HEART INFINITY: HOW HYPERCONNECTED ECOSYSTEMS ARE ADAPTING, REINVENTING AND TRANSFORMING THE DIGITAL BUSINESS ECOSYSTEM

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Dedication

To my wife, whose infinite patience, persistence, and perseverance turned every challenge into opportunity and every uncertainty into infinite possibility; and to my daughter, whose tender sketches, gentle chuckles, and curious questions ignited curiosity and illuminated the path to the fascinating world of digital ecosystems.

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ABSTRACT

HEART INFINITY: HOW HYPERCONNECTED ECOSYSTEMS ARE ADAPTING, REINVENTING AND TRANSFORMING THE DIGITAL BUSINESS ECOSYSTEM

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Abstract: A decade ago, the world's most valuable firms sold devices, chips, or software. Today, their power flows from something less tangible yet infinitely more transformative: hyperconnected ecosystems. These living networks dissolve traditional industry boundaries and fuse the physical, digital, and cognitive worlds into an adaptive continuum—finance with mobility, healthcare with AI, energy with semiconductors. Artificial intelligence now acts as the connective tissue of this convergence, enabling new architectures of value creation. By 2030, digital business ecosystems (DBEs) could generate US$70–100 trillion—nearly a third of global GDP (McKinsey and Company, 2023). The World Economic Forum (2023) identifies them as the new epicentre of competitiveness, where advantage stems not from ownership, but from orchestration.

The scale of this transformation is unprecedented. Ten firms—Apple, Microsoft, Amazon, Alphabet, Meta, NVIDIA, Tesla, TSMC, Broadcom, and Samsung—collectively command a market capitalization exceeding US$20 trillion (CompaniesMarketCap, 2024). Several are formally designated as "gatekeepers" under the EU's Digital Markets Act (European Commission, 2023), underscoring both their indispensability and the scrutiny they attract. Yet beneath this dominance lies a paradox: fewer than 10 percent of enterprises have successfully scaled their ecosystems (Jacobides, Cennamo and Gawer, 2018). Why do some transcend industries while others stall? What explains the persistent gulf between ambition and execution—and what hidden rhythms distinguish those who succeed?

This study answers through a multi-layered empirical journey spanning ten global leaders and over one hundred executives. From 2,500 coded insights emerged HEART Infinity—a living, evidence-based operating system that unites strategy and execution in a regenerative loop. Unlike static transformation models, HEART Infinity functions as a dual-loop architecture where strategy breathes through execution and execution regenerates strategy. Its nine interdependent elements—PRISM, BADGE, STAGE, PIVOT, EPICS, EVOLVE, MODEL, SCALE, VALUE—form an infinite rhythm of *sense–align–execute–learn*, enabling ecosystems to evolve coherently rather than chaotically.

Empirically grounded in the STAGE taxonomy, this architecture links institutional clarity, readiness, adaptability, and orchestration, transforming data into design and design into learning. The findings reveal that leadership in digital ecosystems is no longer about control but coherence—the ability to harmonize dualities such as competition and collaboration, innovation and governance, growth and responsibility. HEART Infinity reframes transformation as a living philosophy and science: a rhythm through which institutions, technologies, and people evolve together. It bridges policy and practice,

strategy and execution, analytics and emotion—demonstrating that in the ecosystem era, advantage flows from orchestrating adjacency rather than owning assets.

The central insight is both strategic and human: digital business ecosystems are the new operating system of the global economy, and coherence—measured not by control but by rhythm—will define the next generation of institutional and corporate leadership. HEART Infinity provides that rhythm—a way for systems to learn, leaders to orchestrate, and organizations to rediscover what it means to place heart where it truly belongs: at the centre of the infinite.

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INTRODUCTION

1.1 Introduction

The digital economy is entering a defining era. Traditional industry boundaries, once rigid, are dissolving into expansive digital business ecosystems (DBEs) that cut across sectors and geographies. These ecosystems thrive by linking industries into living networks—finance with mobility, healthcare with AI, energy with semiconductors—where the convergence of physical, digital, and connected technologies enables value creation at a scale no single firm can achieve alone (World Economic Forum, 2023). Artificial intelligence accelerates this transformation further, giving rise to entirely new business models, products, and services that redefine what firms can offer and how they compete.

This transformation has elevated DBEs from niche strategy to global economic force. The ten most valuable ecosystem leaders—Apple, Microsoft, Amazon, Alphabet, Meta, NVIDIA, Tesla, TSMC, Broadcom, and Samsung—together command a market capitalization exceeding US$20 trillion (CompaniesMarketCap, 2024). Their influence stretches far beyond valuation: they shape global standards, orchestrate supply chains, and in some cases have been formally recognized as "gatekeepers" by regulators under the European Union's Digital Markets Act (European Commission, 2023). The sheer speed and scale of this rise highlight the structural power of ecosystems to unlock growth, redistribute value, and reshape entire industries.

And yet, success in DBEs is neither automatic nor widespread. Fewer than one in ten enterprises have managed to scale their ecosystems effectively (Jacobides, Cennamo and Gawer, 2018). Many organizations set ambitious goals but stall in execution, unable to bridge the gap between intent and outcome. This paradox frames the central puzzle of

this research: why do some firms turn ecosystems into engines of growth and advantage, while others falter despite equal ambition?

To address this, the study integrates insights from ten global leaders and a survey of more than 100 executives and practitioners worldwide. The research is guided by three core questions:

RQ1: What strategic choices and execution practices differentiate leading firms in digital business ecosystems?

RQ2: What barriers and execution challenges hinder firms from realizing their DBE ambitions?

RQ3: What capabilities and practices enable firms to overcome these barriers and scale DBE success?

Together, these questions explore not only what leaders do differently but also how ecosystems can be systematically designed and scaled. The analysis culminates in the HEART Infinity, a practical blueprint that synthesizes patterns across technology, strategy, innovation, governance, and sustainability.

This introduction sets the strategic and academic foundation for the thesis. Chapter 1 begins by situating DBEs within the broader landscape of digital transformation, reviewing the literature on platforms, ecosystems, and enterprise strategy. It establishes the theoretical roots and research gaps that motivate this study, providing the groundwork for the empirical exploration that follows.

1.2 Research Problem

Despite the transformative potential of digital business ecosystems (DBEs), most enterprises struggle to translate ambition into realized impact. A small cadre of global leaders—Apple, Microsoft, Amazon, Alphabet, Meta, NVIDIA, Tesla, TSMC, Broadcom,

and Samsung—have orchestrated DBEs at scale, yet fewer than 10% of firms worldwide have succeeded in doing so (Jacobides, Cennamo and Gawer, 2018). This stark disparity underscores a critical research problem: while DBEs are often celebrated, the internal and external barriers to building, governing, and scaling them remain underexplored.

At the heart of the problem lies a tension between strategic intent and execution capability. Many organizations articulate visionary ecosystem ambitions but fail in practice. Common obstacles include technological complexity and integration challenges, governance ambiguity and control dilemmas, regulatory friction across jurisdictions, and misalignment between sustainability goals and business incentives. Scholars have highlighted these tensions in ecosystem contexts, such as managing complementarities, balancing openness and control, and coping with externalities across actors (Jacobides, 2024; Gawer, 2022).

The gap is both managerially consequential and theoretically meaningful. On the practice side, firms risk wasted investment, reputational damage, and regulatory backlash if they cannot scale ecosystem initiatives. On the theory side, while research on platforms and ecosystems has advanced in areas such as value co-creation, network externalities, and governance (Gawer, 2022; Kretschmer et al., 2022), few studies systematically link strategic choices, frictions in execution, and repeatable success patterns across domains such as technology, innovation, governance, and sustainability.

Addressing this problem is urgent. As digital transformation accelerates, DBEs are projected to contribute up to US$70–100 trillion by 2030 (McKinsey, 2023). Failure to understand how ecosystem leadership is built—not just envisioned—will leave many firms stranded in pilot purgatory. This research therefore seeks to uncover the hidden fault lines between ambition and execution, identify the structural barriers, and map the enabling practices that distinguish leaders from laggards.

1.3 Purpose of Research

The purpose of this research is to investigate how leading firms build, govern, and scale digital business ecosystems (DBEs), and why most enterprises struggle to replicate their success. DBEs are increasingly recognized as the organizing architecture of the digital economy, dissolving traditional industry boundaries and fusing physical, digital, and connected technologies (Yoo, Henfridsson and Lyytinen, 2010; Gawer, 2022). Scholars and practitioners alike argue that DBEs are no longer optional but have become central to innovation, competitiveness, and resilience (Jacobides, Cennamo and Gawer, 2018; World Economic Forum, 2023).

Yet, despite their prominence, a gap persists between strategic ambition and executional reality. While a handful of global leaders—Apple, Microsoft, Amazon, Alphabet, Meta, NVIDIA, Tesla, TSMC, Broadcom, and Samsung—command over US$20 trillion in combined market capitalization through ecosystem-based models, fewer than 10% of enterprises worldwide have scaled DBEs effectively (McKinsey, 2023; Jacobides, 2024). The persistence of this gap highlights the need for a systematic study of the strategic choices, execution barriers, and enabling practices that define ecosystem leadership.

This study therefore aims to achieve three interlinked goals. First, to analyze the strategic choices and execution practices that differentiate leaders in DBEs. Second, to identify the systemic frictions—technological, organizational, regulatory, and sustainability-related—that hinder firms from realizing ecosystem ambitions. Third, to distill the enabling capabilities and repeatable success patterns that allow select firms to overcome these barriers. By integrating insights from ten global ecosystem leaders and a survey of over 100 executives and practitioners, the research develops and validates the

HEART Infinity, a practical blueprint for firms seeking to navigate and lead in the ecosystem era.

Ultimately, the purpose of this research is to bridge the gap between aspiration and reality, moving the conversation beyond the celebration of ecosystems to a grounded understanding of how they are built, governed, and sustained.

1.4 Significance of the Study

This study is significant both academically and managerially because it addresses one of the most pressing questions of the digital economy: why do so few firms succeed in scaling digital business ecosystems (DBEs) despite their recognized potential?

From a theoretical perspective, the study extends the growing literature on digital platforms and ecosystems (Jacobides, Cennamo and Gawer, 2018; Gawer, 2022). While prior research has emphasized value co-creation, network effects, and governance mechanisms (Kretschmer et al., 2022; Tiwana, 2014), few works systematically connect strategic intent, execution barriers, and enabling practices across multiple domains such as technology, strategy, innovation, governance, and sustainability. By examining DBEs holistically, this research helps fill a critical scholarly gap and contributes to advancing ecosystem theory with evidence from both case analysis and executive survey data.

From a practical perspective, the study provides guidance to executives, policymakers, and ecosystem participants who face urgent decisions about how to position themselves in the emerging digital economy. For corporate leaders, DBEs are no longer abstract concepts but central to competitive advantage: by 2030, they could generate between US$70–100 trillion, nearly one-third of global GDP (McKinsey, 2023). However, fewer than 10% of enterprises have successfully scaled ecosystems (World Economic Forum, 2023), underscoring the need for actionable insights. By distilling lessons from ten global leaders with a combined market capitalization exceeding US$20 trillion, this study

identifies repeatable patterns that can guide firms in navigating complexity, mitigating risks, and achieving sustainable growth.

Finally, the study is significant for policy and society. Ecosystem leadership is now intertwined with broader concerns about regulation, fairness, and sustainability. Several DBE leaders have been designated as "gatekeepers" under the EU Digital Markets Act (European Commission, 2023), reflecting both their indispensability and the scrutiny they attract. Understanding how ecosystems can be governed responsibly—balancing growth with responsibility for people and planet—has implications that extend beyond firms to markets, regulators, and civil society. In sum, this research contributes to academic knowledge, managerial practice, and policy discourse by providing a structured blueprint for understanding and leading in the ecosystem era.

1.5 Research Purpose and Questions

Building on the research problem, the purpose of this study is to examine how leading firms design, govern, and scale digital business ecosystems (DBEs), and why most enterprises fall short of replicating their success. DBEs are widely recognized as a central organizing logic of the digital economy, enabling value co-creation and cross-industry innovation (Yoo, Henfridsson and Lyytinen, 2010; Jacobides, Cennamo and Gawer, 2018). Yet, while ecosystem leadership has propelled a handful of firms to unprecedented market dominance, most organizations continue to face structural and executional barriers (World Economic Forum, 2023; McKinsey, 2023).

Specifically, this study seeks to uncover the gap between strategic intent and executional reality by exploring three interrelated dimensions:

1. Strategic Choices — how firms define and align their DBE strategies (Tiwana, 2014; Gawer, 2022).

2. Execution Barriers — what frictions prevent organizations from realizing ecosystem ambitions (Kretschmer et al., 2022; Jacobides, 2024).
3. Enabling Practices — what repeatable patterns allow firms to overcome barriers and achieve scale (Adner, 2017; Selander, Jarvenpaa and Henfridsson, 2013).

These dimensions are framed through three central research questions (RQs):

RQ1: Strategic Intent - what strategic choices and execution practices differentiate leading firms in digital business ecosystems? (*Purpose*: To understand how top firms define, align, and operationalize their DBE strategy for competitive advantage).

RQ2: Frictions - what barriers and execution challenges hinder firms from realizing their DBE ambitions? (*Purpose*: To surface systemic gaps between strategic intent and actual outcomes, including technical, organizational, and governance frictions).

RQ3: Success Patterns - what capabilities and practices enable firms to overcome these barriers and scale DBE success? (*Purpose*: To identify repeatable patterns, design principles, and capabilities that drive superior DBE performance).

Together, these research questions provide a strategic storyline: A) RQ1 explores intent and differentiation—what leaders do well. B) RQ2 reveals frictions and barriers—what prevents execution. C) RQ3 identifies enablers and success patterns—how firms overcome challenges and scale.By answering these questions, the study not only advances scholarly understanding of ecosystems but also offers executives and policymakers a structured blueprint for navigating the complexities of DBEs.

1.6 Research Objectives

Given the exploratory and integrative nature of this study, the research does not test hypotheses in the traditional positivist sense. Instead, it pursues a set of interrelated objectives designed to bridge the gap between strategic ambition and executional reality in digital business ecosystems (DBEs).

The objectives are:

1. To analyze the strategic intent of leading firms in DBEs, examining how they define, align, and operationalize ecosystem strategies for competitive advantage (Tiwana, 2014; Jacobides, Cennamo and Gawer, 2018).
2. To identify systemic barriers and frictions—technical, organizational, governance, and sustainability-related—that prevent firms from realizing their DBE ambitions (Kretschmer et al., 2022; World Economic Forum, 2023).
3. To uncover enabling practices and repeatable patterns that allow firms to overcome these barriers and scale DBE success, focusing on capabilities such as orchestration, innovation management, and trust-building (Adner, 2017; Gawer, 2022; Selander, Jarvenpaa and Henfridsson, 2013).
4. To synthesize insights into a practical framework (HEART) that can guide both scholars and practitioners in navigating the complexities of DBEs. This framework integrates findings across technology, strategy, innovation, governance, and sustainability, aligning with emerging academic and managerial discourses on digital transformation (McKinsey, 2023; European Commission, 2023).

By pursuing these objectives, the study contributes to both theory and practice: it enriches ecosystem scholarship by bridging gaps between intent, barriers, and enablers, and it provides actionable guidance to executives and policymakers tasked with steering ecosystems responsibly in the digital economy.

CHAPTER II:

REVIEW OF LITERATURE

2.1 Theoretical Framework

The literature on organizational transformation has evolved significantly in response to the rapid digitization of industries and the emergence of hyperconnected ecosystems. Early theories of management and strategy, such as Industrial Organization Economics (Porter, 1980) and the Resource-Based View (Barney, 1991), offered useful lenses for explaining firm competitiveness in relatively stable environments. However, these frameworks assume clear industry boundaries, linear value chains, and firm-centric control of resources—assumptions increasingly challenged in the digital economy (Jacobides, Cennamo and Gawer, 2018; Autio and Thomas, 2022; Nambisan et al., 2017).

The rise of Digital Business Ecosystems (DBEs) highlights the need for more dynamic and integrative theoretical approaches. In ecosystems, value creation is distributed, competition coexists with collaboration, and firms rely on shared digital infrastructures rather than solely internal resources (Moore, 1996; Adner, 2017; Parker, Van Alstyne and Choudary, 2016). Classical theories such as Innovation Diffusion Theory (Rogers, 2003), Dynamic Capabilities (Teece, Pisano and Shuen, 1997; Teece, 2007), and Institutional Theory (DiMaggio and Powell, 1983) contribute partial insights, but no single theory sufficiently explains how enterprises adapt and thrive in DBEs (Yoo, Henfridsson and Lyytinen, 2010).

In response, this research adopts a multi-theoretical lens that integrates diverse but complementary perspectives. Specifically, it consolidates five major theoretical streams:

Digital Business Ecosystems (DBE): Explains orchestration, network effects, and the co-evolution of actors (Adner, 2017; Gawer, 2022; Jacobides et al., 2018).

Blue Ocean Strategy (BOS): Highlights strategic differentiation and value creation in uncontested spaces (Kim and Mauborgne, 2015; Markides, 2008).

Transformative AI (TAI): Illuminates technology's role in enabling entirely new business models, products, and services (Brynjolfsson and McAfee, 2017; Davenport and Mittal, 2022; Iansiti and Lakhani, 2020).

Governance, Risk, and Compliance (GRC): Embeds assurance, accountability, and regulatory alignment in ecosystem design (Spitzer, 2020; Weill and Woerner, 2018; European Commission, 2023).

Environmental, Social, and Governance (ESG): Situates sustainability as both obligation and advantage, ensuring legitimacy and long-term resilience (Kotsantonis, Pinney and Serafeim, 2016; Eccles, Ioannou and Serafeim, 2014).

Together, these domains form the BADGE framework, which serves as a comprehensive readiness lens for ecosystem leadership. Each component addresses a distinct gap: DBE explains orchestration, BOS frames differentiation, TAI underscores technological disruption, GRC ensures governance, and ESG anchors sustainability.

This multi-theoretical integration aligns with calls for holistic approaches to digital transformation (Vial, 2019; Nambisan et al., 2019; Yoo et al., 2012). It provides a foundation for linking strategic readiness (BADGE) with execution capability (STAGE) and synthesizing both into the HEART Infinity, which operationalizes ecosystem maturity through 25 constructs.

Relevance to this study: By grounding the research in multiple complementary theories, this framework ensures conceptual robustness, academic legitimacy, and practical relevance. It sets the stage for exploring the three research questions on strategic intent, frictions, and success patterns in DBEs.

2.2 Digital Business Ecosystems (DBE)

The theory of business ecosystems emerged in the 1990s, with Moore (1996) framing them as interdependent communities of organizations co-evolving around shared innovations. Unlike the Industrial Organization Economics (Porter, 1980) or the Resource-Based View (Barney, 1991), which assume stable industries and firm-centric control of resources, ecosystem theory recognizes fluid boundaries and distributed interdependencies (Jacobides, Cennamo and Gawer, 2018). This shift marks a theoretical departure from linear value chain thinking toward dynamic systems where firms, partners, and institutions co-create value.

Digital Business Ecosystems (DBEs) extend this ecosystem theory into the digital era, where data, platforms, and algorithms become the organizing principles of value creation. DBE theory highlights how modular architectures and shared infrastructures enable complementarities, scalability, and network effects at unprecedented levels (Nambisan et al., 2019; Parker, Van Alstyne and Choudary, 2016; Yoo, Henfridsson and Lyytinen, 2010). As such, DBEs are often considered an evolution and synthesis of platform theory (Gawer and Cusumano, 2014), innovation networks (Powell et al., 1996), and co-opetition theory (Brandenburger and Nalebuff, 1996).

At its core, DBE theory introduces a new logic of competition and collaboration. Value is created not by single firms but through orchestration of interdependencies among diverse actors—platform owners, complementors, regulators, and users (Adner, 2017; Kapoor, 2018). Orchestration theory (Dhanaraj and Parkhe, 2006) and complementor theory (Cennamo, 2021) further enrich DBE scholarship by explaining how central hubs design participation rules, enforce standards, and allocate value. This places DBE research in dialogue with adjacent theoretical traditions, such as transaction cost economics

(Williamson, 1985), which focuses on governance efficiency, and institutional theory (DiMaggio and Powell, 1983), which addresses legitimacy pressures.

Recent studies reinforce both the opportunities and risks of DBEs. On the opportunity side, DBEs amplify innovation by enabling knowledge recombination across sectors (Autio, Nambisan and Thomas, 2018; Chen, Tongur and Ylinenpää, 2022). On the risk side, they introduce dependencies on central hubs, asymmetries of power, and heightened regulatory scrutiny (Srinivasan and Venkatraman, 2018; European Commission, 2023). These dualities align DBE theory with contemporary governance debates and sustainability imperatives, showing that ecosystems must be analyzed not only as engines of innovation but also as loci of systemic risk.

Relevance to this study: DBE theory provides the foundational perspective for this thesis. It explains the structural, relational, and dynamic properties of digital ecosystems that underpin the BADGE framework. By situating DBEs alongside related theories of platforms, networks, orchestration, and co-opetition, this research builds a comprehensive lens for examining how firms pursue strategic intent (RQ1), face execution frictions (RQ2), and develop success patterns (RQ3).

2.3 Blue Ocean Strategy (BOS)

The Blue Ocean Strategy (BOS), introduced by Kim and Mauborgne (2005), represents one of the most influential contemporary theories of strategic management. Unlike traditional competitive strategy frameworks—such as Porter's (1980) Five Forces, which emphasize rivalry within established industry boundaries—BOS advocates value creation through uncontested market space. It shifts the focus from outperforming rivals to redefining the competitive landscape, encouraging firms to pursue differentiation and low cost simultaneously.

BOS theory builds on and diverges from adjacent strategic paradigms. Whereas the Resource-Based View (Barney, 1991) highlights internal capabilities as sources of advantage, BOS emphasizes reconstruction of market boundaries and value innovation. Similarly, Dynamic Capabilities theory (Teece, Pisano and Shuen, 1997) stresses reconfiguring resources in fast-changing environments, while BOS operationalizes this by prescribing tools such as the strategy canvas, four actions framework, and value curves to guide systematic market creation.

In the context of Digital Business Ecosystems (DBEs), BOS theory is particularly salient. DBEs often thrive not by competing in existing markets but by creating new arenas of value through cross-industry integration and digital convergence. For example, platform orchestrators like Apple and Tesla combine mobility, energy, and software into ecosystems that transcend traditional industry boundaries. This resonates with BOS's central tenet of pursuing "blue oceans" of opportunity rather than "red oceans" of rivalry (Kim and Mauborgne, 2017).

