through compliance and risk. The governance index e bundles the quality of transfer pricing, access control, audit, and culture into a single discipline parameter consistent with the manuscript’s emphasis on hybrid market-hierarchy governance. Figure 1 frames these objects as the generalized ISRM that integrates ICM, IDM, and IAIM logics.

B. Planner’s problem and the internal public-good wedge

The HQ planner chooses allocations to maximize joint value:

$$\begin{aligned} \max_{\{k_i, c_i, x_{is}, y_{im}\}} \quad & \sum_{i=1}^n \theta_i f(k_i, c_i) [1 + \gamma H_i(x_i, y_i)] - \Psi_D(m) - \Psi_A(u) - L(e, k, c), \\ \text{s.t.} \quad & \sum_i k_i \leq K, \quad \sum_i c_i \leq C \end{aligned} \quad (\text{A.5})$$

Let λ_k and λ_c denote the multipliers on the rival constraints. First-order conditions for rival inputs are

$$\theta_i f_k(k_i, c_i) [1 + \gamma H_i(\cdot)] = \lambda_k, \quad \theta_i f_c(k_i, c_i) [1 + \gamma H_i(\cdot)] = \lambda_c \quad (\text{A.6})$$

Optimal nonrival reuse equates the *sum* of divisional marginal benefits with the marginal exposure cost:

$$\sum_{i=1}^n \theta_i f(k_i, c_i) \gamma \frac{\partial H_i}{\partial x_{is}} = \psi_s'(m_s), \quad \sum_i \theta_i f(k_i, c_i) \gamma \frac{\partial H_i}{\partial x_{im}} = \varphi_m'(u_m) \quad (\text{A.7})$$

Economic and Strategic Intuition. Equation (A.6) is the standard shadow-price equalization across divisions for capital and compute. Equation (A.7) is distinctive to ISRM. Because a dataset or foundation model can be reused internally, the correct benchmark is not a unit-level private margin but the *aggregate* marginal product across units, balanced against the marginal risk cost of broader reuse. Optimality therefore requires internal prices for nonrival assets to reflect the shadow value of incremental exposure, not the technical replication cost. This formalizes the manuscript's argument that nonrivalry amplifies both synergy and risk.

C. Decentralization via internal prices

Consider a decentralized ISRM where HQ posts internal prices r_K for capital, p_C for compute, p_s for dataset s , and q_m for model m . Division i solves

$$\max_{\{k_i, c_i, x_{is}, y_{im}\}} \theta_i f(k_i, c_i) [1 + \gamma H_i(x_i, y_i)] - r_k k_i - p_c c_i - \sum_s p_s x_{is} - \sum_m q_m y_{im}, \quad (\text{A.8})$$

If HQ sets

$$r_k = \lambda_k, p_c = \lambda_c, p_s = \psi'_m, q_m = \phi'_m(u_m), \quad (\text{A.9})$$

then the decentralized outcome implements the planner allocation in (A.5) when $e = 1$.

Proposition A.1 (Transparency discipline and welfare loss from mispricing). *Under Assumption A.1, the price system (A.9) decentralizes the first-best. For perturbations $\{\Delta p_s, \Delta q_m\}$ around these shadow prices, the resulting welfare loss is locally quadratic in the wedges:*

$$\Delta W \approx \frac{1}{2} (\sum_s \kappa_s (\Delta p_s)^2 + \sum_m \nu_m (\Delta q_m)^2)$$

for positive curvature weights κ_s, ν_m determined by the aggregator H_i and the exposure functions ψ, ϕ .

Economic and Strategic Intuition. Internal prices that equal shadow values transmit the correct scarcity information to projects. The distinctive feature is that the price of a nonrival asset should rise with reuse breadth because the organization faces convex exposure costs. When prices deviate from these shadow values, ISRM governance distorts which units tap the shared assets, and the deadweight loss scales with the square of the mispricing wedges. This provides a precise rationale for transparent metering, chargebacks, auctions for GPU time, and API-level quotas described in the cases, and it ties the “bright side” directly to the credibility of internal prices.