Contemporary scholarship has extended BOS in two directions. First, researchers emphasize the networked nature of value creation, showing that blue oceans often emerge from collaborations across ecosystems rather than unilateral firm moves (Markides, 2008; Cennamo, 2021). Second, critiques highlight that blue oceans are not permanent—successful innovations invite imitation and regulation, eventually reintroducing competition (Ghemawat, 2002; Adner and Snow, 2010). This dynamic nature makes BOS highly complementary to DBE theory, which also views advantage as contingent on continuous orchestration rather than static positioning.

Relevance to this study: BOS provides the strategic differentiation lens within the BADGE framework. While DBE theory explains how ecosystems function structurally, BOS theory illuminates how firms design strategies that break from path dependence,

reframe competition, and unlock new growth arenas. Together, DBE and BOS theories reinforce the strategic dimension of this research, directly linking to RQ1 (strategic intent) and RQ2 (frictions in sustaining differentiation).

2.4 Transformative AI (TAI)

Artificial Intelligence (AI) has long been studied within the fields of computer science and management, but only recently has it been theorized as a transformative force capable of reshaping entire industries and ecosystems. The emerging theory of Transformative AI (TAI) positions AI not merely as a technological tool but as a general-purpose technology with the potential to create entirely new markets, business models, and institutional logics (Brynjolfsson and McAfee, 2017; Agrawal, Gans and Goldfarb, 2018).

TAI theory builds upon and extends several established traditions. From the perspective of Innovation Diffusion Theory (Rogers, 2003), AI adoption follows an S-curve of experimentation, scaling, and institutionalization. From Dynamic Capabilities (Teece, 2007), AI represents a capability amplifier, enabling firms to sense, seize, and transform opportunities at unprecedented speed. From the lens of General-Purpose Technologies (Bresnahan and Trajtenberg, 1995), AI is comparable to electricity or the internet in its capacity to enable complementary innovations across sectors.

What distinguishes TAI from earlier waves of digitization is its capacity for autonomy and generativity. Unlike traditional IT, which codifies processes, AI can learn, adapt, and create—reshaping not only operational efficiency but also strategic differentiation. Generative AI, for example, enables firms to produce novel content, designs, and code, reducing barriers to innovation and expanding the role of non-technical actors in value creation (Dwivedi et al., 2023). This has implications for ecosystem orchestration, as AI can reconfigure interactions among complementors, users, and regulators in real time.

However, TAI also introduces profound risks and tensions. Scholars highlight challenges such as algorithmic bias (O'Neil, 2016), explainability gaps (Doshi-Velez and Kim, 2017), and systemic risks from hyper-automation (Rahwan et al., 2019). These concerns connect AI to broader theories of governance and legitimacy (DiMaggio and Powell, 1983) and ethics in technology adoption (Floridi and Cowls, 2019). In DBEs, where shared infrastructures magnify both opportunities and vulnerabilities, TAI intensifies the trade-offs between innovation, control, and responsibility.

Relevance to this study: TAI forms the technology and innovation lens within the BADGE framework, complementing DBE and BOS theories. It explains how AI serves as both an enabler of new ecosystem logics (RQ1: intent) and a source of execution frictions (RQ2: risks, adoption barriers). It also anchors the transition to RQ3, where success patterns depend on balancing AI's transformative potential with governance, assurance, and sustainability.

2.5 Governance, Risk and Compliance (GRC)

The theory of Governance, Risk, and Compliance (GRC) has its roots in organizational control, corporate governance, and regulatory studies. Traditionally, governance theory emphasized how firms align managerial decision-making with shareholder interests (Jensen and Meckling, 1976; Shleifer and Vishny, 1997). Risk management theory focused on identifying, assessing, and mitigating uncertainties that threaten firm performance (Miller, 1992). Compliance theory emerged from institutional perspectives, highlighting how firms adapt to legal, regulatory, and normative pressures to secure legitimacy (DiMaggio and Powell, 1983; Scott, 2008). GRC theory integrates these traditions into a holistic framework that links assurance, accountability, and resilience (Racz, Weippl and Seufert, 2010).

In the context of digital business ecosystems (DBEs), GRC acquires new theoretical significance. Ecosystems operate across jurisdictions, involve diverse actors, and depend on shared digital infrastructures, which amplify systemic risks (Srai and Lorentz, 2019). Unlike firm-centric governance models, DBE governance requires balancing multiple stakeholders' interests while ensuring interoperability, data protection, and platform fairness (Tiwana, 2014). This aligns GRC with theories of ecosystem governance (Adner, 2017; Jacobides et al., 2018), platform regulation (Gawer and Srnicek, 2021), and institutional complexity (Greenwood et al., 2011).

Recent scholarship highlights two critical tensions at the heart of GRC in DBEs. First, the global vs. local compliance paradox: while platforms scale globally, they face increasingly fragmented regulatory regimes, from Europe's GDPR and Digital Markets Act to China's cybersecurity laws and U.S. antitrust debates (European Commission, 2023; Zenglein, 2020). Second, the innovation vs. assurance dilemma: firms must foster rapid innovation while embedding safeguards to protect trust, privacy, and systemic stability (Spagnoletti, Resca and Lee, 2015). These tensions position GRC not as a constraint but as an essential enabler of sustainable ecosystem growth.

Relevance to this study: GRC serves as the legitimacy and resilience lens in the BADGE framework. It explains why execution frictions (RQ2) often stem from governance gaps, regulatory uncertainty, or compliance failures, and how successful firms integrate GRC into their operating models. By embedding governance, assurance, and accountability into ecosystem orchestration, GRC theory links directly to the HEART Infinity's constructs of trust, risk management, and compliance maturity, providing a pathway from strategic ambition to sustainable execution.

2.6 Environmental, Social and Governance (ESG)

The theory of Environmental, Social, and Governance (ESG) has evolved from stakeholder and sustainability scholarship. Building on Stakeholder Theory (Freeman, 1984), ESG emphasizes that firm success cannot be measured solely by shareholder value but must account for broader impacts on communities, employees, and the environment. From the perspective of Institutional Theory (DiMaggio and Powell, 1983; Scott, 2008), ESG reflects how societal expectations, regulatory pressures, and normative commitments reshape corporate behavior. It also draws from Sustainability Transitions theory (Geels, 2002), which studies how industries shift toward low-carbon, inclusive, and ethical models over time. Together, ESG has become an integrative theoretical lens situating responsibility and legitimacy as central dimensions of competitiveness (Eccles and Klimenko, 2019).

In digital business ecosystems (DBEs), ESG gains heightened salience. DBEs are not only economic engines but also socio-technical infrastructures with outsized influence on energy use, labor practices, privacy, and information integrity (WEF, 2020). Platforms and ecosystem leaders face scrutiny for their environmental footprints—such as the energy intensity of data centers and AI training models (Strubell et al., 2019)—as well as social concerns, including gig worker conditions, misinformation, and algorithmic bias (Pasquale, 2015; Zuboff, 2019). Governance dimensions overlap with GRC but extend further, focusing on fairness, inclusion, and long-term societal value.

The ESG literature highlights key tensions relevant to DBEs. First, the growth vs. responsibility paradox: scaling ecosystems rapidly may create negative externalities if environmental and social safeguards are neglected (George, Howard-Grenville, Joshi and Tihanyi, 2016). Second, the short-term vs. long-term dilemma: investors and boards must balance quarterly financial performance with commitments to decarbonization, diversity, and ethical technology deployment (Ioannou and Serafeim, 2015). Firms that navigate

these tensions well often turn ESG from a compliance exercise into a source of strategic differentiation and trust.

Relevance to this study: ESG provides the sustainability and legitimacy lens in the BADGE framework, complementing DBE, BOS, TAI, and GRC theories. It illuminates how ecosystem leaders embed environmental responsibility, social inclusion, and ethical governance into strategy, directly addressing RQ2 (frictions) and RQ3 (success patterns). By linking competitiveness with accountability to people and planet, ESG grounds the HEART Infinity in principles of long-term survival and societal trust.

2.7 Multi-Theoretical Integration

While each theoretical stream reviewed—DBE, BOS, TAI, GRC, and ESG—offers distinct insights, no single lens sufficiently explains how firms navigate the complexities of digital business ecosystems (DBEs). The challenge is not only to understand *strategic intent* but also to capture the frictions that hinder execution and the practices that enable scalable success. To address this, the study advances a multi-theoretical integration that consolidates these perspectives into a coherent conceptual structure (Adner, 2017; Jacobides, Cennamo and Gawer, 2018; Nambisan et al., 2019).

The first level of integration is the BADGE framework (Blue Ocean Strategy, Artificail Intelligence, Digital Busienss Ecosystem,s, GRC, and ESG). BADGE functions as a readiness lens, assessing whether firms possess the strategic, technological, governance, and sustainability orientations necessary to compete in DBEs. It synthesizes theories of orchestration and network effects (Moore, 1996; Adner, 2017), strategic differentiation and uncontested market creation (Kim and Mauborgne, 2005), technological transformation through artificial intelligence (Brynjolfsson and McAfee, 2017; Iansiti and Lakhani, 2020), assurance and compliance under uncertainty (Power,

2007; Spira and Page, 2020), and legitimacy through ESG commitments (Eccles and Klimenko, 2019; George et al., 2016).

The second level is the STAGE framework, which translates readiness into executional capability. STAGE emphasizes five capability domains—Sustainability, Technology, Adaptive Capability, Governance, and Enterprise Innvation—that determine whether ecosystem ambitions can be operationalized. It builds on prior work in dynamic capabilities (Teece, Pisano and Shuen, 1997; Teece, 2007), organizational ambidexterity (O'Reilly and Tushman, 2013), and institutional adaptability (Scott, 2008), responding to the gap between strategic aspiration and executional maturity in DBEs (Vial, 2019).

Finally, the HEART Infinity integrates insights from BADGE and STAGE into a holistic maturity model. HEART operationalizes 25 constructs across the five domains of Hyperconnected Ecosystems are Adapting, Reinventing and Transforming, providing a structured way to assess ecosystem leadership. Unlike prior single-theory approaches, HEART bridges the gap between conceptual readiness and practical maturity, offering both diagnostic and prescriptive value (Nambisan et al., 2019; Autio and Thomas, 2022).

This multi-theoretical integration responds directly to calls in the literature for more holistic approaches to digital transformation and ecosystem studies (Vial, 2019; Nambisan et al., 2019; Autio and Thomas, 2022). It ensures that the study is not constrained by the limitations of individual theories but instead leverages their complementarities.

Relevance to this study: BADGE → STAGE → HEART forms the conceptual backbone of the research, guiding both the framing of the research questions (RQ1–RQ3) and the analysis of empirical findings. It ensures conceptual robustness, academic legitimacy, and practical applicability, anchoring the study's contribution to both scholarship and practice.

2.8 Novelty of this Research

Despite the rapid rise of digital business ecosystems (DBEs), academic work remains fragmented, often focusing on narrow aspects such as platform leadership (Gawer and Cusumano, 2014), network orchestration (Adner, 2017), or dynamic capabilities (Teece, 2007). While these studies provide valuable insights, they fall short of explaining the end-to-end architecture of ecosystem leadership, particularly how firms move from strategic intent to scalable execution and long-term legitimacy (Jacobides, Cennamo and Gawer, 2018; Nambisan et al., 2019).

This research addresses that gap by introducing a multi-theoretical integration that is novel in three ways.

First, conceptual integration. Unlike prior studies that rely on a single lens, this study fuses five major theoretical streams—DBE, BOS, TAI, GRC, and ESG—into the BADGE framework, offering a readiness lens that unites strategy, technology, governance, and sustainability. This is a direct response to calls for cross-disciplinary approaches to digital transformation (Vial, 2019; Autio and Thomas, 2022).

Second, operational extension. The study translates readiness into executional capability through the STAGE framework, drawing on theories of dynamic capabilities (Teece, Pisano and Shuen, 1997), ambidexterity (O'Reilly and Tushman, 2013), and institutional theory (DiMaggio and Powell, 1983; Scott, 2008). This step advances the literature by systematically linking strategic frameworks to executional practices, an area where empirical guidance has been limited (Warner and Wäger, 2019).

Third, holistic maturity model. By synthesizing BADGE and STAGE into the HEART Infinity, the study creates a maturity model with 25 constructs called as HEAFRT Beats. Prior models of ecosystem maturity have typically been descriptive or diagnostic

(Moore, 1996; Iansiti and Levien, 2004), but HEART is both diagnostic and prescriptive, offering firms a practical blueprint for ecosystem leadership.

Relevance to scholarship and practice. The novelty lies not only in integrating theories but also in applying them to real-world leaders. Drawing on case evidence from ten global DBE leaders and a survey of 100+ executives, the study provides empirical grounding that most integrative frameworks lack. This dual contribution—theoretical consolidation and empirical validation—positions the research at the intersection of academic rigor and managerial relevance (Eisenhardt, 1989; George et al., 2016).

2.9 Summary

This chapter has reviewed the theoretical foundations relevant to understanding digital business ecosystems (DBEs) and positioned this study within the broader strategy, technology, and management literature. Classical perspectives such as Industrial Organization Economics (Porter, 1980) and the Resource-Based View (Barney, 1991) highlight the importance of industry structure and firm resources, but they assume clear boundaries and linear value chains. Such assumptions no longer hold in the digital economy, where value creation is distributed, boundaries are porous, and ecosystems thrive on shared digital infrastructures (Moore, 1996; Adner, 2017; Jacobides, Cennamo and Gawer, 2018).

To address these dynamics, five theoretical streams were reviewed. Digital Business Ecosystems (DBE) theories illuminate orchestration, network effects, and interdependence (Moore, 1996; Adner, 2017). Blue Ocean Strategy (BOS) provides insights on strategic differentiation and value innovation (Kim and Mauborgne, 2005). Transformative AI (TAI) emphasizes the technological drivers of new business models and operating logics (Brynjolfsson and McAfee, 2017; Iansiti and Lakhani, 2020). Governance, Risk, and Compliance (GRC) highlights the assurance mechanisms needed to build

resilience in uncertain environments (Power, 2007; Spira and Page, 2020). Finally, Environmental, Social, and Governance (ESG) frameworks situate sustainability as a source of both legitimacy and long-term advantage (Eccles and Klimenko, 2019; George et al., 2016).

While each theory contributes valuable perspectives, no single lens can fully explain the strategic intent, frictions, and success patterns of DBEs. To bridge this gap, this study advances a multi-theoretical integration—the BADGE → STAGE → HEART Infinity. BADGE provides a readiness lens, STAGE translates readiness into execution, and HEART synthesizes both into a holistic maturity model with 25 constructs. This integration directly responds to calls for holistic approaches to digital transformation (Nambisan et al., 2019; Vial, 2019; Autio and Thomas, 2022).

In doing so, the chapter establishes the theoretical grounding for the study. It not only consolidates fragmented streams into an integrative model but also positions the research to make both scholarly and practical contributions. The next chapter builds on this foundation by outlining the research methodology, including design, sampling, data collection, and analysis, which operationalize the theoretical framing into an empirical study.

CHAPTER III:

METHODOLOGY

3.1 Overview of the Research Problem

The rapid acceleration of the digital economy is not merely redrawing competitive landscapes—it is dissolving them. Traditional industry boundaries, once stable markers of strategy, are giving way to ecosystems where finance meets mobility, healthcare fuses with AI, and energy intersects with semiconductors. In this new reality, advantage no longer rests on the control of internal assets but on the ability to orchestrate and participate in digital business ecosystems (DBEs) that span industries, geographies, and technologies (Jacobides et al., 2018; Autio and Thomas, 2022).

The scale of this shift is staggering. DBEs already account for a significant share of global market capitalization and are projected to generate nearly one-third of global GDP by 2030 (McKinsey, 2023; World Economic Forum, 2023). Yet behind this promise lies a paradox: while a handful of firms—Apple, Microsoft, Amazon, Alphabet, and others—have scaled ecosystems to trillions in value, fewer than 10 percent of enterprises worldwide have achieved similar success. The gap between ambition and execution remains one of the most pressing strategic puzzles of our time.

Existing theories provide only partial explanations. Industrial Organization Economics (Porter, 1980) and the Resource-Based View (Barney, 1991) emphasize market structure and firm-controlled resources, but these frameworks assume clear industry boundaries and linear value chains. Such assumptions collapse in hyperconnected ecosystems, where firms must simultaneously manage paradoxes: competition and collaboration, openness and control, global and local compliance, growth and responsibility. The Dynamic Capabilities view (Teece, 2007) and Institutional Theory

(DiMaggio and Powell, 1983) add nuance but still fall short of fully explaining how firms adapt in boundaryless networks (Adner, 2017; Nambisan et al., 2019).

Compounding this challenge is the transformative role of artificial intelligence, which enables new business models, products, and services that redefine the scope of competition, while also amplifying uncertainty. At the same time, intensifying regulatory scrutiny—such as the EU's designation of "gatekeepers" under the Digital Markets Act—highlights both the indispensability of DBEs and the governance dilemmas they invite (WEF, 2023).

Against this backdrop, the research problem comes into focus: why do some firms achieve ecosystem leadership while most stall? What strategic choices, frictions, and success patterns explain the difference? Addressing these questions requires more than incremental extensions of existing theory. It demands an integrated research design that bridges multiple perspectives and grounds them in empirical evidence from the world's most influential ecosystem leaders.

3.2 Operationalization of Theoretical Constructs

To translate conceptual foundations into empirical inquiry, this study operationalizes its theoretical constructs through a multi-stage framework. Chapter II identified five complementary theories—Digital Business Ecosystems (DBE), Blue Ocean Strategy (BOS), Transformative AI (TAI), Governance, Risk and Compliance (GRC), and Environmental, Social and Governance (ESG)—that collectively form the BADGE readiness model. BADGE highlights the imperatives of orchestration, strategic differentiation, technological transformation, institutional accountability, and sustainability (Jacobides et al., 2018; Kim and Mauborgne, 2015; Teece, 2007; DiMaggio and Powell, 1983).

Building on BADGE, the study employs the STAGE framework to capture executional dimensions of DBE performance. STAGE organizes ecosystem execution into Sustainability, Technology, Adaptive Capability, Governance, and Enterprise Innovation, reflecting calls in the literature to integrate strategy with implementation in digital transformation research (Vial, 2019; Nambisan et al., 2019). Together, BADGE and STAGE provide complementary lenses—readiness and execution—ensuring that leadership is understood as both aspiration and practice.

These foundations converge in the HEART Infinity, which operationalizes maturity across 25 constructs mapped to five capability domains: Strategy, Technology, Innovation, Governance, and Sustainability. Each construct was translated into guiding questions and indicators for both case analysis and survey design. For example, constructs such as ecosystem experimentation, data-driven strategy, AI-driven innovation, regulatory alignment, and sustainability integration were transformed into Likert-scale survey items and qualitative probes. This structured translation ensured that abstraction gave way to measurable inquiry, enabling triangulation across qualitative and quantitative evidence.

By grounding the research in BADGE (readiness), STAGE (execution), and HEART (measurement), the study ensured conceptual rigor, operational clarity, and practical relevance. This three-tiered operationalization allowed the research to capture DBE dynamics not just as theoretical constructs but as observable practices capable of answering the three research questions.

3.3 Research Purpose and Questions

The purpose of this research is to investigate how enterprises achieve leadership in digital business ecosystems (DBEs) by examining the interplay between strategic intent, execution challenges, and enabling practices. While DBEs are heralded as transformative sources of value creation, fewer than 10 percent of firms have successfully scaled them

(McKinsey, 2023; World Economic Forum, 2023). Bridging this gap between ambition and execution is not merely an academic puzzle; it is a pressing managerial imperative for firms operating in hyperconnected markets.

Guided by the theoretical foundations operationalized through the BADGE (readiness), STAGE (execution), and HEART (measurement) frameworks, this study addresses three research questions:

RQ1: Strategic Intent – What strategic choices and execution practices differentiate leading firms in DBEs?

RQ2: Frictions – What barriers and execution challenges hinder firms from realizing their DBE ambitions?

RQ3: Success Patterns – What capabilities and practices enable firms to overcome these barriers and scale DBE success?

Together, these questions form a coherent storyline: identifying what leaders do well, explaining why many firms fail to realize their ambitions, and uncovering how successful firms overcome these challenges through repeatable patterns. In this way, the inquiry extends existing theories of strategy, ecosystems, and digital transformation (Adner, 2017; Nambisan et al., 2019; Vial, 2019), while also offering practical guidance for executives grappling with the paradoxes of ecosystem leadership.

3.4 Research Design

To answer these questions, the study adopts a multi-method, qualitative-dominant design that integrates in-depth case studies with a global survey. This design balances the contextual richness of case evidence with the broader generalizability of survey data(quantitative), creating the conditions for triangulation and enhancing both validity and reliability (Yin, 2018; Eisenhardt and Graebner, 2007).

The choice of a multi-method approach reflects both the complexity of DBEs and the nature of the research problem. Ecosystems are inherently cross-boundary, spanning multiple industries, governance models, and enabling technologies. As Edmondson and McManus (2007) note, emergent and dynamic phenomena cannot be fully understood through single-method inquiry. By combining exploratory case analysis with confirmatory survey evidence, this study surfaces both firm-specific practices and cross-industry patterns.

The research design also reflects the unique vantage point of the researcher. With over two decades of professional experience in consulting and solutioning across 30+ Fortune 500 firms, 20+ countries, and multiple industries, the researcher had privileged access to senior executives and ecosystem leaders. This professional grounding informed not only the identification of case firms and participants but also the construction of instruments, ensuring they were both academically rigorous and practically relevant.

Data collection was organized into two pillars:

1. Case Studies of Ten Global DBE Leaders – Apple, Microsoft, Amazon, Alphabet, Meta, NVIDIA, Tesla, TSMC, Broadcom, and Samsung. These cases provided detailed evidence on technology, strategy, innovation, governance, and sustanability
2. Global Survey of 100+ Executives and Practitioners – curated through professional and LinkedIn networks to ensure diversity of role, geography, and industry exposure. The survey validated and extended insights from the case studies, particularly around the operationalization of DBE practices.

By blending these approaches, the design moves beyond firm-centric analysis to capture systemic, relational, and ecosystem-level dynamics, aligning with the

study's overarching purpose: decoding the strategic choices, frictions, and success patterns that define DBE leadership.

3.5 Population and Sample

The population of interest for this study comprises global enterprises that define the frontier of digital business ecosystems (DBEs). These firms are not only the world's largest by market capitalization but also the most influential in shaping the digital economy through platform-based business models, cross-sector orchestration, and ecosystem-led innovation. To ground the research in firms of systemic importance, the study selected ten acknowledged DBE leaders—Apple, Microsoft, Amazon, Alphabet, Meta, NVIDIA, Tesla, TSMC, Broadcom, and Samsung. Collectively, these firms command a combined market capitalization exceeding US$20 trillion, reflecting both their economic gravity and their centrality to the ecosystem era. Several have been formally designated as "gatekeepers" under the European Union's Digital Markets Act, underscoring their indispensability and the global scrutiny they attract.

This purposive sample was chosen for three reasons. First, their ecosystem leadership and global scale make them uniquely suited to exploring the study's three research questions on strategic choices, execution frictions, and success patterns. Second, their cross-industry linkages—spanning technology, mobility, energy, finance, and healthcare—offer a natural laboratory for studying DBEs as boundary-spanning phenomena. Third, the richness of available secondary data—including annual reports, investor briefings, analyst coverage, regulatory filings, case repositories, and industry research—enabled systematic analysis even in the absence of direct primary access.

The research applied documentary and archival methods (Bowen, 2009; Ventresca and Mohr, 2002), collating evidence into a structured database aligned with the HEART Infinity. Each data point was initially captured as a First-Order Element (FO)—a verbatim

or closely paraphrased observation or disclosure. Related FOs were consolidated into Capability Practices (CPs), representing recurring managerial routines or ecosystem practices. CPs were then clustered into Capability Domains (CDs), reflecting the aggregate dimensions of ecosystem leadership: Strategy, Technology, Innovation, Governance, and Sustainability.

This FO → CP → CD progression draws directly from the Gioia methodology (Gioia, Corley, and Hamilton, 2013), ensuring transparency, theoretical rigor, and inductive depth. The structuring allowed the research to move from raw empirical fragments to integrative constructs, anchoring insights in both practice and theory.

Thus, while the sample was deliberately narrow, it was also strategically robust. By focusing on the ten firms most central to the global DBE landscape, the study ensured that findings derived from FO–CP–CD analysis were both empirically rich and globally relevant—capturing the dynamics of firms that are not just participants but architects of the digital economy.

3.6 Participant Selection

Reaching the right participants for a study on digital business ecosystems (DBEs) is not straightforward. Unlike established enterprise technologies such as SAP or Oracle, DBEs do not have neatly organized user groups or professional associations. Executives shaping and scaling ecosystems are widely dispersed, embedded in global organizations, and often inaccessible through conventional research panels. Designing, targeting, and curating a representative sample was therefore a tall order—one that required both persistence and precision.

This study of survey quantitative analysis leveraged my personal and professional network of over 200 senior leaders and a LinkedIn community of 2,000+ professionals, carefully curated over years of consulting and solutioning with more than 30+ Fortune 500

firms across 20+ countries. This network provided rare access to executives with direct DBE exposure—individuals who not only understand their industries but also operate at the front lines of digital convergence.

The result is a participant pool with a truly global operating footprint:

Asia-Pacific (74%), North America (71.9%), Europe (69.8%), Middle East and Africa (21.9%), and Latin America (10.4%). Importantly, these numbers reflect where participants actively lead programs, serve clients, and manage operations, not merely where they are based.

Industry exposure spans BFSI/Fintech (38.5%), Healthcare/Lifesciences (26%), CPG/Retail (27.1%), Manufacturing/Automotive (16.7%), eCommerce/Software (46.9%), Public Sector (10.4%), and Energy/Natural Resources (12.5%)—domains where DBE adoption is most visible and strategically relevant.

Role distribution reflects a near-balanced split between strategic leadership (executive, VP, policy/strategy roles) and executional leadership (delivery, operations, and technology). Notably, 49% of respondents hold executive leadership roles in multi-billion-dollar organizations across services, product engineering, and consulting.

This mix was not accidental. It was the outcome of deliberate design, targeting, outreach, and balancing to ensure the study reflects both boardroom strategy and executional reality. The diversity across regions, industries, and roles mirrors the inherently global and cross-sectoral nature of DBEs, making this participant pool uniquely suited to address the research questions of strategic intent, execution frictions, and success patterns.

3.7 Instrumentation

The study employed a multi-instrument design, combining archival analysis of DBE leaders with a structured survey of executives and practitioners. This hybrid approach was essential: while firm-level documents provide the strategic voice of ecosystems, executive insights reflect the lived reality of execution. Together, these two lenses form a triangulated evidence base, capturing both organizational intent and practitioner experience (Yin, 2018).

Archival Instruments: For the ten DBE leaders, data were collected from annual reports, investor presentations, regulatory filings, analyst briefings, industry repositories, and case studies. Each source was systematically reviewed, and verbatim or closely paraphrased excerpts were entered into an Excel-based coding database. Evidence was organized through the First-Order Element (FO) → Capability Practice (CP) → Capability Domain (CD) schema, directly aligned with the HEART Infinity. This process follows the Gioia methodology (Gioia, Corley, and Hamilton, 2013), ensuring transparency in how raw disclosures were abstracted into higher-order constructs.-taxanomy.

Survey Instruments: To complement firm-level analysis, a structured survey was designed to capture practitioner perspectives. Survey questions were derived from the 25 constructs of the HEART Infinity, then classified along the three research questions (RQ1–RQ3) and five thematic domains (Strategy, Technology, Innovation, Governance, and Sustainability). This resulted in 15 direct questions designed to capture a macro-level view at the intersection of each RQ and theme. The survey combined Likert-scale ratings with targeted open-ended items, balancing quantitative comparability with qualitative richness.

The instrument was piloted with a subset of respondents for clarity and refinement, before being distributed via curated professional networks and a LinkedIn outreach pool of 2,000+ executives. Respondents represented a carefully balanced mix of strategy and

execution roles, ensuring that the survey captured both boardroom choices and operational realities.

Hybrid Design Justification: In DBE research, where formalized instruments are scarce and phenomena are rapidly evolving, this hybrid instrumentation provides robustness. Archival evidence offered longitudinal depth (Ventresca and Mohr, 2002), while the survey introduced contemporary validation from practitioners at the frontier of DBE execution (Bryman, 2016). By aligning both instruments with the FO–CP–CD schema and grounding them in the HEART Infinity, the study ensured that findings were rigorous, triangulated, and actionable.

3.8 Data Collection Procedures

The collection of data followed a dual-stream design: archival research of DBE leaders and a global survey of executives and practitioners. Together, these streams created a triangulated dataset that balanced strategic disclosure from firms with practitioner-level lived experience (Bowen, 2009; Yin, 2018).

Archival Data Collection: Evidence for the ten DBE leaders was sourced from annual reports, investor presentations, regulatory filings, analyst coverage, case repositories, and executive interviews spanning multiple years. Because disclosures related to ecosystems are rarely consolidated, this process required iterative extraction and cross-verification. Relevant insights were entered as First-Order Elements (FOs), later grouped into Capability Practices (CPs) and Capability Domains (CDs) using the Gioia methodology (Gioia, Corley, and Hamilton, 2013). By systematically triangulating multiple documents for each firm, the archival stream ensured reliability, while also capturing the strategic voice of ecosystem leadership.

Survey Data Collection: Survey administration required designing and executing a rare recruitment strategy, given that executives with substantive DBE exposure are globally

dispersed and hard to reach. Unlike established domains such as ERP or supply chain, where formal respondent panels exist, DBE expertise cuts across industries and functions, making conventional sampling impractical. To overcome this, the survey tapped into a curated professional network of over 2,000 senior LinkedIn connections, supplemented by targeted outreach.

Respondents reflected a diverse mix across industries (technology, consulting, finance, healthcare, energy, and manufacturing) and balanced representation between strategy leadership and execution leadership roles. Nearly 3/4 of respondents were executives within multi-billion-dollar organizations, engaged in product engineering, consulting, or services with either direct accountability or involved in relavent capacity with DBE centric inititives. Geographical diversity was achieved not only by where respondents were physically based but also by where they had active program responsibilities — managing DBE partnerships in Asia while headquartered in Europe, or driving platform rollouts across North America while operating from the Middle East. This approach ensured that regional spread reflected meaningful exposure and accountability, not simply physical presence.

Feet on the Ground, Network at Scale: The data collection journey itself reflects the challenges of studying an emergent domain like DBEs. Assembling this sample required designing a profile mix, targeting senior leaders, and balancing global coverage — a tall order that would not have been possible without decades of professional experience and firsthand consulting engagement with 30+ Fortune 500 firms across 20+ countries. This foundation provided both the credibility to approach participants and the insight to design instruments that resonated with their lived experience. In this sense, the dataset is not only academically rigorous but also deeply grounded in the reality of executive decision-making in the ecosystem era.

3.9 Data Analysis

The analysis followed a structured, five-step process designed to transform raw secondary evidence and survey responses into a coherent framework of ecosystem practices. This approach combined manual rigor with selective use of AI-enabled tools, ensuring both academic integrity and analytical efficiency.

Step 1: Extracting Raw Snippets (RS): The process began with the systematic extraction of RS—verbatim text fragments from annual reports, analyst notes, regulatory filings, and survey responses. Each RS represented the *underlying textual evidence* on which further coding was built. Maintaining RS ensured fidelity to original sources and provided an auditable trail for validation (Bowen, 2009; Braun and Clarke, 2006).

Step 2: Coding First-Order Elements (FOs): RS were distilled into First-Order Elements (FOs)—concise expressions of specific managerial practices, disclosures, or observations. Across the ten DBE leaders, the study captured approximately 2,500 FOs spanning the three research question dimensions. This breadth of evidence provided both granularity and diversity of perspective.

Step 3: Grouping into Capability Practices (CPs): Related FOs were aggregated into 125 Capability Practices (CPs), each representing a recurring managerial routine or ecosystem mechanism. This step surfaced convergence in practices (e.g., *Privacy by Design*) as well as divergences tied to industry, geography, or maturity level.

Step 4: Clustering into Capability Domains (CDs): CPs were then clustered into 25 Capability Domains (CDs), reflecting the five aggregate themes of ecosystem leadership: Strategy, Technology, Innovation, Governance, and Sustainability. This RS → FO → CP → CD progression followed the Gioia methodology (Gioia, Corley, and Hamilton, 2013), which emphasizes inductive rigor while allowing theoretical abstraction.

Step 5: Macro and Micro Integration: At this stage, the dataset was analyzed from two complementary perspectives:

Macro View (Adoption Tiers). Each CD was classified into one of four adoption categories:

a) Broadly Adapted – practices consistently observed across firms.
b) Moderately Adapted – practices evident but unevenly distributed.
c) Selectively Adapted – practices present only in niche contexts.
d) Zero Evidence – practices absent from available data.

This adoption-tier classification offered a bird's-eye view of how ecosystem practices diffuse across leading firms.

Micro View (HEART Lens). The same CDs were mapped against the HEART Infinity (Hyperconnected Ecosystems Are Adapting, Reengineering, and Transforming). This contextualization provided a practice-level narrative of progression: whether firms are merely adapting existing routines, reengineering them for digital scale, or transforming them into entirely new ecosystem models. Together, these perspectives enabled both breadth of comparison (macro adoption) and depth of insight (micro maturity). The integration ensured that findings could highlight not only *what practices exist* but also *how they evolve* and *where firms diverge* in their ecosystem journey.

Use of AI Tools: AI-enabled assistants (e.g., ChatGPT, Google Gemini, Microsoft Copilot) were selectively employed to augment clustering and validation tasks—identifying semantic similarity, checking redundancy, and stress-testing CP-to-CD alignments. Importantly, all coding and interpretation were performed and validated by the researcher; AI outputs served only as accelerators for human judgment (Lu et al., 2023).

Outcome: Through this layered RS → FO → CP → CD → Adoption + HEART process, the study distilled thousands of text fragments into a structured dataset of 2,500

FOs, 125 CPs, 25 CDs, 5 themes, 4 adoption tiers, and 1 integrative HEART Infinity. This dataset forms the empirical backbone of Chapters 4–6, linking raw evidence to both macro-level adoption patterns and micro-level maturity trajectories in DBEs.

3.9 Research Design Limitations

Every research design carries boundaries, and this study is no exception. In fact, the very act of investigating digital business ecosystems (DBEs)—arguably the most dynamic organizational form of our time—creates a paradox: data is abundant, yet fragmented; disclosures are rich, yet curated; practices are visible, yet often incomplete. Attempting to decode how the world's most successful firms orchestrate ecosystems is, by design, an ambitious undertaking. It is less a static analysis than a puzzle set against a moving backdrop.

First, reliance on secondary data; Much of the evidence came from annual reports, regulatory filings, investor presentations, analyst coverage, and case repositories. These sources are authoritative, but they also reflect what firms choose to reveal (Bowen, 2009; Yin, 2018). In ecosystems, where competition and collaboration coexist, omissions can be as telling as inclusions. To mitigate this, insights were triangulated across multiple document types and validated against survey evidence from practitioners.

Second, purposive focus on leaders: The study deliberately examined ten firms at the frontier of DBEs. Their combined market capitalization exceeds US$20 trillion, and several have been designated "gatekeepers" by regulators. While this purposive sampling maximizes depth and relevance, it also means that findings speak most directly to firms operating at the frontier. Smaller or less mature players may follow different paths, but the intent here was to learn from the most advanced orchestrators (Eisenhardt and Graebner, 2007).

Third, participant mix: The curated survey of over 100 executives balanced strategy and execution roles, spanning geographies and industries. Yet participation relied on professional networks and voluntary engagement, raising the possibility of non-response bias (Maxwell, 2012). That said, given the difficulty of accessing senior leaders with genuine DBE exposure, the resulting mix represents a rare and valuable dataset.

Fourth, interpretive coding: The FO → CP → CD → HEART pipeline required interpretive judgment in grouping and classifying practices. While anchored in the Gioia methodology (Gioia, Corley, and Hamilton, 2013) and supported by AI-enabled semantic checks, qualitative analysis always carries a degree of subjectivity (Silverman, 2020). This was addressed through iteration and transparency, though alternative interpretations remain possible.

Finally, temporal context: DBEs evolve faster than regulatory regimes or research cycles. The rise of AI is already reshaping business models and governance at breathtaking speed. Thus, while this study captures a snapshot of ecosystem leadership, it is a snapshot in motion.

These limitations should not be read as weaknesses but as context. They reflect the inherent difficulty—and perhaps the intellectual drama—of studying a phenomenon that blurs industries, geographies, and governance logics. DBEs sit at the intersection of multiple theories, where value emerges from connections, where boardrooms wrestle with paradoxes, and where the boundaries of competition are redrawn in real time. That the study can even attempt to systematize this space is, in itself, remarkable.

Closing bridge: With its boundaries acknowledged and its ambition clarified, this study does not claim finality—it claims relevance. What follows is not the last word on DBEs, but a carefully constructed lens on a moving target. It is a snapshot of leadership in the ecosystem era, captured at a moment when strategy, technology, and humanity collide.

And like any powerful snapshot, its purpose is not only to document, but to provoke—so that future research, future leaders, and future boardrooms will see the drama more clearly, and act with greater intent.

3.10 Conclusion

This chapter has outlined the methodological foundation of the study, tracing how evidence was identified, curated, and analyzed to illuminate the dynamics of digital business ecosystems (DBEs). By combining purposive sampling of ten global DBE leaders with a curated executive survey, the research assembled a dataset of unusual breadth and depth. Through the structured FO → CP → CD → HEART pipeline, raw snippets were transformed into meaningful patterns, bridging micro-level practices with macro-level ecosystem insights. At the same time, the chapter acknowledged the study's inherent limitations—its reliance on secondary data, purposive focus on frontier firms, interpretive coding, and the challenge of researching a phenomenon that evolves in real time. These boundaries, however, do not diminish the study's relevance. Rather, they underscore the intellectual drama of examining DBEs: a space where industries blur, governance is contested, and leadership is constantly renegotiated.

In closing, the methodology presented here offers not just rigor, but perspective. It provides a lens through which the practices of ecosystem leaders can be examined systematically, even amid complexity and flux. With this foundation in place, the study now turns to the empirical findings. Chapter 4 presents the results and synthesis, distilling what leading firms actually do to define, execute, and scale their digital business ecosystems.

CHAPTER IV:

RESULTS

4.1 Research Question One

What Strategic choices and execution practices differentiate leading firms in digital business ecosystems? - as part of Qualitative analysis, the central finding of this research is that leadership in Digital Business Ecosystems (DBEs) is not explained by the possession of any single technological advantage, market position, or governance model. Instead, it is the integration of strategic choices with disciplined execution practices across five domains—Technology, Strategy, Innovation, Governance, and Sustainability—that distinguishes leaders from laggards.

At the heart of this integration lies a pattern: leading firms build non-negotiable anchors, experiment at the frontier, and institutionalize balance across paradoxes. Anchors such as robust data foundations, proprietary stacks, and interoperability create resilience and legitimacy. Frontier practices—including co-creation, coopetition, and regenerative sustainability models—signal ambition and prepare the ground for future growth. In between, the balancing of dualities (openness and control, competition and collaboration, growth and responsibility) ensures that these firms can scale ecosystems without collapsing under their own contradictions.

Three observations crystallize this differentiation:

1. Technology as the backbone. Leaders stabilize data, AI, and infrastructure foundations, while also experimenting with modularity, developer ecosystems, and frontier architectures. They ensure that technological advantage is not episodic but institutionalized.

2. Strategy as orchestration. Leaders move beyond single-firm competitive positioning to ecosystem-scale design. They define platform boundaries, align with institutional logics, ESG acts as compliance and a strategic lever.
3. Innovation as a repeatable loop. Ecosystem leaders embed co-creation cycles with partners, align innovation with measurable value, and institutionalize AI-led reinvention. They innovate with discipline, not just speed.
4. Governance as trust architecture. Leaders design rules, escalation mechanisms, and privacy-by-design safeguards that allow participation without fragmentation. Governance becomes an enabler of scale, not just a constraint.
5. Sustainability as a license to operate. Leaders integrate carbon tracking, supply traceability, and social equity into the core of their ecosystems. They move ESG from periphery to strategy, transforming legitimacy into differentiation.

In short, what differentiates leaders in DBEs is not that they avoid paradox but that they design for it. They treat ecosystems not as extensions of the firm but as living systems that require shared trust, distributed innovation, and sustainable growth models.

This chapter therefore unpacks RQ1 across the five thematic lenses. Each subsection (4.1.1–4.1.5) presents the adoption evidence, the narrative synthesis, and the progression from broadly adopted to selective and frontier practices. Together, they reveal how leaders convert strategy into execution in ways that scale ecosystems, balance contradictions, and sustain long-term advantage.

4.1.1 Technology

Technology forms the backbone of Digital Business Ecosystems (DBEs). It determines whether ecosystems achieve resilience and scalability or collapse under fragmentation and inefficiency. Leading firms distinguish themselves not only by the

technologies they adopt but also by the ways in which they embed defensibility, interoperability, and trust into their architectures. In this sense, technology is not merely an enabler but the operating substrate on which all strategic and ecosystem choices depend.

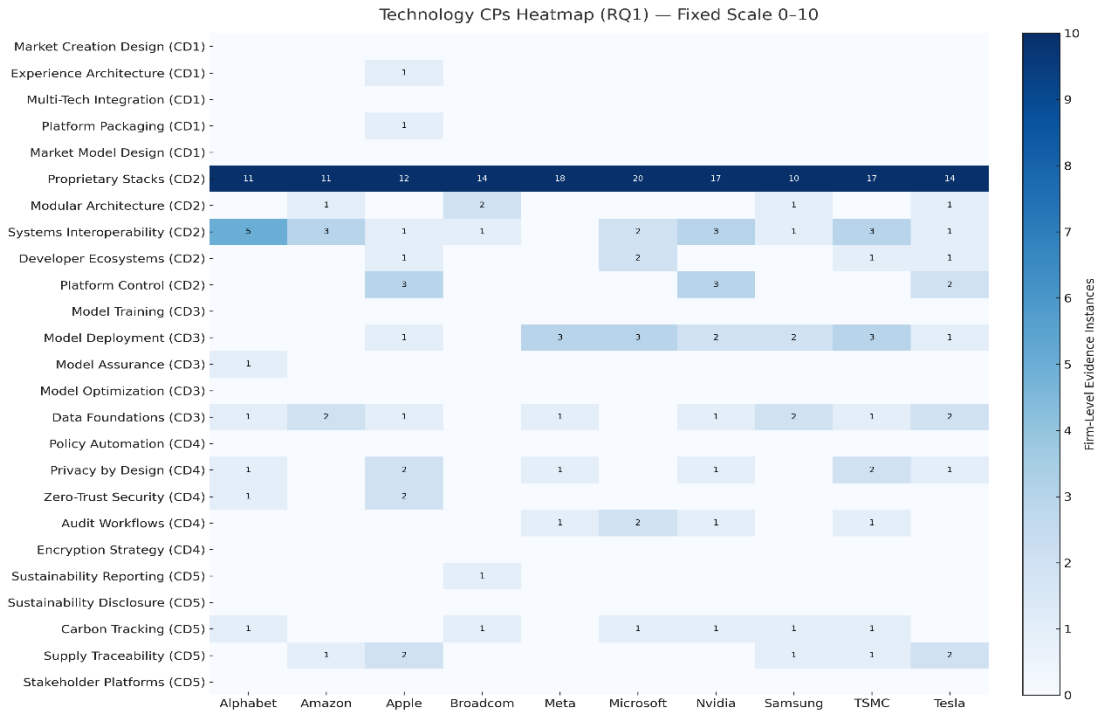

Figure 4.1.1
RQ1 – Technology CPs Heatmap

To analyze these dynamics, a heatmap approach has been applied as given above to classify adoption patterns across firms. The heatmap organizes practices into four levels: broadly adopted, moderately adopted, selectively adopted, and zero evidence. This layered structure makes visible both the common foundations that ecosystems converge on and the areas of divergence where firms either hesitate, experiment, or leave gaps. It shows at a glance where capabilities have become structural anchors, where they remain in transition, and where firms are probing the frontier of possibility without yet achieving scale.

The accompanying data table below summarizes the evidence for technology practices across capability dimensions. It highlights how firms approach model

foundations, proprietary stacks, systems interoperability, sustainable technology, and trust and controls, positioning each practice along the adoption spectrum. In doing so, the table provides a structured basis for understanding how ecosystems translate ambition into practice and where the critical gaps still persist.