D. Diversification as the expansion of recombinable re- sources

Let n denote the number of business lines. Entry into a new line j contributes a baseline cash flow $\bar{\pi}_j$, a vector of data novelty $z_j \in \mathbf{R}^S$, and fixed organizational costs $\kappa_0 + \kappa_1 n$. Let $\theta_D \geq 0$ capture the firm's orientation toward data and AI, and $s \geq 1$ the scale of shared platforms that amplify reuse. The ISRM-enabled synergy term is modeled as

$$S(n; \theta_D, s) = \theta_D s \cdot G\left(\sum_{j=1}^n g(z_j)\right), \quad (\text{A.10})$$

with G concave and g increasing and more concave in overlap. Total value is

$$V(n) = \sum_j \bar{\pi}_j + S(n; \theta_D, s) - (\kappa^0 + \kappa^1 n). \quad (\text{A.11})$$

Proposition A.2 (Data orientation and platform scale raise optimal scope). *Suppose candidate entries are ordered by decreasing $g(z_j)$. The optimal scope n^* is the largest n for which the marginal contribution $\Delta V(n) \geq 0$. Then $\partial n^* / \partial \theta_D > 0$ and $\partial^2 n^* / \partial \theta_D \partial s > 0$.*

Economic and Strategic Intuition. Data orientation magnifies the payoff to incremental variety because each new business adds reusable features to the shared data/model base. Platform scale s amplifies this effect by lowering reuse frictions and increasing cross-unit access, which the manuscript describes as the infrastructural bright side of ISRMs. When θ_D and s are large, the firm tolerates broader scope because the internal option value of recombination outweighs additional coordination costs.

To formalize unrelated diversification, let $\delta_j \in [0, 1]$ denote the novelty of the candidate line's data relative to the incumbent corpus, with $\delta = 1$ signifying orthogonality. If g is strictly concave in overlap, the marginal synergy $\partial S / \partial n$ is increasing in δ_j , implying a preference for entries that deliver novel data even if product-market relatedness is low.

Economic and Strategic Intuition. Unrelated diversification appears attractive when viewed through the lens of *resource* relatedness rather than narrow product proximity. A project that is product-wise distant can be highly valuable if it imports orthogonal data that expand the frontier of feasible recombinations. This reframes the traditional relatedness criterion by centering nonrival resources.

E. Innovation as recombination intensity

Let division i 's innovation arrivals follow a Poisson process with intensity

$$\lambda_i = \lambda_0 + \lambda_1 e H_i(x_i, y_i), \quad (\text{A.12})$$

where e is ISRM efficiency. Aggregate innovation is

$$\Lambda(n, e) = \sum_{i=1}^n \lambda_i = n \lambda_0 + \lambda_1 e \sum_{i=1}^n H_i(x_i, y_i). \quad (\text{A.13})$$

Proposition A.3 (Breadth and governance are complements for innovation). *Under the planner allocation, $\partial \Lambda / \partial n > 0$ provided H_i rises with the breadth of reusable assets, and $\partial^2 \Lambda / (\partial n \partial e) > 0$.*

Economic and Strategic Intuition. Scope expands the menu of building blocks; governance quality e determines how quickly and widely those blocks circulate. The cross-partial positivity formalizes the manuscript's claim that good ISRMs not only raise the level of innovation but also increase the marginal return to diversification. Weak governance, in contrast, turns breadth into congestion and politics, attenuating recombination.

F. Valuation and the digital diversification discount

Let market value M reflect productive value net of agency and regulatory exposures:

$$M = V(n) - \Omega(n; 1 - e) - Y(\mathbf{m}, \mathbf{u}), \quad (\text{A.14})$$

where Ω captures influence and empire-building losses and Y the expected regulatory/penalty burden induced by breadth of reuse. Let $\alpha \in [0, 1]$ index the strategic salience of data/AI, scaling the synergy term (A.10).

Proposition A.4 (Governance compresses the diversification discount in data-intensive environments). *Define the discount Δ as the difference in M/A between a focused firm and its diversified counterpart. Then $\partial\Delta/\partial e < 0$, and the moderation is stronger when α is larger, i.e., $\partial^2\Delta/\partial e \partial\alpha < 0$.*

Economic and Strategic Intuition. As governance strengthens, political leakages shrink and more of the recombination surplus is capitalized, especially when data and AI drive value creation. In such settings, investors rationally penalize scope less because internal markets substitute for missing external markets and reveal disciplined allocation through internal prices and metering. This is the valuation counterpart of the innovation complementarity in Proposition A.3.