RQ1 - Adaption Tiers for Technology 4.1.1

AD/ CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Collaborative Discovery		Joint IP Models (5); Cross-Sector Innovation (6)	Co-Creation Methods (2)	Partner Innovation Labs (0); Open Data Access (0)
Ecosystem Experimentation	Rapid Prototyping (8)	Ecosystem Sandboxes (6); Pilot-to-Scale Pathways (5); Failsafe Experimentation (7)	Open Experimentation Platforms (4)	
Innovation Portfolios			Risk-Reward Allocation (2)	Horizon Balancing (0); Resource Flexing (0); Portfolio Sequencing (0); Path-to-Scale Options (0)
Market Foresight		Future Opportunity Mapping (6); Ecosystem Trend Monitoring (7)		Emerging Tech Scans (0); Non-Customer Discovery (0); Disruption Radar (0)
Scaling Innovation		Standardization for Scale (7)	Platform Adoption Catalysts (3); Complementor Enablement (1)	Network Effects Leverage (0); Ecosystem Diffusion (0)

Broadly Adopted Practices

Broadly adopted practices form the structural anchors of digital business ecosystems, establishing the common foundations on which firms converge. They matter

because they represent capabilities so essential for resilience, legitimacy, and scale that virtually no ecosystem can function without them. At this tier, three capability dimensions consistently stand out: Model Foundations, which stabilize data pipelines and infrastructure as the bedrock of AI scale; Proprietary Stacks, which consolidate silicon, software, and services into vertically integrated control points; and Systems Interoperability, which ensures connectivity and seamless integration across diverse ecosystems.

First, in Model Foundations by securing pipelines, governance, and infrastructure that guarantee high-quality data flows — without which AI ecosystems fail. Cloud leaders scale ingestion, labeling, and orchestration platforms (Amazon, Microsoft, Alphabet), consumer firms embed privacy and compliance at the architectural layer (Apple), semiconductor players industrialize pipelines with digital twins (NVIDIA, TSMC), and device ecosystems ensure real-time flows across mobility and consumer interfaces (Tesla, Samsung).

Second, in Proprietary Stacks by fusing silicon, software, and services into tightly coupled platforms that enforce control and accelerate adoption. Consumer and cloud ecosystems capture value by vertically integrating operating systems, application layers, and services (Apple, Alphabet, Amazon, Microsoft, Samsung). Semiconductor firms extend fab-to-deployment continuity (TSMC, Broadcom), while leaders like Meta and NVIDIA accelerate adoption in AI and XR domains. Tesla fuses autonomy with energy platforms, creating closed-loop advantages.

Third, Systems Interoperability ensures cross-platform orchestration and partner connectivity so ecosystems scale without fragmentation. Firms operationalize this through SDKs, API gateways, and integration fabrics (Alphabet, Amazon, Microsoft), privacy-

centric device connectors (Apple), multi-cloud and fab-level collaboration (NVIDIA, TSMC), and mobility–energy pathways (Tesla).

Moderately Adopted Practices

Moderately adopted practices represent the next frontier of ecosystem capability-building, where maturity advances but depth and consistency remain uneven. Unlike broadly adopted anchors at the epicenter, these practices occupy a transitional zone — critical yet inconsistently deployed. At this tier, three capability dimensions capture the tension between promise and patchiness: Model Foundations, which determine how effectively data and models scale; Sustainable Tech, which embeds environmental responsibility into digital infrastructure; and Trust and Controls, which shape the confidence with which partners, regulators, and customers engage with ecosystems.

First, firms extend Model Foundations into Model Deployment, which operationalizes AI at scale by moving models from research into production pipelines. This matters because without robust deployment, DBEs cannot translate experimentation into real-world impact. Cloud leaders industrialize deployment infrastructure to ensure reliability and speed (Amazon, Microsoft), consumer ecosystems apply deployment pipelines to personalize user experiences (Apple), and semiconductor firms embed deployment practices into downstream system performance, optimizing chips for AI-heavy workloads (NVIDIA, TSMC).

Second, ecosystems advance Sustainable Tech through Carbon Tracking brings auditable emissions data into operations and supply chains, aligning ecosystem growth with climate accountability. and Supply Traceability, extends visibility to upstream partners, reducing ESG and compliance risk across networks, embedding accountability into infrastructure and supply chains. Cloud firms deliver emissions dashboards and reduction pathways (Microsoft, Amazon), semiconductor firms track footprint across fabs

and logistics (TSMC, Samsung), and Tesla integrates carbon metrics across its vertically integrated model. Supply traceability reinforces supplier compliance (TSMC, Samsung), ensuring resilience under geopolitical and regulatory scrutiny.

Third, ecosystems pursue Trust and Controls through Privacy by Design, which ensures that user rights and compliance safeguards are embedded into systems from the ground up rather than added later. This is critical as DBEs manage sensitive data flows across boundaries. Cloud providers integrate privacy safeguards into core data services (Microsoft, Alphabet), consumer firms anchor privacy in tightly governed device ecosystems (Apple), and semiconductor players extend compliance assurances through system-level protections to satisfy regulators and partners (TSMC).

Selectively Adopted Practices

Selectively adopted practices reflect areas of experimentation and strategic differentiation, where firms probe frontier options but adoption remains fragmented. They matter because they spotlight capabilities that could become tomorrow's anchors but today function as hedges, bets, or niche advantages. At this tier, five capability dimensions come into focus: Market Creation, which frames how entirely new categories or platforms emerge; Model Foundations, which extend to assurance and optimization beyond core deployment; Proprietary Stacks, which test modularity and openness against vertical control; Sustainable Tech, which broadens reporting beyond carbon to disclosures and platforms; and Trust and Controls, which explore advanced security, audit, and policy automation to strengthen governance confidence.

First, within Market Creation, firms probe XR-Led Experience Architecture probes new interaction and monetization surfaces (Meta) and Platform Packaging modularizes capabilities for selective externalization while retaining control (Tesla).

Second, for Model Foundations, selective investment emerges in Model Assurance, introduces transparency dashboards and reliability checks in AI workflows (Microsoft).

Third, in Proprietary Stacks, firms experiment with three selective practices — Modular Architectures, Developer Ecosystems, and Platform Control — which extend adaptability, broaden innovation participation, and secure ecosystem economics.

Forth, Modular Architectures enable hardware–software co-design, giving flexibility to fast-shifting domains; semiconductor leaders apply this to chips (Broadcom, TSMC), while Tesla and Samsung test modularity in mobility and devices.

Fifth, Developer Ecosystems orchestrate external innovation loops through SDKs, app stores, and federated APIs, mobilizing broad participation (Apple, Microsoft, Tesla).

Sixth, Platform Control safeguards economics and governance by selectively restricting openness: Apple enforces app-store rules to lock in value, NVIDIA sustains CUDA as an industry standard in AI, and Tesla limits interoperability to protect margins.

White Spaces (Zero Evidence)

White spaces represent capability dimensions where evidence is absent, either because practices are too nascent to register or because firms have chosen not to invest. They matter because these gaps illuminate both blind spots and latent opportunities: what ecosystems are not yet addressing may prove decisive for future resilience or legitimacy. Absent practices span Market Creation Design, Multi-Tech Integration, Market Model Design; Model Training, Model Optimization; Sustainability Disclosure, Stakeholder Platforms; Policy Automation, Encryption Strategy—signaling immaturity, unsettled standards, or weak incentives today.

Synthesis and Transition

Taken together, the technology practices reveal a layered progression. Broadly adopted practices establish the non-negotiable anchors of data, control, and connectivity.

Moderately adopted practices expose a transitional zone where scaling, sustainability, and trust-building remain uneven. Selectively adopted practices showcase frontier bets in modularity, developer ecosystems, and reporting. White spaces highlight areas where technological infrastructure has yet to mature. Collectively, this landscape underscores that while firms converge on foundations, divergence persists in how far and fast they invest in sustainability, trust, and frontier architectures. This sets the stage for examining how these technological anchors translate into strategic choices in RQ1 — Strategy.

If technology forms the operating backbone of DBEs, strategy determines how these foundations are mobilized into market power and competitive advantage. The practices that anchor data, stacks, and controls translate directly into the strategic playbooks firms deploy to scale ecosystems.

4.1.2 Strategy

If technology provides the backbone of Digital Business Ecosystems (DBEs), strategy determines how those foundations are mobilized into competitive positioning, market power, and long-term resilience. Leading firms do not simply accumulate technological assets; they translate them into strategic playbooks that guide opportunity discovery, ecosystem design, and legitimacy building. In this sense, strategy becomes the organizing logic that converts technical capability into durable advantage, ensuring that ecosystems scale with both coherence and credibility.

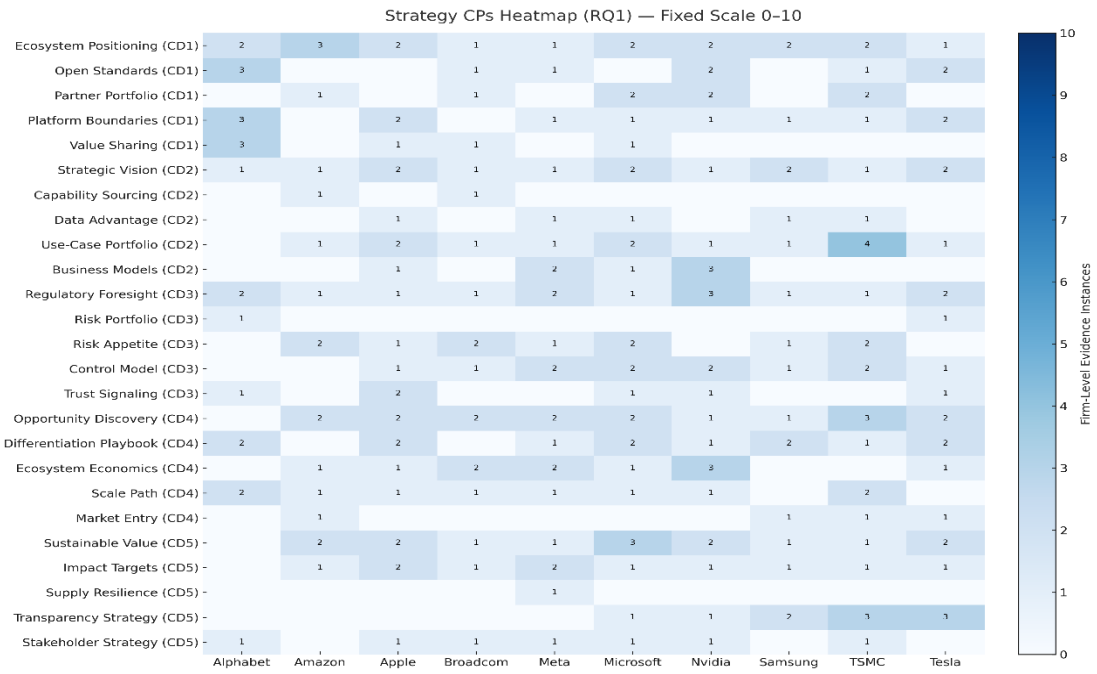

Figure 4.1.2
RQ1 – Strategy CPs Heatmap

To analyze these dynamics, a heatmap framework give above was applied to capture the maturity and distribution of strategic practices across firms. The heatmap reveals where practices have become broadly adopted anchors, where they are moderately institutionalized but uneven, where they are selectively tested as frontier bets, and where white spaces remain. This visualization makes clear that while most leaders converge on core scaffolding—such as opportunity discovery, regulatory foresight, and sustainability targets—others diverge on issues like value-sharing, stakeholder engagement, or systemic resilience. In effect, the heatmap offers a panoramic view of how strategy is practiced, highlighting both convergence around non-negotiables and divergence at the edges of experimentation.

The accompanying data table summarizes adoption patterns across five strategic capability dimensions: Competitive Positioning, Data-Driven Strategy, Ecosystem

Strategy, Governance Strategy, and Sustainability Strategy. Each dimension is mapped along the four adoption categories, allowing comparison of where firms consistently embed direction and legitimacy, and where they falter or experiment without scale. By organizing evidence this way, the table establishes a structured foundation for interpreting how ecosystems shape strategic scaffolding and reveals the maturity gaps that separate leaders from laggards.

RQ1 - Adaption Tiers for Strategy 4.1.2

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Competitive Positioning	Opportunity Discovery (9); Differentiation Playbook (8); Scale Path (8)	Ecosystem Economics (7)	Market Entry (4)	
Data-Driven Strategy	Strategic Vision (10); Use-Case Portfolio (9)	Data Advantage (5)	Capability Sourcing (2); Business Models (4)	
Ecosystem Strategy	Ecosystem Positioning (10); Platform Boundaries (8)	Open Standards (6); Partner Portfolio (5)	Value Sharing (4)	
Governance Strategy	Regulatory Foresight (10); Control Model (8)	Risk Appetite (7); Trust Signaling (5)	Risk Portfolio (2)	
Sustainability Strategy	Sustainable Value (9); Impact Targets (9)	Transparency Strategy (5); Stakeholder Strategy (7)	Supply Resilience (1)	

Broadly Adopted Practices

Broadly adopted practices define the strategic anchors of digital business ecosystems, providing direction, differentiation, and legitimacy. They matter because they represent the minimum strategic scaffolding without which ecosystems cannot achieve scale, credibility, or competitive positioning. At this tier, five capability dimensions dominate: Competitive Positioning, which determines how ecosystems discover opportunities, differentiate, and scale; Data-Driven Strategy, which aligns vision and portfolios with evidence and advantage; Ecosystem Strategy, which sets boundaries, positions actors, and orchestrates value-sharing; Governance Strategy, which ensures foresight, control, and legitimacy in regulatory environments; and Sustainability Strategy, which embeds environmental and social targets into strategic core.

First, firms excel at Competitive Positioning Clarifies where to compete, how to win, and how to scale advantage in DBEs by investing in Opportunity Discovery, Differentiation Playbooks, and Scale Paths. Consumer ecosystems pursue blue-ocean expansion into adjacent services (Apple, Alphabet), cloud firms differentiate through service depth and AI leadership (Amazon, Microsoft), and semiconductor players create scale through global capacity expansion (TSMC, NVIDIA).

Second, Data-Driven Strategy embeds analytics into vision and use-case portfolios so direction is evidence-led.is broadly adopted through Strategic Vision and Use-Case Portfolios. Firms link long-term narratives to data-backed growth bets (Microsoft, Amazon), expand use-case breadth across sectors (Alphabet, Meta), and tie vision to scaling paths in devices and mobility (Tesla, Samsung).

Third, ecosystems advance Ecosystem Strategy calibrates openness and boundaries to maximize network value while preserving control.by shaping Ecosystem Positioning and Platform Boundaries. Consumer ecosystems enforce strict platform rules (Apple),

cloud players expand boundaries through partner APIs (Amazon, Microsoft), and semiconductor firms calibrate roles to manage fab dependencies (TSMC, Samsung).

Fourth, Governance Strategy anticipates regulation and codifies rules so strategy scales with legitimacy, anchored through Regulatory Foresight and Control Models. Cloud and consumer firms anticipate and align with data, competition, and safety regulation (Microsoft, Alphabet), while semiconductor firms design control regimes to balance global supply risks and compliance (TSMC).

Fifth, Sustainability Strategy converts ESG into investable targets and credible value propositions, becomes a strategic anchor through Sustainable Value and Impact Targets. Firms articulate climate commitments (Microsoft, Apple), tie targets to investor disclosures (Alphabet, Meta), and extend sustainable practices across value chains (Tesla, TSMC).

Moderately Adopted Practices

Moderately adopted practices represent the next frontier of strategic capability-building, where ecosystems expand commitments but with uneven reach and maturity. Unlike broadly adopted anchors, these practices signal ambitions that are critical for future resilience but inconsistently deployed. At this tier, five capability dimensions matter: Competitive Positioning, which expands to ecosystem economics; Data-Driven Strategy, which pushes into data advantage; Ecosystem Strategy, which tests openness and partner depth; Governance Strategy, which navigates risk appetite and trust; and Sustainability Strategy, which experiments with transparency and stakeholder engagement.

First, firms extend Competitive Positioning through Ecosystem Economics Revenue-/cost-sharing pilots in partner marketplaces (Microsoft, Amazon), aligning competitive choices with shared incentives. Cloud firms experiment with shared-revenue models (Amazon, Microsoft), consumer players balance subscription versus advertising

economics (Apple, Alphabet), and semiconductor firms manage value flows through long-term contracts (TSMC).

Second, ecosystems advance Data-Driven Strategy by pursuing Data Advantage Proprietary datasets and telemetry loops used to reinforce moats (Tesla, NVIDIA), where firms weaponize unique data assets. Consumer players integrate device telemetry for personalized services (Apple, Tesla), cloud providers scale cross-sector datasets for AI (Amazon, Microsoft), and chipmakers consolidate production data to optimize yield (TSMC, Samsung).

Third, Ecosystem Strategy evolves via Open Standards and Partner Portfolios Interoperability and curated partner sets balance reach and control (Microsoft, Amazon, TSMC). Cloud firms build credibility through open interfaces (Microsoft, Alphabet), consumer players selectively embrace standards to expand markets (Apple), and semiconductor firms orchestrate large but controlled partner bases (TSMC).

Fourth, Governance Strategy broadens with Risk Appetite and Trust Signaling Public commitments and guardrails frame strategic risk-taking (Apple, Microsoft)., Cloud firms take calculated risks in emerging AI and data services (Microsoft, Amazon), consumer players emphasize safety and trust to preserve user legitimacy (Apple), and semiconductor firms emphasize resilience under geopolitical risks (TSMC).

Fifth, Sustainability Strategy expands to Transparency and Stakeholder Strategy, ESG dashboards and investor engagement align capital with intent (Microsoft, Alphabet). Cloud firms publish detailed ESG disclosures (Microsoft), consumer firms engage in stakeholder dialogues (Apple), and Tesla links sustainability to brand differentiation.

Selectively Adopted Practices

Selectively adopted practices highlight strategic differentiation and hedging, where firms test novel approaches that are not yet mainstream. They matter because they reveal

frontier experiments that could harden into future anchors or fade as failed bets. At this tier, five capability dimensions come into play: Competitive Positioning, Data-Driven Strategy, Ecosystem Strategy, Governance Strategy, and Sustainability Strategy.

First, within Competitive Positioning, firms explore Market Entry Adjacent plays test scope expansion and fit. Tesla tests direct-to-consumer and digital-only models, while semiconductor firms experiment with new regional entry under export constraints (TSMC, Samsung).

Second, in Data-Driven Strategy, firms trial Capability Sourcing and Business Models Acquisitions and pricing experiments tune value capture (Microsoft, NVIDIA; Apple). Cloud providers selectively outsource capabilities through acquisitions (Microsoft, Amazon), consumer players test subscription and hybrid monetization (Apple, Alphabet), and semiconductor firms adjust licensing models (Broadcom, NVIDIA).

Third, for Ecosystem Strategy, firms pursue Value Sharing redistribution levers are tried to increase ecosystem stickiness (cloud marketplaces). Cloud ecosystems share value with developers through marketplace incentives (Microsoft, Amazon), while semiconductor firms cautiously balance value capture with partners (TSMC).

Forth, in Governance Strategy, selective adoption is visible in Risk Portfolios diversified exposure hedges geopolitical and supply risk (TSMC, NVIDIA). Firms diversify into experimental but risky bets — from metaverse platforms (Meta) to autonomy expansion (Tesla) — that hedge long-term disruption.

Fifth, Sustainability Strategy experiments with Supply Resilience Battery and rare-earth strategies de-risk growth (Tesla, Samsung). Semiconductor firms seek redundancy in supplier networks (TSMC, Samsung), while Tesla tests vertically integrated resilience strategies.

White Spaces (Zero Evidence)

White spaces represent strategic dimensions where ecosystems show no evidence of adoption, highlighting blind spots or deferred priorities. They matter because what is missing can be as revealing as what is adopted. At this tier, two capability dimensions remain unaddressed: Competitive Positioning, where no evidence of Market Creation Design, Multi-Tech Integration, or Market Models appears; and Sustainability Strategy, where resilience beyond supply remains untested.

Synthesis and Transition

Taken together, strategy practices reveal how ecosystems translate technological anchors into market direction and legitimacy. Broadly adopted practices provide the scaffolding of competitive, data-driven, ecosystem, governance, and sustainability anchors. Moderately adopted practices expose uneven extensions into economics, openness, risk, and transparency. Selectively adopted practices highlight hedges in entry models, value sharing, and resilience. White spaces mark where strategic imagination and integration lag. Collectively, these patterns show that while ecosystems converge on core scaffolding, divergence persists in how firms stretch strategy toward risk, openness, and resilience — setting the stage for how innovation ecosystems unfold in RQ1 — Innovation.

Strategy defines the positional logic of DBEs, but without continuous innovation, these positions erode. The frontier of ecosystem advantage therefore lies in how effectively firms translate strategy into renewal mechanisms — making innovation the next layer of capability.

4.1.3 Innovation

Innovation represents the lifeblood of Digital Business Ecosystems (DBEs). While technology supplies the backbone and strategy provides the scaffolding, it is innovation that renews advantage, keeps ecosystems dynamic, and prevents stagnation in fast-shifting

markets. Leading firms distinguish themselves not only by their ability to generate novel ideas but also by how effectively they institutionalize discovery, experimentation, foresight, and scaling into repeatable playbooks. In this sense, innovation is less about breakthrough moments and more about systemically embedding renewal mechanisms that ensure ecosystems remain relevant and resilient.

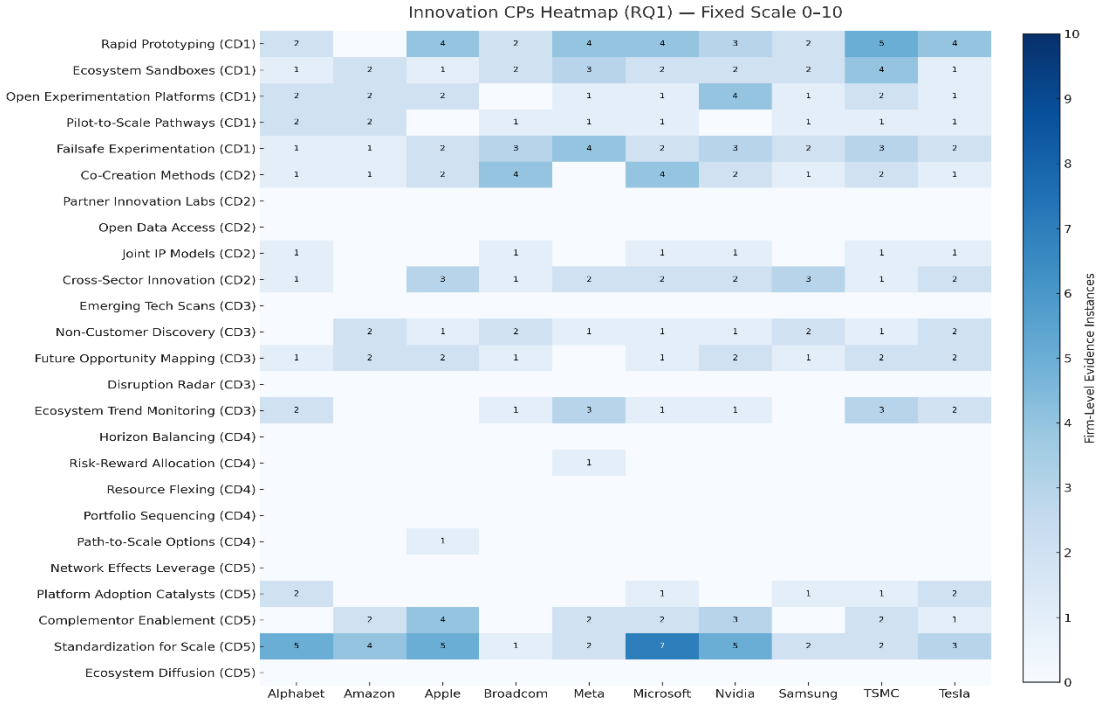

Figure 4.1.3
RQ1 – Innovation CPs Heatmap

To capture this dynamic, a heatmap lens was applied to track adoption across five capability dimensions: Collaborative Discovery, Ecosystem Experimentation, Innovation Portfolios, Market Foresight, and Scaling Innovation. The heatmap shows where practices have become broadly institutionalized anchors, where they remain moderately adopted but uneven, where experimentation occurs selectively, and where white spaces remain. This layered structure highlights how firms converge on activities like rapid prototyping,

sandboxes, and non-customer discovery, while divergence persists around frontier practices such as emerging tech scans, network effects leverage, or portfolio sequencing. The heatmap thus surfaces not only the strengths but also the fragilities in how firms sustain innovation.

The accompanying data table summarizes the evidence of adoption across these innovation dimensions. It reveals a strong emphasis on experimentation and foresight, with consistent adoption of practices such as co-creation, cross-sector innovation, and standardization for scale. At the same time, it exposes thin adoption of structured portfolio management, weak institutionalization of horizon balancing, and near absence of ecosystem diffusion mechanisms. By positioning practices along the adoption spectrum, the table provides a clear map of how ecosystems sustain renewal today and where untapped potential for differentiation lies.

RQ1 - Adaption Tiers for Innovation 4.1.3

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Collaborative Discovery	Co-Creation Methods (9); Cross-Sector Innovation (9)	Joint IP Models (6)		Partner Innovation Labs (0); Open Data Access (0)
Ecosystem Experimentation	Rapid Prototyping (9); Ecosystem Sandboxes (10); Open Experimentation Platforms (9); Pilot-to-Scale Pathways (8); Failsafe Experimentation (10)			
Innovation Portfolios			Risk-Reward Allocation (1); Path-to-Scale Options (1)	Horizon Balancing (0); Resource Flexing (0); Portfolio Sequencing (0)

Market Foresight	Non-Customer Discovery (9); Future Opportunity Mapping (9)	Ecosystem Trend Monitoring (7)	Emerging Tech Scans (0); Disruption Radar (0)
Scaling Innovation	Standardization for Scale (10)	Platform Adoption Catalysts (5); Complementor Enablement (7)	Network Effects Leverage (0); Ecosystem Diffusion (0)

Broadly Adopted Practices

Broadly adopted practices in innovation are anchored around four capability dimensions—Collaborative Discovery, which expands ideation through co-creation and cross-sector ties; Ecosystem Experimentation, which institutionalizes trial-and-error through sandboxes, prototyping, and fail-safe loops; Market Foresight, which anticipates opportunities beyond current demand; and Scaling Innovation, which translates breakthroughs into standards and adoption pathways. These dimensions matter because ecosystems cannot differentiate or sustain growth without continuous renewal.

First, in Collaborative Discovery, firms adopt Co-Creation Methods and Cross-Sector Innovation to expand idea flow beyond firm boundaries. Co-Creation Methods embed structured joint design (Microsoft, Amazon; Apple, Meta), while Cross-Sector Innovation links domains such as semiconductors, mobility, and energy (TSMC, NVIDIA), reducing blind spots and widening discovery.

Second, in Ecosystem Experimentation, firms embed five practices: Rapid Prototyping, which accelerates iteration (Amazon); Ecosystem Sandboxes, which mobilize developers in controlled environments (Alphabet); Open Experimentation Platforms, which scale testing via shared repositories (Microsoft); Pilot-to-Scale Pathways, which compress timelines from trial to deployment (Tesla); and Failsafe Experimentation, which

preserves agility without destabilization. Together, these practices ensure novelty is tested safely before scaling.

Third, in Market Foresight, firms adopt Non-Customer Discovery and Future Opportunity Mapping to anticipate unmet needs. Non-Customer Discovery surfaces overlooked segments (Apple, Meta), while Future Opportunity Mapping identifies adjacencies in healthcare, finance, and automotive (Microsoft, Amazon, TSMC, NVIDIA), ensuring ecosystems orient toward emerging demand.

Fourth, in Scaling Innovation, firms institutionalize Standardization for Scale, embedding compatibility and norms across ecosystems. Cloud leaders set de facto standards via APIs and AI frameworks (Microsoft, Amazon, Alphabet), consumer ecosystems define design conventions (Apple), and semiconductor firms establish cross-industry manufacturing standards (TSMC, Samsung).

Moderately Adopted Practices

Moderately adopted practices span three capability dimensions—Collaborative Discovery, which matures through shared IP; Market Foresight, which evolves into systematic monitoring; and Scaling Innovation, which extends to complementors and adoption catalysts. These dimensions matter because they signal uneven institutionalization of governance and scaling.

First, in Collaborative Discovery, the practice of Joint IP Models balances openness and control. Semiconductor players co-develop designs with partners (TSMC, NVIDIA), cloud firms experiment with shared patents (Microsoft), and Tesla licenses technology selectively to protect advantage.

Second, in Market Foresight, the practice of Ecosystem Trend Monitoring deepens foresight capacity. Alphabet and NVIDIA scan for technological and consumer signals,

Amazon and Microsoft track enterprise adoption, and Apple and Meta monitor user preferences across platforms.

Third, in Scaling Innovation, the practices of Platform Adoption Catalysts and Complementor Enablement expand adoption. Cloud firms subsidize adoption with credits (Microsoft, Amazon), consumer firms support developers via app stores and APIs (Apple, Meta), and Tesla bundles charging and software ecosystems to accelerate uptake.

Selectively Adopted Practices

Selectively adopted practices concentrate on one capability dimension—Innovation Portfolios, which balance and sequence bets. This dimension matters because portfolio-level governance spreads risk and diversifies scaling pathways, but adoption remains shallow.

First, within this, firms adopt Risk-Reward Allocation and Path-to-Scale Options. Risk-Reward Allocation balances moonshots against incremental projects (Microsoft), while Path-to-Scale Options test alternative rollout models in autonomy and energy (Tesla). Yet other practices such as Horizon Balancing, Resource Flexing, and Portfolio Sequencing remain absent, leaving portfolio maturity fragile.

White Spaces (Zero Evidence)

White spaces emphasize systemic immaturity. In Collaborative Discovery, missing labs and data access hinder external contributions. In Innovation Portfolios, absent balancing mechanisms constrain risk management. In Market Foresight, lack of disruption tools blinds ecosystems to shocks. In Scaling Innovation, missing amplification levers constrain ecosystem-wide uptake.

Synthesis and Transition

Taken together, RQ1 – Innovation shows ecosystems broadly adopt Co-Creation Methods, Cross-Sector Innovation, Rapid Prototyping, Ecosystem Sandboxes, Open

Experimentation Platforms, Pilot-to-Scale Pathways, Failsafe Experimentation, Non-Customer Discovery, Future Opportunity Mapping, and Standardization for Scale as anchors. Moderately adopted practices such as Joint IP Models, Ecosystem Trend Monitoring, Platform Adoption Catalysts, and Complementor Enablement expose uneven maturity. Selectively adopted practices in Risk-Reward Allocation and Path-to-Scale Options highlight portfolio experimentation but reveal fragility. Zero evidence underscores gaps in labs, access, balancing, foresight, and diffusion. Ecosystems therefore converge on experimentation and foresight but diverge in portfolio governance and amplification.

Transition: This sets the stage for RQ1 – Governance, where innovation's dynamism requires stabilizing mechanisms that legitimize experimentation, align actors, and mitigate systemic risks.

4.1.4 Governance

If technology provides the backbone, strategy the scaffolding, and innovation the renewal engine, then governance is the invisible architecture that keeps Digital Business Ecosystems (DBEs) legitimate, resilient, and trusted. Without robust governance, even the most advanced technologies and boldest innovations can unravel under the weight of regulatory scrutiny, ethical lapses, or fractured accountability. Leading firms differentiate themselves by institutionalizing governance as both a guardrail and an enabler — balancing compliance, oversight, and assurance with the agility needed to operate across interdependent networks.

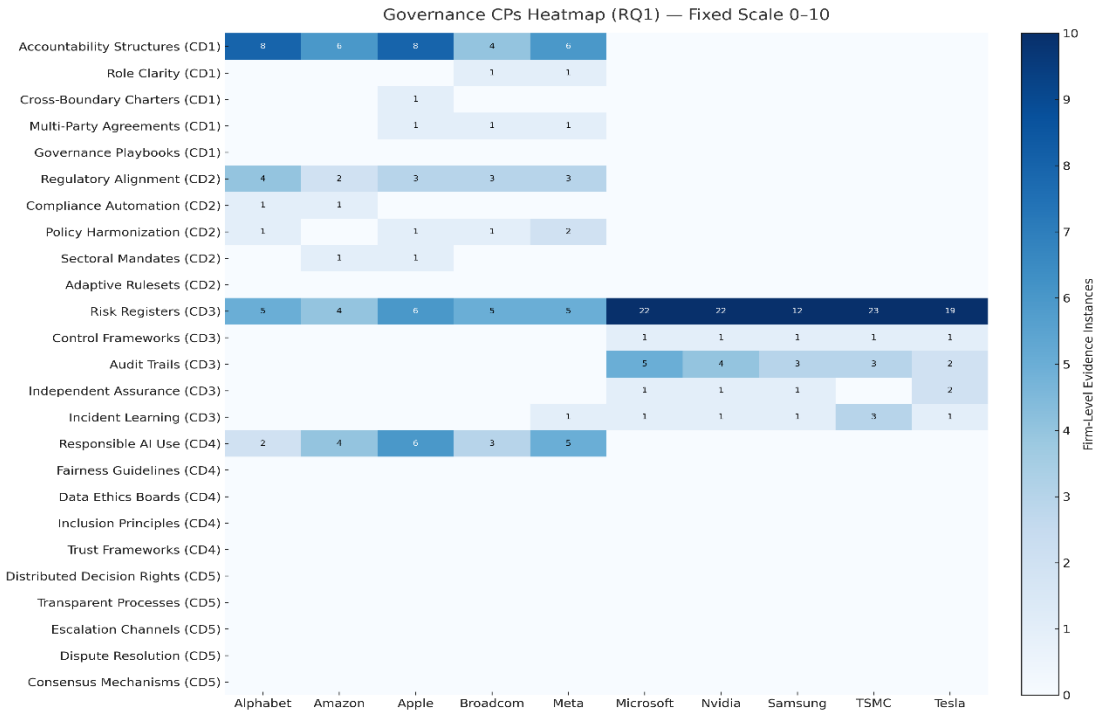

Figure 4.1.4
RQ1 – Governance CPs Heatmap

The governance heatmap tracks adoption across five capability dimensions: Decision Governance, Ecosystem Oversight, Ethical Governance, Policy and Compliance, and Risk and Assurance. It highlights a clear asymmetry. Firms are strongest in risk registers, regulatory alignment, and accountability structures, reflecting defensive priorities to protect ecosystems from failure or sanctions. Moderately adopted practices, such as control frameworks, audit trails, compliance automation, and role clarity, signal emerging maturity but uneven institutionalization. Meanwhile, white spaces in distributed decision rights, consensus mechanisms, fairness guidelines, and adaptive rulesets reveal a governance architecture that is still more reactive than anticipatory. The heatmap thus illustrates that while firms secure the essentials, they have yet to fully operationalize governance as a forward-looking capability.

The data table provides a structured view of adoption patterns across these governance dimensions. It shows robust deployment of traditional risk and compliance practices, partial experimentation in cross-boundary governance tools and ethical frameworks, and very limited evidence of advanced participatory or adaptive mechanisms. This progression reinforces the dual character of governance in DBEs: strong enough to protect current systems, but still fragile when it comes to codifying transparency, inclusivity, and adaptability at scale. As DBEs expand across industries and geographies, this governance gap will increasingly determine which firms sustain legitimacy and which risk systemic breakdowns.

RQ1 - Adaption Tiers for Governance 4.1.4

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Decision Governance				Distributed Decision Rights (0); Transparent Processes (0); Escalation Channels (0); Dispute Resolution (0); Consensus Mechanisms (0)
Ecosystem Oversight		Accountability Structures (5)	Role Clarity (2); Cross-Boundary Charters (1); Multi-Party Agreements (3)	Governance Playbooks (0)
Ethical Governance		Responsible AI Use (5)		Fairness Guidelines (0); Data Ethics Boards (0); Inclusion Principles (0); Trust Frameworks (0)
Policy and Compliance		Regulatory Alignment (5)	Compliance Automation (2); Policy Harmonization (4); Sectoral Mandates (2)	Adaptive Rulesets (0)

Risk and Assurance	Risk Registers (10)	Control Frameworks (5); Audit Trails (5); Incident Learning (6)	Independent Assurance (4)

Broadly Adopted Practices

Broadly adopted practices in governance are anchored around one capability dimension—Risk and Assurance, which makes risks visible and manageable across distributed actors. This dimension matters because without risk assurance, ecosystems cannot function credibly or maintain trust with regulators, partners, and customers.

First, in Risk and Assurance, the practice of Risk Registers institutionalizes live, dynamic documentation of vulnerabilities and mitigations. Cloud leaders embed registers into compliance pipelines (Microsoft, Amazon), consumer firms codify product and data risks into governance dashboards (Apple, Meta), and semiconductor players integrate export controls and operational dependencies into assurance systems (TSMC, NVIDIA). These registers create shared baselines for accountability, shifting risk management from firm-level to ecosystem-wide responsibility.

Moderately Adopted Practices

Moderately adopted practices span four capability dimensions—Ecosystem Oversight, Ethical Governance, Policy and Compliance, and Risk and Assurance—which extend governance beyond foundational registers. These dimensions matter because without them, ecosystems risk fragmentation, regulatory pushback, and partner mistrust.

First, in Ecosystem Oversight, the practice of Accountability Structures creates councils and working groups that allocate oversight across firms. Cloud firms formalize partner accountability through contracts and SLAs (Microsoft, Amazon), consumer firms assign oversight for app ecosystems (Apple, Alphabet), and semiconductor players codify

co-development agreements (TSMC). These structures clarify roles and escalation paths, though adoption remains uneven.

Second, in Ethical Governance, the practice of Responsible AI Use Principles embeds fairness and safety into product pipelines. Alphabet operationalizes responsible AI standards, Microsoft trains developers on bias mitigation, and Meta runs responsible innovation labs. While impactful, adoption remains concentrated in AI-intensive firms rather than ecosystem-wide.

Third, in Policy and Compliance, the practice of Regulatory Alignment ensures proactive conformity to mandates. Semiconductor firms synchronize with export control regimes (TSMC, NVIDIA), cloud firms align with cross-border data regulations (Amazon, Microsoft), and Tesla adapts governance to safety requirements. Despite widespread adoption, many firms lag in keeping pace with shifting mandates.

Fourth, in Risk and Assurance, firms adopt Control Frameworks, Audit Trails, and Incident Learning to extend governance depth. Microsoft and Amazon embed control frameworks into product lifecycles, Apple and Meta run audits across app stores and supply chains, and TSMC and NVIDIA institutionalize incident-learning protocols to adapt designs after disruptions. These mechanisms extend registers into preventive and adaptive governance, though adoption depth varies.

Selectively Adopted Practices

Selectively adopted practices span three capability dimensions—Ecosystem Oversight, Policy and Compliance, and Risk and Assurance—where frontier experiments are underway but not yet institutionalized. These dimensions matter because they demonstrate attempts to formalize collaboration and resilience across boundaries.

First, in Ecosystem Oversight, firms explore Role Clarity, Cross-Boundary Charters, and Multi-Party Agreements to clarify responsibilities in distributed networks.

Tesla defines roles in multi-party ventures, Amazon codifies expectations through charters, and TSMC formalizes agreements for fab collaborations, while Alphabet experiments with shared oversight models. Adoption remains patchy, limiting accountability across ecosystems.

Second, in Policy and Compliance, firms trial Compliance Automation, Policy Harmonization, and Sectoral Mandates to reduce friction. Microsoft and Amazon pilot automation engines to streamline audits, TSMC and NVIDIA align cross-industry rules for collaboration, and Tesla adapts mandates to automotive safety. Yet adoption remains fragmented, preventing uniform compliance.

Third, in Risk and Assurance, firms experiment with Independent Assurance to validate systems through external oversight. Microsoft commissions third-party audits of AI systems, TSMC brings in industry boards to review chip governance, NVIDIA partners with evaluators, and Meta tests ethics reviews. While these efforts boost credibility, they remain rare and inconsistent.

White Spaces (Zero Evidence)

Zero evidence highlights absent practices across four capability dimensions—Decision Governance, Ecosystem Oversight, Ethical Governance, and Policy and Compliance. Missing practices such as Distributed Decision Rights, Transparent Processes, Escalation Channels, Dispute Resolution, and Consensus Mechanisms in Decision Governance show participatory governance is underdeveloped. In Ecosystem Oversight, absent Governance Playbooks leaves accountability fragmented. In Ethical Governance, no evidence exists for Fairness Guidelines, Data Ethics Boards, Inclusion Principles, or Trust Frameworks, underscoring legitimacy gaps. In Policy and Compliance, the absence of Adaptive Rulesets highlights slow responsiveness to regulatory flux.

Synthesis and Transition

Taken together, RQ1 – Governance shows ecosystems broadly adopt Risk Registers as structural anchors. Moderately adopted practices such as Accountability Structures, Responsible AI Use Principles, Regulatory Alignment, Control Frameworks, Audit Trails, and Incident Learning extend governance but remain uneven. Selectively adopted practices in Role Clarity, Cross-Boundary Charters, Multi-Party Agreements, Compliance Automation, Policy Harmonization, Sectoral Mandates, and Independent Assurance highlight experimentation at the frontier. Zero evidence underscores missing mechanisms in participatory decision-making, governance playbooks, ethical boards, and adaptive compliance.

Transition: This sets the stage for RQ1 – Sustainability, where governance scaffolding must extend to climate accountability, value chain transparency, and operational efficiency to secure ecosystems' broader societal legitimacy.

4.1.5 Sustainability

Sustainability has moved from being an external reporting obligation to becoming a core strategic anchor of Digital Business Ecosystems (DBEs). In ecosystems that span industries and geographies, environmental and social accountability is no longer optional — it is a prerequisite for legitimacy, investor trust, and long-term resilience. Leading firms differentiate themselves not simply by publishing ESG metrics, but by embedding sustainability into operations, governance, and value chains, ensuring that growth does not come at the expense of credibility. Sustainability, therefore, acts as the moral compass of DBEs, converting ecosystem power into durable, responsible advantage.

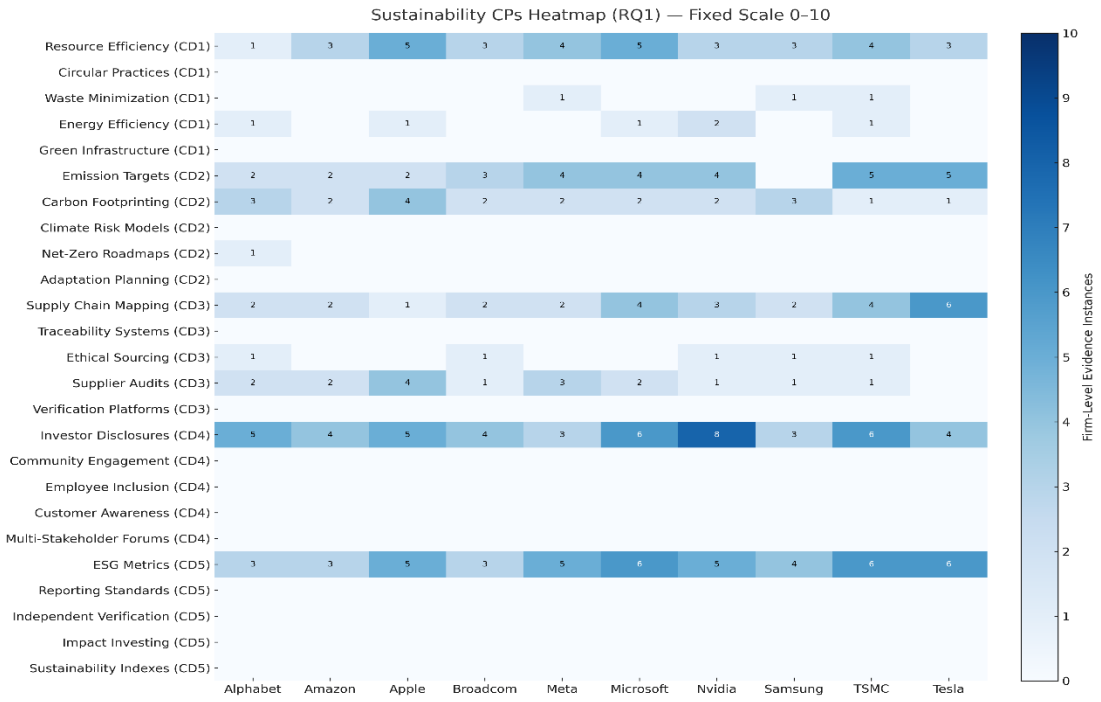

Figure 4.1.5
RQ1 – Sustainability CPs Heatmap

The sustainability heatmap reveals how firms are aligning practices across five capability dimensions: Climate Accountability, Impact Measurement, Stakeholder Engagement, Sustainable Operations, and Value Chain Transparency. Broad adoption is evident in emissions tracking, ESG metrics, investor disclosures, resource efficiency, and supply chain mapping, underscoring how firms anchor credibility in measurable and verifiable commitments. Moderately adopted practices, such as net-zero roadmaps, energy efficiency, and ethical sourcing, highlight ambition but inconsistent execution. Selectively adopted practices — like waste minimization — signal frontier experiments, while white spaces in circular practices, climate risk models, and multi-stakeholder forums reveal systemic blind spots. The heatmap therefore illustrates that while firms have embedded sustainability into the core, they remain uneven in translating it into holistic, ecosystem-wide impact.