G. Regulatory boundary conditions as reuse caps

Model regulation as a cap $r \in (0, 1]$ on admissible reuse breadth: $x_{is} \leq rn$ and $x_{is} \leq rn$ for all s, m . Let the planner reoptimize under these constraints.

Proposition A.5 (Innovation loss and entrenchment from integration caps). *Under the cap r , $\partial\Delta/\partial r > 0$ whenever recombination contributes positively to H_i . If an incumbent I holds*

legacy stocks (D_0, A_0) usable regardless of r , while an entrant E must rely on cross-unit integration to build H , then $\partial(\Pi_I - \Pi_E)/\partial r > 0$, where Π_J denotes profit for $J \in \{I, E\}$.

Economic and Strategic Intuition. Integration caps reduce the feasible set of recombinations and thus blunt the principal engine of digital innovation. Because incumbents can monetize pre-existing stocks with less need for incremental integration, such caps differentially burden entrants that depend on breadth creation, thereby entrenching incumbents. This reproduces the manuscript’s policy boundary-conditions logic in a welfare framework.

F. Co-insurance of digital infrastructure

Let each division’s compute demand shock be X_i with mean $\bar{x}$, variance σ^2 , and correlation $\rho \in [0, 1)$. Provisioning idiosyncratically requires capacity for each unit’s tail, while pooling through a common ISRM requires capacity for the tail of $\sum_i x_i$. For any convex idle-capacity cost h , Jensen’s inequality implies

$$\mathbb{E}h\left(\sum_i x_i\right) < \sum_i \mathbb{E}h(x_i) \text{ when } \rho < 1.$$

Economic and Strategic Intuition. Pooling smooths idiosyncratic bursts in GPU demand and lowers the expected cost of slack, freeing capital for experimentation. The co-insurance channel is purely technological and complementary to the pricing channel in Section C: auctions or metered chargebacks help ration the common pool, while the pool itself lowers aggregate cost.

I. Influence costs as wedges in shadow-price equalization

Suppose unit i exerts political pressure with weight $w_i \geq 0$. A reduced-form perturbation to division i 's objective adds $\mu(1 - e)w_i(k_i + c_i)$. The rival FOCs in (A.6) become

$$\theta_i f_k(k_i, c_i)[1 + \gamma H_i] = \lambda_k - \mu(1 - e)w_i, \quad \theta_i f_c(k_i, c_i)[1 + \gamma H_i] = \lambda_c - \mu(1 - e)w_i.$$

Economic and Strategic Intuition. Political power acts like a shadow subsidy for input consumption. Higher e compresses these wedges toward zero by strengthening rule-based allocation and auditability. The dispersion in marginal products across units becomes a sufficient statistic for misallocation, connecting the theory to measurement.

J. Dynamic option value of experimentation

Let launching a project require fixed setup F . A shared ISRM reduces per-project setup through reusable pipelines and libraries: $F(e, n) = F_0 - \zeta e \log(1 + n)$ with $\zeta > 0$. For success probability p and benefit B , the real-option value from n parallel bets is

$$\mathbb{V}(n, e) = 1 - (1 - p)^n - \frac{nF(e, n)}{B}.$$

Economic and Strategic Intuition. Platformization reduces the cost of trying and thus raises the optimal breadth of exploration. Governance enters because reusable assets are only as valuable as the firm's ability to make them discoverable, safe, and quick to integrate; stronger e magnifies the option value by lowering F more steeply in scope.

K. Empirical mapping

The theory yields observables that can be operationalized in a measurement program. ISRM

efficiency e can be proxied by the time-to-access approved datasets and models, by the share of projects employing cross-unit assets, and by the dispersion of internal marginal products for rival inputs inferred from usage and output elasticities. Data orientation θ_D is reflected in the prevalence of data catalogs, internal APIs, and analytics talent. Data novelty for entries can be captured by content-based distances between new-business data schemas and the incumbent corpus. Innovation intensity aligns with release cadence, forward citations, or weighted feature velocity. Reuse penalties ψ and ϕ can be calibrated from audit logs and incident probabilities against penalty schedules or instrumented with policy shocks. Since Figure 1 positions ISRMs as the synthesis of ICMs, IDMs, and IAIMs, cross-country and cross-regime comparisons are natural designs for identifying the role of regulation and institutional caps on reuse.