The data table complements this view by systematically mapping adoption patterns across the five dimensions. It shows that while climate and ESG metrics are institutionalized, the infrastructure for independent verification, stakeholder inclusion, and circular operations remains weak. This pattern reflects a broader paradox: ecosystems are increasingly judged by their sustainability narratives, but their practices remain concentrated on compliance and reporting rather than systemic resilience and shared accountability. Closing these gaps will be critical for ensuring that DBEs evolve not just as engines of economic growth, but also as credible vehicles for addressing the world's most pressing environmental and social challenges.

RQ1 - Adaption Tiers for Sustainability 4.1.5

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Climate Accountability	Emission Targets (9); Carbon Foot printing (10)		Net-Zero Roadmaps (1)	Climate Risk Models (0); Adaptation Planning (0)
Impact Measurement	ESG Metrics (10)			Reporting Standards (0); Independent Verification (0); Impact Investing (0); Sustainability Indexes (0)
Stakeholder Engagement	Investor Disclosures (10)			Community Engagement (0); Employee Inclusion (0); Customer Awareness (0); Multi-Stakeholder Forums (0)
Sustainable Operations	Resource Efficiency (10)	Energy Efficiency (5)	Waste Minimization (3)	Circular Practices (0); Green Infrastructure (0)
Value Chain Transparency	Supply Chain Mapping (10); Supplier Audits (9)	Ethical Sourcing (5)		Traceability Systems (0); Verification Platforms (0)

Broadly Adopted Practices

Broadly adopted practices in sustainability are anchored around five capability dimensions—Climate Accountability, which targets and footprints emissions to anchor credible decarbonization; Impact Measurement, which institutionalizes ESG metrics for comparable performance; Stakeholder Engagement, which ensures investor disclosures translate intent into trust; Sustainable Operations, which embed efficiency to cut cost and risk; and Value Chain Transparency, which extends oversight through mapping and audits. These dimensions matter because they form the credibility backbone of DBEs, signaling measurable commitment to responsibility and legitimacy.

First, in Climate Accountability, firms adopt Emission Targets and Carbon Foot printing to establish reduction pathways and baseline impact. Apple commits to 2030 carbon neutrality across devices, Microsoft integrates foot printing into its Cloud for Sustainability, and NVIDIA models operational footprints across data centers. These commitments enhance transparency and comparability across ecosystems.

Second, in Impact Measurement, the practice of ESG Metrics embeds sustainability into reporting systems. Microsoft and Alphabet integrate ESG metrics into investor communications, Amazon publishes carbon intensity per order, and TSMC tracks factory-level water and energy metrics. These measures provide yardsticks for accountability.

Third, in Stakeholder Engagement, the practice of Investor Disclosures institutionalizes ESG reporting alongside financials. Apple ties ESG disclosures to product lifecycles, Microsoft publishes audited sustainability reports, and Tesla integrates disclosures into impact narratives. By elevating investor trust, firms set ecosystem-wide norms.

Fourth, in Sustainable Operations, the practice of Resource Efficiency embeds environmental responsibility into infrastructure and processes. Semiconductor leaders optimize fab-level water and energy usage (TSMC, Samsung), cloud players decarbonize compute operations (Microsoft, Amazon), and Tesla integrates efficiency into EV and energy systems. These efforts both reduce costs and build resilience.

Fifth, in Value Chain Transparency, the practices of Supply Chain Mapping and Supplier Audits extend responsibility upstream. Apple discloses supplier practices down to smelters, TSMC enforces audits across multi-tier suppliers, and Amazon increases transparency in logistics emissions. These mechanisms distribute accountability beyond firm boundaries.

Moderately Adopted Practices

Moderately adopted practices represent the next stage of maturity but remain inconsistently deployed. At this tier, three capability dimensions matter: Climate Accountability, Sustainable Operations, and Value Chain Transparency.

First, in Climate Accountability, firms advance Net-Zero Roadmaps, converting targets into operational trajectories. Microsoft outlines a 2030 net-zero roadmap, Alphabet commits to 24/7 carbon-free energy, and Amazon integrates pledges with its Climate Pledge initiative. Yet adoption is partial, with many ecosystems lagging in scaled action.

Second, in Sustainable Operations, the practice of Energy Efficiency optimizes intensity in data centers and fabs. Amazon and Microsoft power cloud infrastructure with renewable PPAs, TSMC and Samsung reduce fab-level intensity, and Tesla integrates efficiency into battery production. While progress is visible, rigor and scale vary widely.

Third, in Value Chain Transparency, the practice of Ethical Sourcing expands supplier compliance to cover social as well as environmental criteria. Apple enforces labor and conflict-free sourcing standards, Microsoft integrates ethical requirements into

devices, and Tesla enforces responsible mineral sourcing. These moves embed legitimacy but adoption remains clustered.

Selectively Adopted Practices

Selectively adopted practices highlight frontier ambition but shallow institutionalization. Activity is visible in two capability dimensions—Climate Accountability and Value Chain Transparency.

First, in Climate Accountability, firms experiment with deeper Net-Zero Roadmap Integration, though unevenly. Tesla emphasizes renewable integration, Microsoft details phased milestones, but broader adoption is inconsistent.

Second, in Value Chain Transparency, firms extend Ethical Sourcing and trial selective traceability. Alphabet and Microsoft increase oversight in AI hardware supply chains, and Tesla enforces lithium sourcing checks. Adoption, however, remains narrow and unsystematic.

White Spaces (Zero Evidence)

Zero evidence underscores structural gaps across four capability dimensions—Climate Accountability, Impact Measurement, Stakeholder Engagement, and Sustainable Operations. Missing practices include Climate Risk Models and Adaptation Planning, Reporting Standards and Independent Verification, Community Engagement and Multi-Stakeholder Forums, as well as Circular Practices and Green Infrastructure. In Value Chain Transparency, absent Traceability Systems and Verification Platforms leave ecosystems blind to deep-tier risks. These absences highlight fragility in systemic credibility.

Synthesis and Transition

Taken together, RQ1 – Sustainability shows ecosystems broadly adopt Emission Targets, Carbon Foot printing, ESG Metrics, Investor Disclosures, Resource Efficiency, Supply Chain Mapping, and Supplier Audits as their structural baseline. Moderately

adopted practices such as Net-Zero Roadmaps, Energy Efficiency, and Ethical Sourcing extend ambition but remain uneven. Selectively adopted practices in Net-Zero Roadmap Integration and Selective Traceability reflect experimentation but lack scale. Zero evidence highlights missing tools in adaptation, standards, engagement, circularity, and traceability, exposing systemic risks.

Transition: This concludes RQ1, where sustainability emerges as both license to operate and competitive flywheel. Anchors establish credibility, but uneven maturity and white spaces constrain legitimacy. The analysis now sets the stage for RQ2, shifting from adoption to outcomes—how practices across technology, strategy, innovation, governance, and sustainability shape ecosystem performance, resilience, and competitive advantage.

4.1.6 Quantitative Analysis – Survey results (RQ1)

Introduction (Consolidated Insight)

The first research question (RQ1) asked: *"What strategic choices and execution practices differentiate leading firms in digital business ecosystems (DBEs)?"* To explore this, the survey tested five dimensions—sustainability, interoperability, scalability, agility, and governance—each representing critical enablers of ecosystem leadership. The responses (n=100) provide a clear signal: while enterprises broadly recognize the strategic imperatives of DBEs, the degree of confidence and alignment varies across dimensions.

Survey Insights (linked to the five questions)

Sustainability (Q1): A strong majority (80%) either *agreed* or *strongly agreed* that their organizations design technology solutions with sustainability goals in mind, while only 5% disagreed. This indicates that sustainability has matured from an ESG narrative into a strategic execution lever.

Interoperability (Q4): 82% of respondents affirmed interoperability as a priority, with only 6% dissenting. This reinforces the view that cross-platform compatibility is no longer a choice but a survival requirement in DBEs.

Scalability (Q7): 82% again reported their solutions are designed to scale, confirming that scalability is a universally recognized necessity. The consistency across firms shows scalability is a hygiene factor for DBEs, not a differentiator.

Agility (Q10): 80% of leaders reported agility as a practiced strength, though 8% noted gaps. This reflects that while agility is a cultural aspiration, execution maturity varies—suggesting that agility differentiates advanced ecosystem leaders from the rest.

Governance (Q13): Governance strength was affirmed by 82% of respondents, but 8% flagged weaknesses. This signals that governance is acknowledged but unevenly institutionalized, often lagging behind technology and strategy in execution maturity.

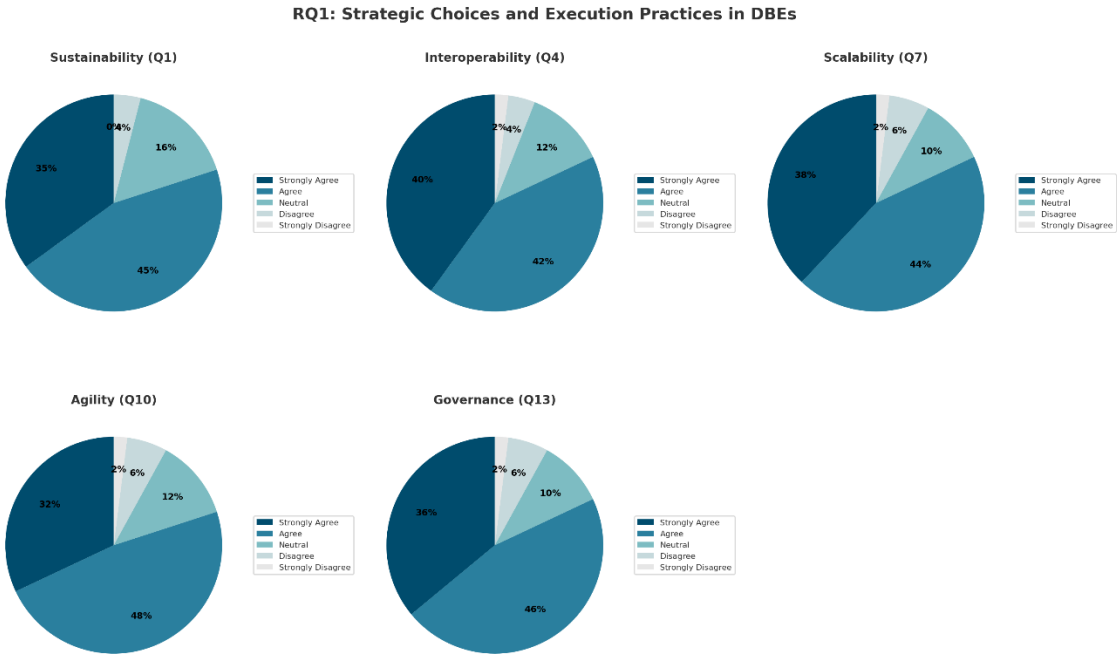

Figure 4.1.6
RQ1 – Global Survey Results

Survey Conclusion (Quantitative Analysis)

Overall, the RQ1 survey data shows that leading enterprises converge around the *"must-haves"* of DBE leadership—sustainability, interoperability, scalability, agility, and governance. The consistently high agreement levels (80–82% across all five) suggest these factors are no longer optional—they are table stakes. However, the small but persistent pockets of neutrality and disagreement (10–16%) highlight execution gaps that separate aspirants from orchestrators.

The implication is clear: DBE leaders succeed not just by acknowledging these imperatives but by embedding them into operating models. This is precisely where the HEART Infinity provides value—helping organizations move from recognizing principles to institutionalizing them as repeatable practices.

4.1.7 RQ1 Overall Summary (Quantitative + Quantitative)

RQ1 – What strategic choices and execution practices differentiate leading firms in DBEs?

Micro Lens (Qualitative Patterns): Leaders in digital business ecosystems differentiate themselves not by the volume of initiatives, but by the coherence of their execution systems. First, they demonstrate role clarity, committing firmly to positions such as orchestrator, integrator, or participant instead of drifting between them. Second, they design for interoperability, embedding API-first architectures and open standards as strategic commitments. Third, they create scaling pathways for innovation, institutionalizing repeatable transitions from pilot to platform, while laggards remain mired in "PoC purgatory." Fourth, leaders integrate AI and analytics as systemic enablers, embedding intelligence into decision-making rather than treating it as discrete tools. Fifth, they elevate governance into a trust asset, developing agile compliance structures, data assurance pipelines, and transparent partner frameworks that attract ecosystem

participation. Sixth, sustainability becomes structural, not symbolic — circularity, traceability, and net-zero commitments shape business models rather than sit on the periphery. Seventh, leaders orchestrate ecosystem economics, designing incentive structures that sustain collaboration and prevent value capture asymmetries. Eighth, they enable adaptive talent ecosystems, blending in-house, partner, and cross-industry skills to reduce friction. Ninth, foresight is operationalized — leaders continuously scan adjacency opportunities rather than treating strategy as static. Finally, they reinforce execution through orchestration rituals — quarterly ecosystem reviews, portfolio dashboards, and partner scorecards — embedding ecosystem logic into day-to-day management.

Macro Lens (Quantitative Validation): Survey data validates these leadership practices at scale. 82% of respondents confirmed interoperability as critical, consistent with the qualitative emphasis, though neutrality responses confirm uneven implementation. 85% rated innovation scaling as essential, reinforcing the leaders' ability to move from pilot to platform, but only a minority demonstrate institutionalized pathways. Over 80% of respondents agreed that ESG should be core to ecosystem strategy, confirming its growing centrality, yet the qualitative evidence explains why many firms remain aspirational rather than operational. Governance maturity scored highest (>4.3/5), confirming leaders' investment in institutional trust frameworks. Strategy-related results showed widespread ambition but fragmented clarity, mirroring the qualitative observation of "role ambiguity" as a laggard trait.

RQ1 Conclusion: The convergent insight is clear: DBE leaders win by turning ambition into orchestration systems. Qualitative evidence reveals the texture of these practices — role clarity, interoperability, innovation scaling, systemic governance, and structural sustainability. Quantitative survey data confirms that these are widely recognized priorities, but execution gaps remain broad, validating the differentiation observed in

practice. For executives, the implication is decisive: firms that align strategic intent with orchestrated execution convert ecosystems from aspiration to structural advantage. For researchers, the integration of micro and macro findings strengthens construct validity, showing convergence between observed practices and systemic patterns. Looking forward, signals point to firms that embed adaptive interoperability, structural ESG, and foresight-driven innovation as the ones most likely to dominate the next wave of ecosystem evolution.

4.2 Research Question Two

What barriers and execution challenges hinder firms realizing their DBE ambitions? - as part of Qualitative analysis, if Research Question One identified what leaders do differently, Research Question Two exposes the obstacles that hold others back. The findings show that while many firms articulate compelling visions for Digital Business Ecosystems (DBEs), the path from ambition to realization is strewn with barriers that span technology, strategy, innovation, governance, and sustainability. These barriers are less about lack of intent and more about gaps in execution discipline, systemic integration, and the ability to balance paradoxes at scale.

Three patterns stand out:

1. Execution Friction is Persistent. Firms struggle to move from pilots to scale, with bottlenecks in data readiness, governance design, and ecosystem trust. Promising technologies remain trapped in silos, and many ecosystems collapse under integration costs or misaligned incentives.
2. Dualities Become Fault Lines. Where leaders balance openness and control, most firms over-rotate—either locking down platforms so tightly that partners disengage, or opening too widely and losing defensibility. Similarly, strategies built on

competition or collaboration alone often falter; without both, ecosystems remain brittle.

3. Legitimacy Gaps Undermine Scale. ESG commitments, regulatory alignment, and equitable value-sharing are too often treated as compliance checkboxes rather than embedded practices. This creates reputational exposure, regulatory backlash, and partner distrust, slowing ecosystem growth.

Across the five dimensions, the most common barriers include:

Technology: Weak model foundations, underdeveloped sustainability tech, and incomplete trust architectures that prevent scaling.

Strategy: Failure to align ecosystem positioning with institutional forces, and over-reliance on firm-centric competitive logic rather than ecosystem orchestration.

Innovation: Pilots that fail to embed repeatability, coupled with fragmented value–innovation loops and insufficient risk controls.

Governance: Ambiguity around roles, accountability, and standards that creates friction and deters participation.

Sustainability: Patchy carbon traceability, inconsistent disclosures, and absence of systemic equity models that undermine legitimacy.

In short, the barriers to DBE success are not merely technical hurdles but systemic execution challenges. They reveal that ambition is easy to declare but hard to embed without discipline, trust, and shared accountability.

This section therefore unpacks RQ2 across the five thematic lenses (4.2.1–4.2.5), presenting the adoption patterns, gaps, and white spaces that hinder firms from turning ecosystem intent into impact. Together, these insights illustrate why fewer than 10 percent of enterprises scale DBEs successfully, and why leadership requires more than vision—it requires solving for execution frictions at every layer of the ecosystem.

4.2.1 Technology

Technology represents both the enabler and the Achilles' heel of Digital Business Ecosystems (DBEs). While the backbone of scale and resilience depends on robust digital infrastructure, the same foundations often reveal the sharpest barriers when maturity is uneven, fragmented, or incomplete. Firms consistently cite technical frictions — from data reliability to interoperability bottlenecks, from limited assurance frameworks to underdeveloped sustainability tooling — as central obstacles to realizing ecosystem ambitions. In this sense, technology emerges not as a neutral platform but as a contested terrain where execution challenges dictate whether ecosystems stall or scale.

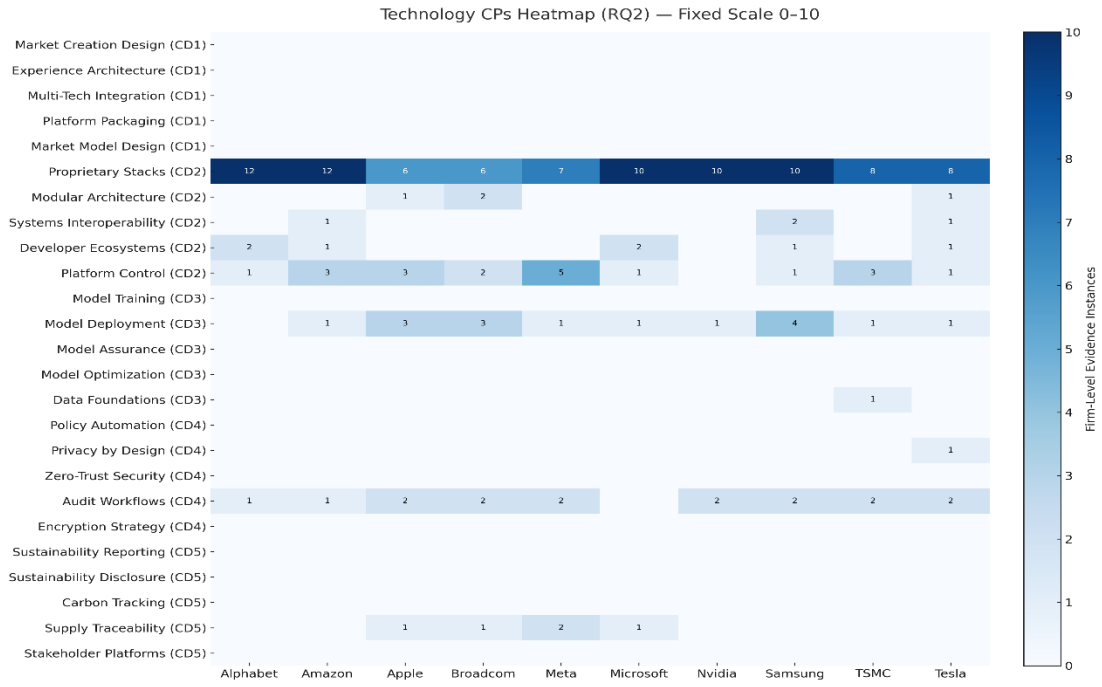

Figure 4.2.1
RQ2 – Technology CPs Heatmap

The technology heatmap illustrates this paradox by mapping adoption across five capability dimensions: Market Creation, Model Foundations, Proprietary Stacks, Sustainable Tech, and Trust and Controls. It shows strong convergence around proprietary

stacks, platform control, and audit workflows — defensive anchors that provide stability but often harden into rigid silos. Moderately adopted practices such as developer ecosystems, data foundations, supply traceability, and privacy-by-design signal intent but remain inconsistently institutionalized. Selective practices like modular architecture and limited systems interoperability expose experimentation without standardization, while white spaces in model training, sustainability disclosure, and policy automation reveal systemic blind spots. The heatmap highlights how ecosystems have built control and defensibility, but in doing so often underinvest in openness, sustainability, and proactive trust frameworks.

The accompanying data table sharpens this picture by detailing adoption patterns across the five dimensions. It reveals a bifurcated reality: ecosystems are strong in building and defending proprietary stacks, but weak in embedding resilience into sustainable technology and advanced trust controls. In practice, this creates a glass ceiling for scaling DBEs — robust architectures exist, but bottlenecks in assurance, interoperability, and sustainability stall momentum. For executives, the table underscores a central insight: the barriers to DBE success are less about the absence of technology and more about its uneven deployment, fragmented standards, and lack of integration across value chains.

RQ2 - Adaption Tiers for Technology 4.2.1

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Market Creation				Market Creation Design (0); Experience Architecture (0); Multi-Tech Integration (0); Platform Packaging (0); Market Model Design (0)
Model	Model Deployment (9)		Data Found	Model Training (0); Model Assurance (0); Model Optimization (0)

Foundations			ations (1)
Proprietary Stacks	Proprietary Stacks (10); Platform Control (9)	Developer Ecosystems (5)	Modular Architecture (3); Systems Interoperability (3)
Sustainable Tech			Supply Traceability (4) Sustainability Reporting (0); Sustainability Disclosure (0); Carbon Tracking (0); Stakeholder Platforms (0)
Trust and Controls	Audit Workflows (9)		Privacy by Design (1) Policy Automation (0); Zero-Trust Security (0); Encryption Strategy (0)

Broadly Adopted Practices

Broadly adopted technology practices cluster around three capability dimensions—Data Foundations, which establish the pipelines and architectures for scale and reliability; Proprietary Stacks, which ensure defensibility and integration by giving firms control over their technological destiny; and Systems Interoperability, which enables seamless connectivity and scaling across platforms. These dimensions matter because they form the non-negotiable baseline of digital ecosystems: without robust data, proprietary control points, and interoperability, ecosystems cannot function competitively or grow sustainably.

First, firms advance Data Foundations through Data Fabrics and Pipelines, structuring ingestion, management, and deployment at scale. Amazon and Microsoft embed fabrics into their cloud platforms, ensuring engineers and product teams have access to high-quality data streams that reduce latency and errors, enabling reliable downstream analytics and AI pipelines.

Second, leaders strengthen Proprietary Stacks by developing Compute Platforms and investing in Hardware–Software Co-Design. NVIDIA integrates CUDA into developer

workflows, Apple fuses chip design with operating systems, and TSMC refines process nodes that anchor global supply chains. RandD teams and technical architects embed these control points into production systems, safeguarding differentiation and preventing commoditization.