L. Connection to the manuscript’s cases

The internal prices in (A.9) map to transfer-pricing disciplines for cloud and models emphasized in the Amazon and Microsoft cases; the recombination aggregator H_i captures Google’s and Alibaba’s cross-service data/model reuse; and the political wedges reflect the influence dynamics documented across all cases. The co-insurance logic explains shared-infrastructure efficiencies during demand spikes. The regulatory cap r mirrors the constraints highlighted in the policy discussion and shows how integration limits dampen innovation while privileging incumbents with legacy stocks. These mappings clarify how the qualitative narratives instantiate the mechanisms in this appendix.

Appendix II. Case selection, sources, and limitations

Case selection rationale

We selected Amazon, Google, Microsoft, Alibaba, and Tencent as illustrative cases because they represent leading diversified technology firms that (i) operate across multiple industries, (ii) manage vast pools of data, AI, and digital infrastructure, and (iii) have publicly documented governance mechanisms that resemble Internal Strategic Resource Markets (ISRM). These firms are frequently studied in both academic and practitioner literatures as archetypes of digital-era diversification and internal market design. Selecting across U.S. and Chinese contexts also provides variation in institutional regimes, allowing us to highlight regulatory contingencies.

Purpose of the cases

The cases are intended as theory-informed illustrations of our propositions rather than as systematic empirical tests. They demonstrate the plausibility of ISRM as governance mechanisms by showing how internal exchanges of digital resources operate in practice, how they generate value, and how they invite political or regulatory hazards.

Sources of evidence

Case material was drawn from a combination of:

- Public company documents (e.g., annual reports, SEC filings, shareholder letters, press releases);
- Executive speeches and interviews (e.g., Jeff Bezos's 2002 API mandate memo, Satya Nadella's "One Microsoft" communications);
- Industry and journal analyses (Harvard Business Review, Financial Times, Wall Street

Journal, Wired, Caixin);

- Regulatory filings and rulings (e.g., EU Commission reports on Google’s data practices, Chinese regulatory announcements on Alibaba/Ant Group);
- Secondary academic sources (e.g., peer-reviewed articles and case studies on digital platforms, diversification, and internal capital markets).

Summary table of case sources

Firm	ISRM Mechanism	Illustrative Sources (Examples)
Amazon	API mandate; AWS transfer pricing	Bezos (2002) memo; AWS documentation; Cusumano & Gawer (2014); FT/WSJ analyses
Google	Unified data pool; AI model reuse	EU Commission (2017); HBR on data strategy; Kaplan & Vakili (2015); industry reports
Microsoft	Azure internal pricing; Microsoft Graph	Nadella’s “One Microsoft” speeches; company blogs; analyst reports on Azure; acquisition integrations
Alibaba	Data Middle Office; AliCloud credit system	Ozalp et al. (2022); Chinese regulatory filings; company white papers; Caixin articles
Tencent	Tech Committee; CSIG cloud marketplace	Caixin and industry reports; Tencent annual reports; accounts of “mountain strongholds” culture

Limitations of illustrations

These cases have several limitations. The selection is not exhaustive: many smaller or non-digital firms are also experimenting with internal data and AI markets, but public evidence is limited.

The cases therefore represent illustrative archetypes rather than a representative sample.