Third, ecosystems reinforce Systems Interoperability through Hybrid Integration and API Gateways. Microsoft links on-premise and cloud workloads with hybrid architectures, while Alphabet advances interoperability through an API-first ecosystem. Technology architects and partner-facing teams enforce modular frameworks and adoption standards, reducing friction and accelerating cross-platform scaling.

Moderately Adopted Practices

Moderately adopted technology practices spread across three capability dimensions—Model Foundations, which scale machine learning beyond experimentation; Sustainable Tech, which links technology footprints to climate accountability; and Trust and Controls, which embed assurance and privacy into design. These dimensions matter because they connect technical promise with systemic legitimacy, though adoption is fragmented and inconsistent across industries.

First, ecosystems mature Model Foundations with Model Deployment, translating algorithms into production-ready applications. Microsoft pushes models into enterprise products such as Copilot, while Tesla integrates AI into autonomous driving, both relying on DevOps pipelines and ML engineers coordinating with product teams. These deployments expand impact but often face integration costs and failure risks.

Second, firms develop Sustainable Tech through Carbon Tracking and Supply Traceability, embedding accountability into operations. Microsoft and Amazon operate carbon dashboards to track emissions across business units, while Apple enforces supplier audits

verified by external parties. Sustainability officers ensure disclosures are credible, but adoption remains uneven across firms and sectors.

Third, ecosystems strengthen Trust and Controls via Privacy by Design, embedding safeguards into systems from the outset. Apple integrates privacy directly into its operating systems, institutionalizing protections against regulatory scrutiny and reputational risks. Engineering and compliance teams conduct design reviews and automated enforcement, making privacy default rather than retrofit.

Selectively Adopted Practices

Selectively adopted technology practices surface across five capability dimensions—Market Creation, Model Foundations, Proprietary Stacks, Sustainable Tech, and Trust and Controls. These dimensions matter because they represent frontier experimentation: they reveal ambition to shape new markets, embed responsibility, and deepen defensibility, but adoption is still thin and inconsistent.

First, ecosystems test Market Creation through Experience Architecture and Platform Packaging, designing new ways of consumption. Tesla experiments with bundled mobility–energy services, while Meta pilots XR ecosystems. Product strategists and partner teams orchestrate offerings, but adoption remains sparse.

Second, Model Foundations expand into Model Assurance, where validation frameworks are still embryonic. Amazon and Microsoft pilot bias testing and certification protocols, but without standardized benchmarks, efforts remain localized. ML engineers and governance teams lead these pilots, highlighting recognition but limited scale.

Third, firms evolve Proprietary Stacks with Modular Architectures, Developer Ecosystems, and Platform Control. Microsoft and AWS break down monoliths into flexible services, Apple and NVIDIA grow developer ecosystems through SDKs and app stores, and Apple and Alphabet enforce platform rules contested by regulators. Engineering leads,

ecosystem managers, and legal teams coordinate these efforts, reflecting ambition but also friction.

Fourth, ecosystems advance Sustainable Tech with Sustainability Reporting, aligning disclosures with ESG mandates. Microsoft and Amazon develop reporting dashboards to standardize visibility, while sustainability officers and compliance teams integrate them into governance. Comparability across firms remains limited.

Fifth, Trust and Controls extend into Zero-Trust Security and Audit Workflows, embedding accountability into operations. Google's BeyondCorp pioneered zero-trust principles, while Microsoft builds audit workflows tracing accountability pipelines across teams. Security engineers and compliance officers lead deployments, though resource intensity limits scale.

White Spaces (Zero Evidence)

White spaces in technology span five capability dimensions—Market Creation, missing Design Playbooks for systematic orchestration; Model Foundations, lacking Training Pipelines and Optimization Protocols for performance at scale; Proprietary Stacks, without robust Modular Orchestration and partner integration; Sustainable Tech, missing Automated Disclosure and mature traceability systems; and Trust and Controls, without evidence of Continuous Audit frameworks. These gaps matter because they expose ecosystems to climate, security, and performance risks, showing how far they remain from embedding resilience and responsibility.

Synthesis and Transition

Taken together, technology practices reveal convergence around Data Foundations, Proprietary Stacks, and Systems Interoperability, while showing uneven maturity in Model Deployment, Carbon Tracking, and Privacy by Design. Selective practices such as Modular Architectures, Zero-Trust Security, and Sustainability Reporting highlight experimentation

without scale, while white spaces expose critical gaps in playbooks, automation, and assurance. Collectively, ecosystems have built strong technical foundations but remain far from embedding resilience and responsibility at scale.

Transition: Technology provides the building blocks of digital ecosystems, but Strategy determines how these foundations are mobilized into positioning, value creation, and long-term advantage. The next section explores how firms translate technology into strategic direction and ecosystem design.

4.2.2 Strategy

If technology exposes the operational bottlenecks of Digital Business Ecosystems (DBEs), strategy reveals the cracks in ambition — the points where bold narratives fail to translate into consistent execution. Strategic intent is abundant across leading firms: visions of platform dominance, ecosystem expansion, and sustainable impact are well-articulated. Yet the heatmap shows that these ambitions often fragment in practice, with firms overinvesting in defensive postures while underdelivering on differentiation, portfolio breadth, and long-term resilience. In this sense, the barriers at the strategy layer are less about lacking ambition and more about a persistent execution gap between aspiration and reality.

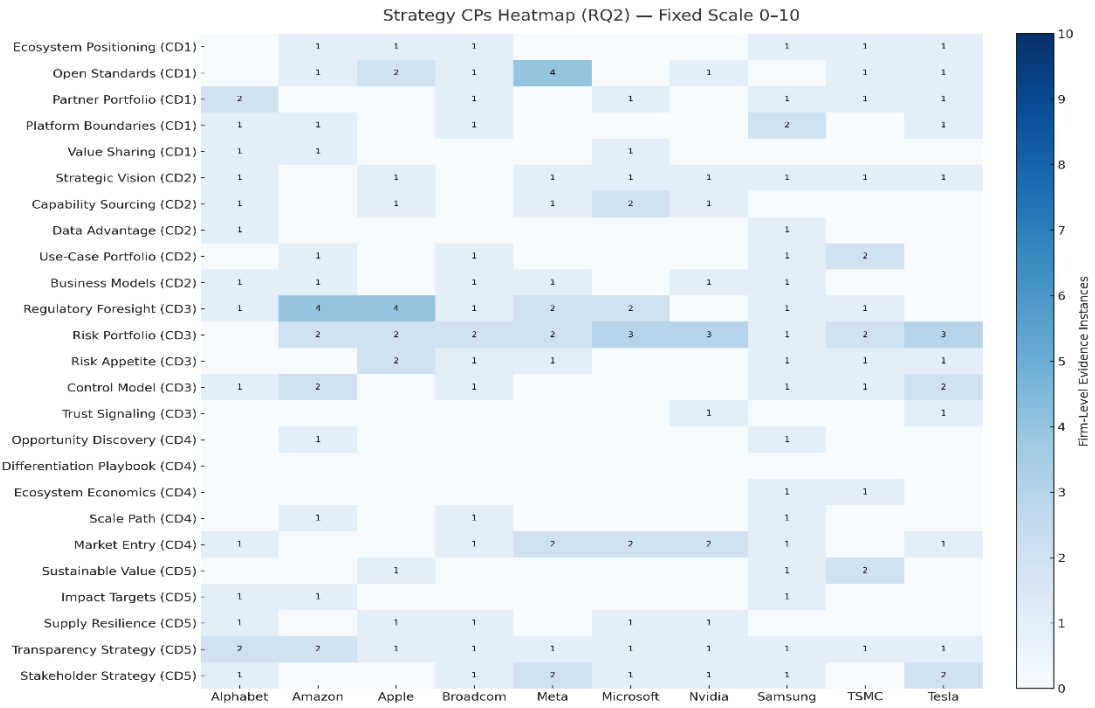

Figure 4.2.2
RQ2 – Strategy CPs Heatmap

The strategy heatmap charts adoption across five capability dimensions: Competitive Positioning, Data-Driven Strategy, Ecosystem Strategy, Governance Strategy, and Sustainability Strategy. It highlights how broadly adopted practices cluster around market entry, strategic vision, ecosystem positioning, regulatory foresight, risk portfolio management, and transparency strategies. These anchors ensure ecosystems retain legitimacy and directional clarity but often harden into short-term safeguards. Moderately adopted practices — such as capability sourcing, business model innovation, risk appetite calibration, and stakeholder strategy — demonstrate ambition but remain inconsistently scaled. Selective practices, including value sharing, sustainable value creation, and impact targets, show promise but reveal a lack of systemic adoption. Zero evidence in areas like differentiation playbooks underscores how few firms succeed at designing distinctive, repeatable strategies that transcend defensive positioning.

The data table reinforces this narrative by quantifying adoption tiers. It shows ecosystems doubling down on compliance, transparency, and market access, but struggling to institutionalize portfolio diversity, differentiated playbooks, or integrated sustainability anchors. This creates a paradox: DBEs appear strategically coherent on paper but lack the adaptability, differentiation, and incentive-sharing mechanisms required for long-term success. For executives, the table delivers a sobering message: barriers to DBE ambition are not rooted in weak strategy formulation, but in the inability to operationalize strategy beyond compliance and entry points. The execution challenge, therefore, lies in converting vision into scalable, distinctive practices that can survive in the hyperconnected ecosystem arena.

RQ2 - Adaption Tiers for Strategy 4.2.2

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Competitive Positioning		Market Entry (7)	Opportunity Discovery (2); Ecosystem Economics (2); Scale Path (3)	Differentiation Playbook (0)
Data-Driven Strategy	Strategic Vision (8)	Capability Sourcing (5); Business Models (6)	Data Advantage (2); Use-Case Portfolio (4)	
Ecosystem Strategy		Ecosystem Positioning (6); Open Standards (7); Partner Portfolio (6); Platform Boundaries (5)	Value Sharing (3)	
Governance Strategy	Regulatory Foresight (8); Risk Portfolio (9)	Risk Appetite (6); Control Model (6)	Trust Signaling (2)	

Sustainability Strategy	Transparency Strategy (10)	Supply Resilience (5); Stakeholder Strategy (7)	Sustainable Value (3); Impact Targets (3)

Broadly Adopted Practices

Broadly adopted practices in strategy are anchored around three capability dimensions—Data-Driven Strategy, which grounds direction in evidence; Governance Strategy, which equips ecosystems to anticipate pressures and manage uncertainty; and Sustainability Strategy, which embeds transparency as a visible and enforceable element of legitimacy. These dimensions matter because they form the structural foundations of execution, ensuring ecosystems earn trust, comply with regulation, and signal accountability.

First, in Data-Driven Strategy, firms adopt Strategic Vision, anchoring purpose in evidence-based roadmaps. Alphabet frames an AI-first vision with multi-decade milestones, while Tesla integrates autonomy and energy transition into long-term strategy. Senior leaders and strategy teams institutionalize these visions to avoid improvisation and secure coherent trajectories.

Second, in Governance Strategy, firms operationalize Regulatory Foresight and Risk Portfolios. Microsoft integrates responsible AI governance into product pipelines, TSMC builds compliance with export controls directly into operations, NVIDIA diversifies exposure through multi-region partnerships, and Meta adjusts policies to manage reputational risk. These mechanisms embed foresight and risk management into daily operations.

Third, in Sustainability Strategy, firms institutionalize Transparency Strategies, converting ESG into measurable accountability. Microsoft deploys dashboards to track

emissions, Amazon publishes supply chain disclosure reports, and auditors enforce comparability across stakeholders. These mechanisms shift sustainability from symbolic commitments to verifiable performance.

Moderately Adopted Practices

Moderately adopted practices expand the strategic toolkit across five capability dimensions—Competitive Positioning, which tests new entry models; Data-Driven Strategy, which operationalizes vision through sourcing and models; Ecosystem Strategy, which defines participation through positioning, partners, and boundaries; Governance Strategy, which manages execution through risk and control; and Sustainability Strategy, which extends accountability through resilience and stakeholder engagement. These dimensions matter because they build beyond the baseline anchors, but uneven adoption leaves ecosystems exposed to competitive, regulatory, and climate risks.

First, in Competitive Positioning, firms test Market Entry into new geographies and sectors. Tesla bundles energy and mobility, while Amazon pushes into healthcare. Yet strategy teams often struggle to convert such experiments into profitable businesses.

Second, in Data-Driven Strategy, firms pursue Capability Sourcing and Business Models to operationalize vision. Microsoft's acquisition of Nuance and NVIDIA's purchase of Mellanox extend capabilities, while subscription and usage-based pricing reshape revenue streams. Still, integration challenges and inertia dilute impact.

Third, in Ecosystem Strategy, firms experiment with Ecosystem Positioning, Open Standards, Partner Portfolios, and Platform Boundaries. NVIDIA positions CUDA as indispensable, Apple locks control within its devices, Amazon and Microsoft promote APIs and multi-cloud standards, and Samsung and NVIDIA curate partner portfolios. Variation emerges in openness: Apple enforces rigid OS rules, while others allow more permeability.

Fourth, in Governance Strategy, firms apply Risk Appetite and Control Models to enforce rules of execution. Tesla tolerates higher risk through shadow pilots, Microsoft phases rollouts conservatively, Alphabet uses escalation protocols for content governance, and TSMC embeds audits for compliance. Risk officers and legal teams shape these thresholds.

Fifth, in Sustainability Strategy, firms embed Supply Resilience and Stakeholder Strategies. Apple diversifies suppliers to mitigate concentration, TSMC invests in overseas fabs, Amazon engages investors through disclosure initiatives, and Alphabet builds alliances. Yet adoption remains ad hoc, limiting systemic resilience.

Selectively Adopted Practices

Selectively adopted practices represent frontier experiments across five capability dimensions—Competitive Positioning, Data-Driven Strategy, Ecosystem Strategy, Governance Strategy, and Sustainability Strategy. These dimensions matter because they showcase emerging creativity and ambition, but without institutionalization, they remain fragile bets that may fail to scale or erode credibility.

First, in Competitive Positioning, firms pursue Opportunity Discovery, Ecosystem Economics, and Scale Paths. Amazon probes financial services, Alphabet experiments with quantum applications, Tesla expands Gigafactories, and Apple and Alphabet sustain app-store monetization under regulatory scrutiny. These efforts showcase creativity but fragile scaling.

Second, in Data-Driven Strategy, firms test Data Advantage and Use-Case Portfolios. Tesla leverages proprietary mobility telemetry, Alphabet scales insights from search datasets, Microsoft integrates Copilot into productivity suites, and Meta pilots XR monetization. Yet constraints in access, sovereignty, and compliance limit reach.

Third, in Ecosystem Strategy, firms pilot Value Sharing to sustain loyalty. TSMC develops risk-sharing arrangements, while Amazon creates incentive funds for partners. These redistribution mechanisms remain in early phases.

Fourth, in Governance Strategy, firms test Trust Signaling through voluntary disclosures and oversight boards. Microsoft experiments with ethics reviews, and Meta convenes external oversight groups. Such practices improve transparency but remain rare.

Fifth, in Sustainability Strategy, firms pursue Sustainable Value and Impact Targets. Apple brands carbon-neutral devices as ESG milestones, while Amazon advances its Climate Pledge. Most, however, remain aspirational rather than embedded in business models.

White Spaces (Zero Evidence)

Zero evidence exposes structural gaps across five capability dimensions—Competitive Positioning, where Differentiation Playbooks are absent; Data-Driven Strategy, where sustainable models balancing monetization with privacy, fairness, and sovereignty remain incomplete; Ecosystem Strategy, where mature Value-Sharing Mechanisms and Risk Allocation Frameworks are lacking; Governance Strategy, where Trust Signals and robust Risk Portfolios are underdeveloped; and Sustainability Strategy, where Resilience Frameworks and long-term Accountability Models are missing. These dimensions matter because their absence leaves ecosystems reliant on ad hoc responses, undermining differentiation, accountability, and resilience in the face of external shocks.

Synthesis and Transition

Taken together, RQ2 – Strategy shows convergence around Strategic Vision, Regulatory Foresight, Risk Portfolios, and Transparency as anchors. Moderately adopted practices such as Market Entry, Capability Sourcing, Partner Portfolios, and Supply Resilience extend ambition but remain uneven. Selectively adopted practices—

Opportunity Discovery, Data Advantage, Value Sharing, Trust Signaling, and Sustainable Value Targets—highlight experimentation without scale. White spaces underscore fragilities in differentiation, accountability, and resilience.

Transition: If technology provides the building blocks, strategy determines how they are mobilized into positioning and resilience. The next section turns to Innovation, where ecosystems convert these foundations into products, models, and services that generate renewal and growth.

4.2.3 Innovation

Innovation sits at the heart of Digital Business Ecosystems (DBEs), yet it is also where the most stubborn barriers surface. Ecosystems thrive on experimentation, portfolio diversification, and foresight, but the reality revealed by the data is one of patchy institutionalization and uneven scaling. Firms demonstrate a willingness to innovate but often lack the pathways to translate prototypes into sustained market impact. This creates a structural bottleneck: while the rhetoric of innovation dominates boardrooms, the practices underpinning it remain inconsistent, leaving ecosystems vulnerable to stalled momentum and unrealized potential.

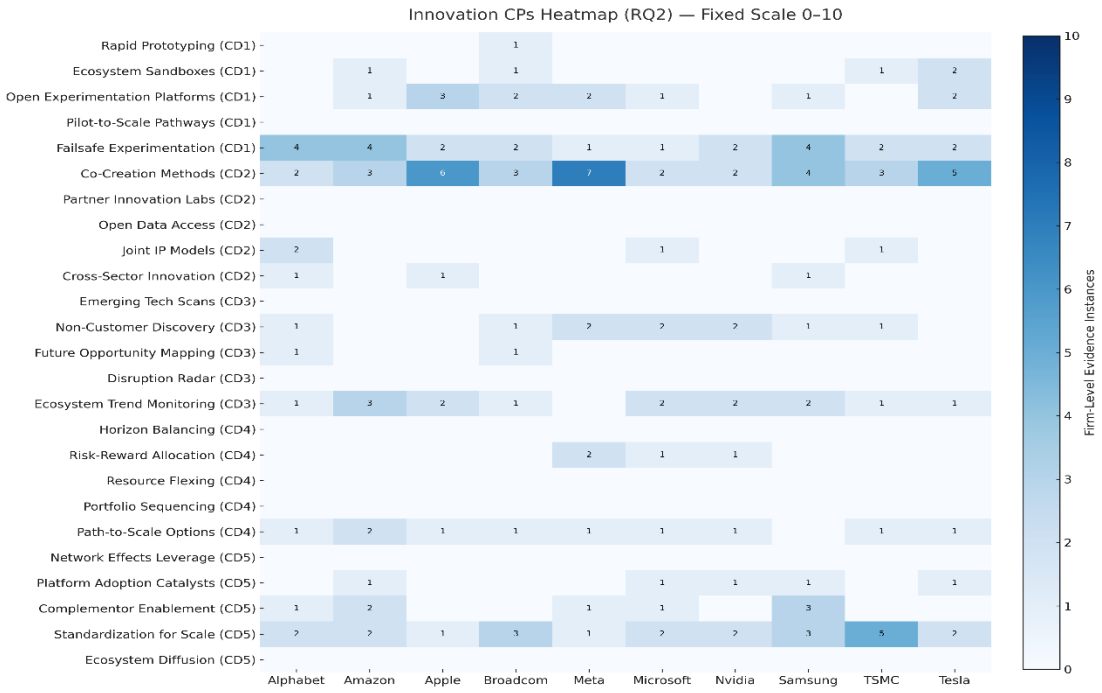

Figure 4.2.3
RQ2 – Innovation CPs Heatmap

The innovation heatmap organizes adoption across five capability dimensions: Collaborative Discovery, Ecosystem Experimentation, Innovation Portfolios, Market Foresight, and Scaling Innovation. It shows strong adoption of co-creation methods, failsafe experimentation, path-to-scale options, trend monitoring, and standardization for scale — practices that provide guardrails and predictability. Moderately adopted practices such as joint IP models, cross-sector innovation, open experimentation platforms, non-customer discovery, and complementor enablement demonstrate ambition but limited scale. Selective practices like rapid prototyping and future opportunity mapping highlight experimentation without maturity, while white spaces in areas such as partner innovation labs, pilot-to-scale pathways, disruption radars, and portfolio balancing expose fundamental gaps. The heatmap therefore signals ecosystems that are innovating in bursts but struggling to embed sustained renewal engines.

The data table reinforces this diagnosis. It shows that while firms excel in anchoring standardized processes, failsafe mechanisms, and path-to-scale options, they falter in building balanced innovation portfolios and in scanning for disruptive threats. In practice, this creates a "comfort zone" paradox: ecosystems focus on safer, incremental innovation rather than cultivating the bold, risk-managed bets that unlock new categories and sustained differentiation. For executives, the table underscores a pressing challenge: DBE ambitions cannot be met by isolated experiments alone. To overcome innovation barriers, firms must build resilient, multi-layered innovation systems that balance exploration with exploitation — a discipline few have yet mastered at scale.

RQ2 - Adaption Tiers for Innovation 4.2.3

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Collaborative Discovery	Co-Creation Methods (10)		Joint IP Models (3); Cross-Sector Innovation (3)	Partner Innovation Labs (0); Open Data Access (0)
Ecosystem Experimentation	Failsafe Experimentation (10)	Open Experimentation Platforms (7)	Rapid Prototyping (1); Ecosystem Sandboxes (4)	Pilot-to-Scale Pathways (0)
Innovation Portfolios	Path-to-Scale Options (9)		Risk-Reward Allocation (3)	Horizon Balancing (0); Resource Flexing (0); Portfolio Sequencing (0)
Market Foresight	Ecosystem Trend Monitoring (9)	Non-Customer Discovery (7)	Future Opportunity Mapping (2)	Emerging Tech Scans (0); Disruption Radar (0)
Scaling Innovation	Standardization for Scale (10)	Platform Adoption Catalysts (5); Complementor Enablement (5)		Network Effects Leverage (0); Ecosystem Diffusion (0)

Broadly Adopted Practices

Broadly adopted innovation practices cluster around five capability dimensions—Collaborative Discovery, which pools knowledge across firms; Ecosystem Experimentation, which embeds risk-managed exploration into operating models; Innovation Portfolios, which create pathways for scaling pilots; Market Foresight, which anticipates disruption before it materializes; and Scaling Innovation, which standardizes and diffuses promising solutions. These dimensions matter because they form the backbone of ecosystem-level innovation, ensuring credibility, resilience, and long-term growth.