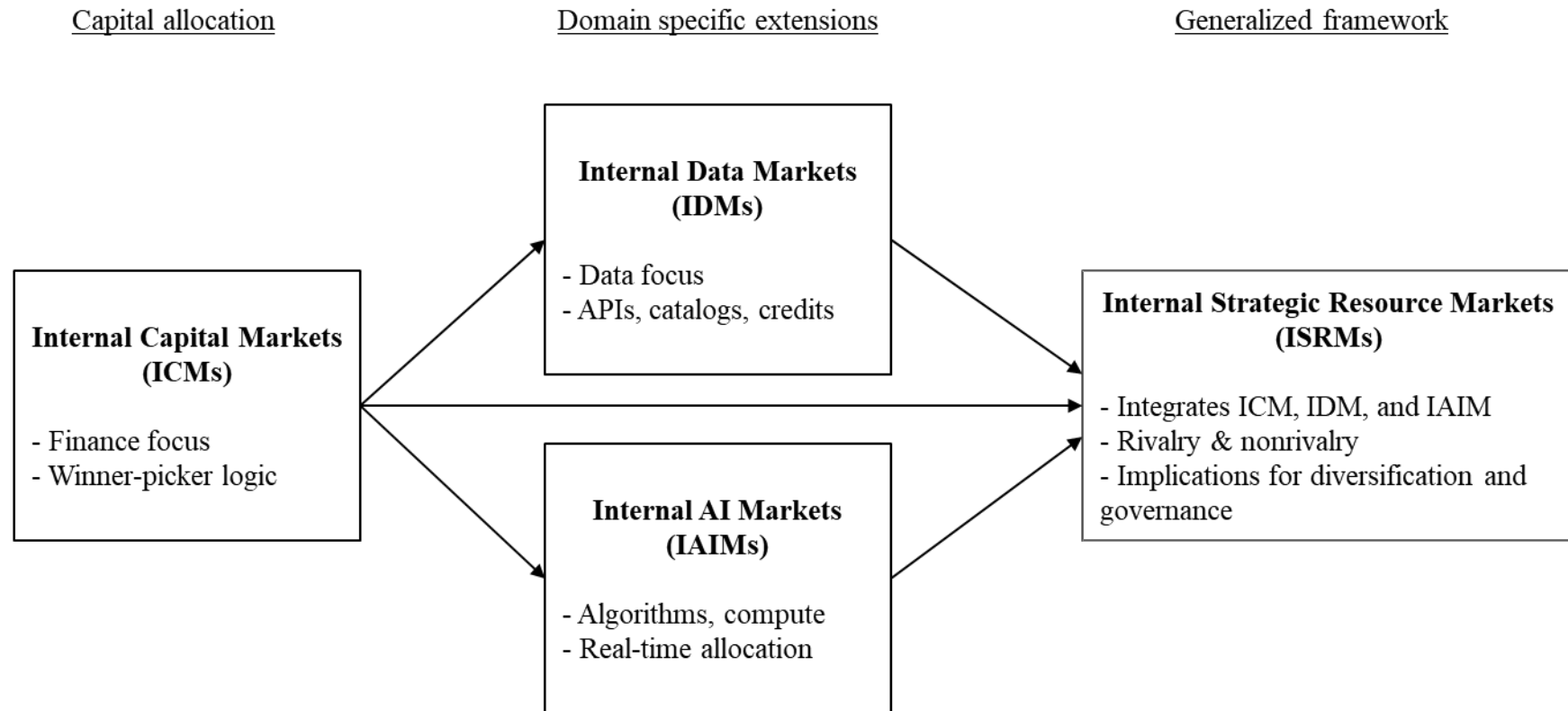
Furthermore, our reliance on secondary data constrains the level of detail available, particularly regarding internal decision-making processes or political bargaining dynamics. Finally, while the cases are used to support theoretical propositions, they should not be interpreted as formal empirical validation; future research employing longitudinal designs, proprietary datasets, or

fieldwork will be required to test the generalizability of ISRMs and their performance consequences.

Role in the manuscript

Given the limitations, we position these cases as plausibility probes that enrich the theoretical framework. They demonstrate how ISRMs manifest in practice, provide variation across contexts, and highlight observable implications that future empirical research could examine. This use is consistent with the manuscript's conceptual purpose: to develop a novel theoretical framework for internal strategic resource markets in the digital age.

Figure 1. Conceptual lineage of internal strategic resource markets (ISRM)



Note: This figure depicts ISRM as a unifying governance framework that integrates the logics of Internal Capital Markets (ICMs), Internal Data Markets (IDMs), and Internal AI Markets (IAIMs). Unlike prior forms, ISRM govern both rival resources (capital, compute) and nonrival resources (data, AI). The distinctive role of nonrivalry is that it enables resources to be redeployed across divisions at near-zero marginal cost, amplifying both synergies (innovation, recombination, co-insurance) and hazards (duplication, lobbying, regulation). In this sense, ISRM extend classic internal-market theory while reframing the diversification debate: value creation depends less on diversification per se than on the governance quality and institutional boundaries that shape these internal exchanges.