First, ecosystems strengthen Collaborative Discovery with Co-Creation Methods, making joint problem-solving foundational. Alphabet builds AI research alliances, Microsoft runs enterprise co-innovation centers, and Tesla advances mobility–energy pilots. Shared design labs, cross-industry workshops, and co-investment ventures allow firms to generate innovations no single actor could deliver alone.

Second, firms institutionalize Ecosystem Experimentation through Failsafe Experimentation, ensuring exploration does not destabilize systems. Amazon runs controlled A/B pilots, Microsoft deploys shadow rollouts, and Meta tests social features incrementally. Technical kill switches, staged launches, and financial firewalls enable learning while safeguarding trust and capital.

Third, ecosystems advance Innovation Portfolios with Path-to-Scale Options, preventing ideas from stalling as pilots. NVIDIA grew CUDA from a niche developer tool to a global AI standard, while Tesla evolved pilot plants into global Gigafactories. Governance checkpoints, commercialization roadmaps, and resource allocation models ensure systematic scaling.

Fourth, Market Foresight is reinforced with Ecosystem Trend Monitoring. Samsung tracks electronics lifecycles, Alphabet monitors AI regulation, and Microsoft

forecasts enterprise cloud adoption. Dedicated foresight units and horizon-scanning platforms allow ecosystems to detect shifts early and align investments.

Fifth, ecosystems embed Scaling Innovation with Standardization for Scale, codifying adoption. Amazon enforces AWS compliance blueprints, Apple standardizes device protocols, and TSMC aligns semiconductor interfaces with global standards. Standards bodies, compliance teams, and technical architects provide the infrastructure for interoperability and diffusion.

Moderately Adopted Practices

Moderately adopted innovation practices span three capability dimensions—Ecosystem Experimentation, which broadens innovation inputs through openness; Market Foresight, which extends discovery beyond existing customers; and Scaling Innovation, which accelerates adoption by empowering partners. These dimensions matter because they expand participation, uncover new markets, and amplify diffusion, though institutionalization remains inconsistent across ecosystems.

First, ecosystems expand Ecosystem Experimentation with Open Experimentation Platforms, giving external developers, researchers, and partners controlled access to testbeds. Alphabet's TensorFlow ecosystem, Amazon's AWS environments, and Microsoft's GitHub sandboxes exemplify this balance of openness and governance. Adoption remains limited to firms confident in safeguards.

Second, firms advance Market Foresight through Non-Customer Discovery, extending sensing beyond current user bases. Tesla investigates adjacent energy use cases, while Microsoft targets SMEs in emerging markets. Ethnographic studies, behavioral analytics, and outreach programs reveal latent demand and inform product strategy.

Third, ecosystems reinforce Scaling Innovation with Platform Adoption Catalysts and Complementor Enablement. Apple subsidizes app developers, NVIDIA funds CUDA

ecosystem projects, and Microsoft supports GitHub accelerators. Developer relations teams orchestrate onboarding, giving complementors resources to scale on shared platforms.

Selectively Adopted Practices

Selectively adopted innovation practices surface across four capability dimensions—Collaborative Discovery, Ecosystem Experimentation, Innovation Portfolios, and Market Foresight. These dimensions matter because they reflect frontier ambition: firms test mechanisms for defensibility, speed, and foresight, but weak institutionalization limits impact and scalability.

First, in Collaborative Discovery, firms experiment with Joint IP Models and Cross-Sector Innovation. Samsung co-develops patents in telecom, while NVIDIA pursues AI–healthcare partnerships. Legal and RandD teams navigate ownership and trust challenges, constraining widespread adoption.

Second, Ecosystem Experimentation progresses with Rapid Prototyping and Ecosystem Sandboxes, accelerating validation. Tesla pilots modular vehicle software, while Meta tests XR in sandboxed environments. These approaches enable agility but demand significant resources and governance controls.

Third, ecosystems build Innovation Portfolios through Risk–Reward Allocation, sharing costs and outcomes to incentivize participation. TSMC develops joint semiconductor ventures, while Microsoft funds enterprise innovation projects. Finance teams and governance committees coordinate, but balancing risks remains a barrier to scaling.

Fourth, ecosystems extend Market Foresight with Future Opportunity Mapping, embedding scenario planning to anticipate divergent futures. Alphabet models quantum

computing trajectories, and Amazon explores logistics scenarios. Foresight units integrate such maps into strategy, but systematic adoption is still rare.

White Spaces (Zero Evidence)

White spaces in innovation highlight gaps across five capability dimensions—Collaborative Discovery, missing Partner Innovation Labs and Open Data Access; Ecosystem Experimentation, lacking Pilot-to-Scale Pathways that translate tests into adoption; Innovation Portfolios, without Horizon Balancing, Resource Flexing, or Portfolio Sequencing; Market Foresight, absent Emerging Tech Scans and Disruption Radar; and Scaling Innovation, where Network Effects Leverage and Ecosystem Diffusion mechanisms are missing. These gaps matter because they expose ecosystems to foresight blind spots, pilot purgatory, and incremental rather than exponential scaling.

Synthesis and Transition

Taken together, innovation practices reveal convergence around Co-Creation Methods, Failsafe Experimentation, Path-to-Scale Options, Ecosystem Trend Monitoring, and Standardization for Scale. Moderately adopted practices expand inputs and accelerate complementor adoption, though uneven maturity reflects governance and resource constraints. Selective practices highlight frontier bets like Joint IP Models, Risk–Reward Allocation, and Future Opportunity Mapping, while white spaces expose structural weaknesses in foresight, scaling, and portfolio governance.

Collectively, ecosystems agree that innovation is inseparable from survival, but diverge in openness, risk appetite, and partner engagement.

Transition: Innovation sustains differentiation, but its success depends on governance frameworks that secure oversight, accountability, and legitimacy. The next section turns to Governance, where ecosystems institutionalize the rules and mechanisms that determine how innovation pipelines are managed and trusted.

4.2.4 Governance

Governance emerges as both the silent backbone and the hidden barrier of Digital Business Ecosystems (DBEs). While firms readily invest in technology and strategy, the mechanisms that ensure accountability, fairness, and resilience often lag behind. Governance failures are rarely immediate; instead, they accumulate silently, surfacing as crises of legitimacy, partner mistrust, or regulatory confrontation. The data reveals that although firms have made progress in basic oversight and compliance alignment, deeper institutionalization of distributed governance, ethical safeguards, and cross-boundary coordination remains conspicuously underdeveloped. In short, ecosystems are learning that without robust governance, even the most advanced technology and boldest strategies struggle to sustain scale.

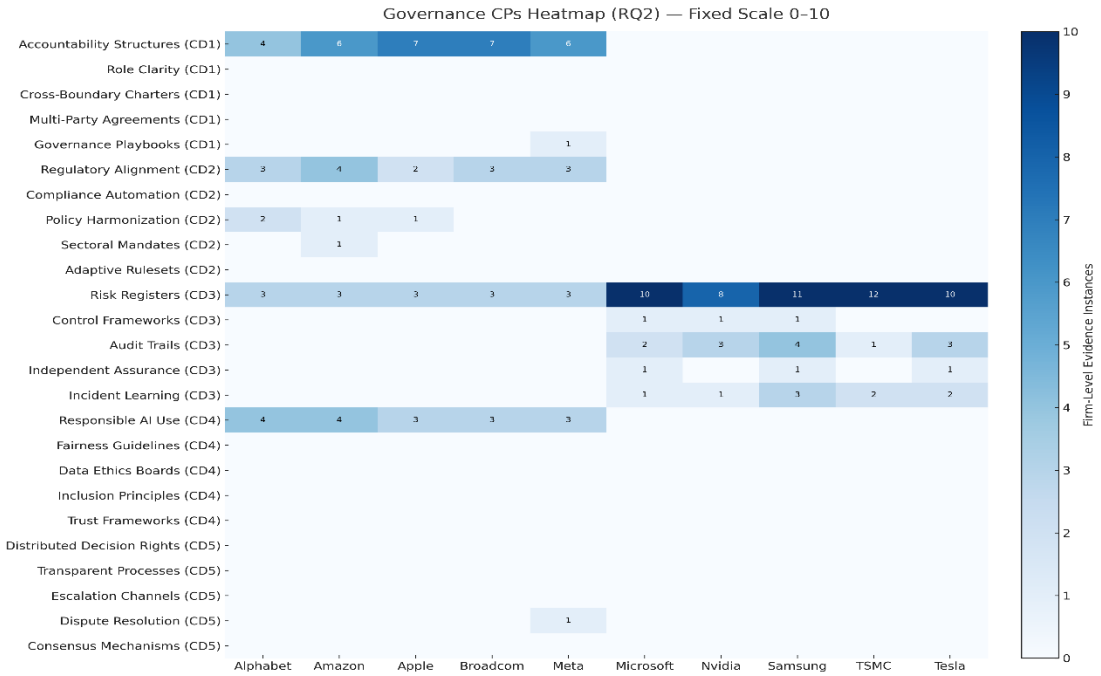

Figure 4.2.4
RQ2 – Governance CPs Heatmap

The governance heatmap maps adoption across five capability dimensions: Decision Governance, Ecosystem Oversight, Ethical Governance, Policy and Compliance, and Risk and Assurance. It highlights that risk registers, accountability structures, regulatory alignment, and responsible AI use are the most consistently adopted practices, providing minimal guardrails. Moderately adopted practices — including governance playbooks, policy harmonization, audit trails, and incident learning — signal efforts to institutionalize oversight, but adoption remains uneven. Selective practices such as dispute resolution and control frameworks appear in isolated instances, while white spaces dominate in distributed decision rights, cross-boundary charters, data ethics boards, compliance automation, and adaptive rulesets. The heatmap underscores the imbalance: ecosystems are better at documenting risks than at distributing authority, aligning policies, or embedding ethical checks into decision-making.

The accompanying data table sharpens this insight. It shows that while firms reliably maintain risk registers and basic accountability mechanisms, they fall short in creating structures that can manage interdependence at ecosystem scale. Absences in consensus mechanisms, fairness guidelines, and automation of compliance reveal governance systems designed for internal control rather than cross-boundary orchestration. For executives, the table highlights a systemic barrier: governance in DBEs has been treated as a bolt-on rather than a foundational design principle. Until ecosystems embed distributed decision-making, harmonized policies, and proactive assurance frameworks, governance will remain a drag on trust, collaboration, and ultimately on the ability to scale DBEs successfully.

RQ2 - Adaption Tiers for Governance 4.2.4

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Decision Governance			Dispute Resolution (1)	Distributed Decision Rights (0); Transparent Processes (0); Escalation Channels (0); Consensus Mechanisms (0)
Ecosystem Oversight		Accountability Structures (5)	Governance Playbooks (1)	Role Clarity (0); Cross-Boundary Charters (0); Multi-Party Agreements (0)
Ethical Governance		Responsible AI Use (5)		Fairness Guidelines (0); Data Ethics Boards (0); Inclusion Principles (0); Trust Frameworks (0)
Policy and Compliance		Regulatory Alignment (5)	Policy Harmonization (3); Sectoral Mandates (1)	Compliance Automation (0); Adaptive Rulesets (0)
Risk and Assurance	Risk Registers (10)	Audit Trails (5); Incident Learning (5)	Control Frameworks (3); Independent Assurance (3)	

Broadly Adopted Practices

Broadly adopted practices in governance cluster around one capability dimension: Risk and Assurance, which forms the backbone of stability in digital ecosystems. This dimension matters because ecosystems operate under constant geopolitical, technological, and reputational uncertainty, and without mechanisms to capture and manage risks, firms remain vulnerable to cascading disruptions. By embedding systematic risk practices, firms transform governance from a compliance burden into a resilience capability.

First, Risk and Assurance anchor practice is Risk Registers, which consolidate identification, cataloguing, and tracking of risks across domains. Microsoft integrates cyber and compliance registers into enterprise frameworks, while TSMC maps geopolitical exposures into fab governance. Strategy teams, compliance officers, and operations

managers jointly maintain these repositories, ensuring consistency and preventing fragmented awareness. This systematization assures regulators, partners, and investors that governance is not reactive but coordinated and credible.

Moderately Adopted Practices

Moderately adopted practices extend governance capacity across four capability dimensions: Ecosystem Oversight, Ethical Governance, Policy and Compliance, and Risk and Assurance. These practices matter because they broaden governance beyond risk capture into accountability, ethics, and operational assurance, though maturity is uneven.

First, ecosystems strengthen Ecosystem Oversight with Accountability Structures, which formalize ownership of decisions and outcomes. Alphabet's AI oversight committees and Amazon's partner responsibility teams establish escalation points and clarify roles. Governance bodies and program managers coordinate responsibilities, reducing ambiguity and reinforcing legitimacy across ecosystems.

Second, firms advance Ethical Governance with Responsible AI Use, embedding fairness and responsibility into innovation. Microsoft integrates responsible AI councils into product cycles, while Tesla applies staged autonomy pilots to manage safety risks. Ethics boards and product managers operationalize these structures, converting principle into enforceable practice.

Third, ecosystems operationalize Policy and Compliance with Regulatory Alignment, anticipating and embedding obligations across geographies. Meta recalibrates systems for GDPR compliance, while TSMC integrates export controls into fab governance. Supporting mechanisms such as compliance automation and policy harmonization reduce manual burden. Legal teams, regulatory specialists, and product designers co-develop these frameworks, though enforcement consistency varies.

Fourth, ecosystems deepen Risk and Assurance through Control Frameworks, Audit Trails, and Incident Learning. TSMC enforces process audits, Microsoft institutionalizes compliance regimes, and Amazon codifies security incident learnings into enterprise guidance. Risk officers, auditors, and IT leads coordinate these frameworks, enhancing traceability and resilience. However, uneven adoption reveals that many firms prioritize headline compliance while underinvesting in systematic learning.

Selectively Adopted Practices

Selectively adopted practices reflect frontier ambition but weak institutionalization, surfacing across three capability dimensions: Ecosystem Oversight, Policy and Compliance, and Risk and Assurance.

First, ecosystems expand Ecosystem Oversight with Role Clarity, Cross-Boundary Charters, and Multi-Party Agreements, aiming to codify responsibilities and risk-sharing across firms. Semiconductor consortia experiment with charters, but evidence shows these mechanisms remain episodic. Governance officers and consortium boards lead these efforts, yet systemic adoption is absent.

Second, firms extend Policy and Compliance with Sectoral Mandates, adapting governance to industry-specific standards. Tesla aligns with automotive safety regimes, while Amazon adapts AWS healthcare services to HIPAA compliance. Regulatory teams and product engineers collaborate to meet sectoral requirements, but efforts remain reactive and fragmented, tied to necessity rather than proactive strategy.

Third, ecosystems pilot Risk and Assurance with Independent Assurance, inviting external validation of governance practices. NVIDIA commissions audits of CUDA libraries, signaling credibility to partners and regulators. External assessors and governance leads coordinate these reviews, but adoption is limited and inconsistent across industries.

White Spaces (Zero Evidence)

White spaces in governance expose foundational absences that prevent ecosystems from moving beyond compliance. At this tier, five capability dimensions remain underdeveloped: Decision Governance, with no evidence of Distributed Decision Rights, Transparent Processes, or Consensus Mechanisms; Ecosystem Oversight, missing Governance Playbooks for multi-party arrangements; Ethical Governance, without Fairness Guidelines, Data Ethics Boards, or Inclusion Principles; Policy and Compliance, lacking Adaptive Rulesets to adjust dynamically to regulatory change; and Risk and Assurance, without scalable Independent Assurance models. These gaps reveal how governance remains dominated by compliance and risk management, underinvesting in legitimacy and participatory mechanisms.

Synthesis and Transition

Taken together, governance practices reveal broad adoption of Risk Registers as anchors of resilience and moderate maturity in areas such as Accountability Structures, Responsible AI Use, Regulatory Alignment, and Control Frameworks. Selective practices demonstrate ambition in multi-party accountability, sectoral adaptation, and external validation, yet systemic gaps persist. White spaces expose missing foundations in decision-making, fairness, and adaptability, leaving governance skewed toward compliance protection rather than innovation in legitimacy. Firms converge on risk management as the central safeguard but diverge on whether governance itself can evolve into a lever of differentiation.

Transition: Governance secures the oversight and legitimacy that sustain innovation and strategy, but it cannot stand alone. The next section turns to Sustainability, where ecosystems are tested on climate accountability, impact measurement, and stakeholder trust as the structural foundations of long-term survival.

4.2.5 Sustainability

Sustainability represents one of the most critical yet under-realized dimensions of Digital Business Ecosystems (DBEs). Firms have been quick to declare climate ambitions and publish ESG metrics, but the data reveals a persistent execution gap between symbolic commitments and systemic practice. At its best, sustainability provides ecosystems with legitimacy, investor trust, and long-term resilience. At its weakest, it risks devolving into "green theater," where targets and disclosures exist without the operational depth to make them credible. The evidence shows that while sustainability anchors are in place, the scaffolding of measurement, assurance, and value chain transformation remains patchy and uneven.

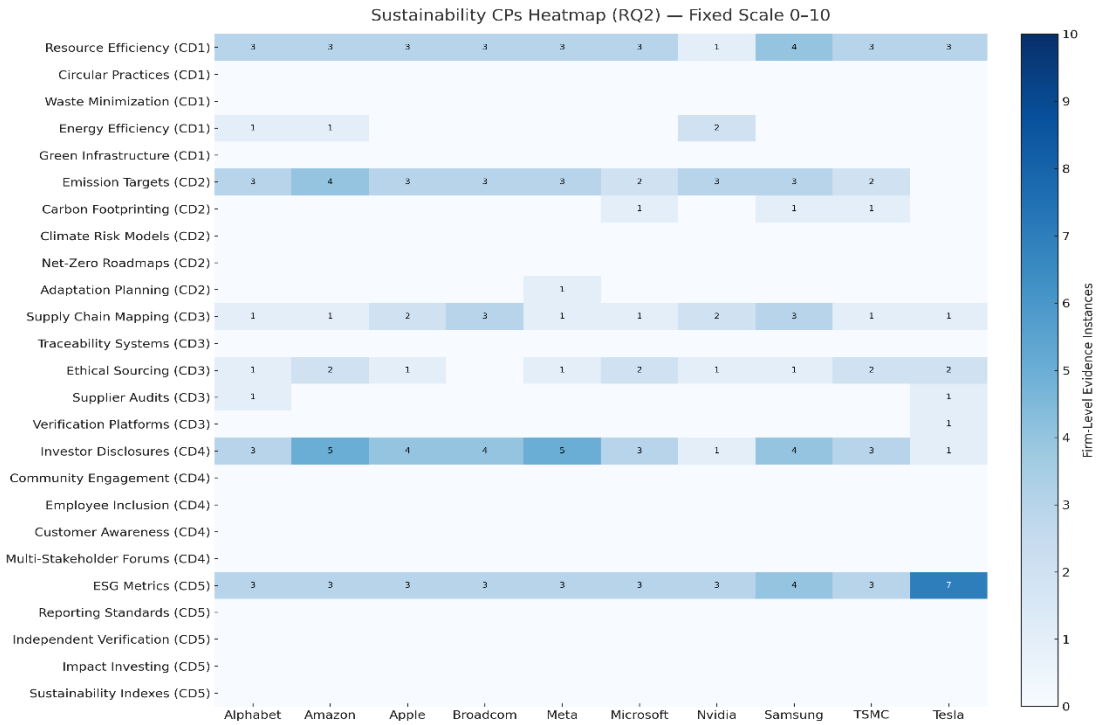

Figure 4.2.5
RQ2 – Sustainability CPs Heatmap

The sustainability heatmap spans five capability dimensions: Climate Accountability, Impact Measurement, Stakeholder Engagement, Sustainable Operations, and Value Chain Transparency. Broadly adopted practices include emission targets, ESG metrics, investor disclosures, resource efficiency, and supply chain mapping — the visible hallmarks of corporate sustainability. Moderately adopted practices such as carbon footprinting, adaptation planning, energy efficiency, supplier audits, and ethical sourcing suggest incremental progress, but adoption remains narrow and firm-specific. Selective practices are sparse, with isolated signals in verification platforms and adaptation efforts. White spaces are most glaring in circular practices, waste minimization, green infrastructure, independent verification, and traceability systems. The heatmap reveals ecosystems that have laid down intentions and visible metrics but have yet to embed sustainability as a fully integrated, end-to-end execution discipline.

The data table drives the point home. It illustrates that while firms consistently meet investor disclosure and high-level target-setting requirements, they struggle to institutionalize systemic practices such as climate risk modeling, net-zero roadmaps, and closed-loop operations. Equally, the absence of multi-stakeholder engagement and independent verification mechanisms underscores the risk of credibility deficits — where claims outpace demonstrable impact. For executives, the message is clear: DBE ambitions will continue to be undermined unless sustainability moves from surface-level commitments into embedded operating models. Without scaling transparency, resilience, and accountability across the ecosystem value chain, sustainability will remain more a barrier than a breakthrough.

RQ2 - Adaption Tiers for Sustainability 4.2.5

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Climate Accountability	Emission Targets (9)		Carbon Footprinting (3); Adaptation Planning (1)	Climate Risk Models (0); Net-Zero Roadmaps (0)
Impact Measurement	ESG Metrics (10)			Reporting Standards (0); Independent Verification (0); Impact Investing (0); Sustainability Indexes (0)
Stakeholder Engagement	Investor Disclosures (10)			Community Engagement (0); Employee Inclusion (0); Customer Awareness (0); Multi-Stakeholder Forums (0)
Sustainable Operations	Resource Efficiency (10)		Energy Efficiency (3)	Circular Practices (0); Waste Minimization (0); Green Infrastructure (0)
Value Chain Transparency	Supply Chain Mapping (10); Ethical Sourcing (9)		Supplier Audits (2); Verification Platforms (1)	Traceability Systems (0)

Broadly Adopted Practices

Broadly adopted sustainability practices cluster around five capability dimensions that anchor responsible ecosystem behavior: Climate Accountability, Impact Measurement, Stakeholder Engagement, Sustainable Operations, and Value Chain Transparency. These practices matter because markets increasingly reward firms that treat sustainability not as philanthropy but as auditable, structural performance. Together, they form the baseline for credibility in markets where sustainability is as decisive as innovation or efficiency.

First, ecosystems strengthen Climate Accountability with Emission Targets, which convert pledges into measurable benchmarks. Microsoft and Apple embed science-based targets into long-term strategies, aligning growth with decarbonization imperatives. Strategy teams, sustainability officers, and external auditors coordinate these commitments, ensuring investors and regulators can track progress consistently.

Second, firms advance Impact Measurement with ESG Metrics, which harmonize disclosures across geographies and firms. Microsoft publishes sustainability dashboards, Apple integrates ESG data into annual reports, and investors use these standardized indicators to evaluate credibility. By embedding ESG data into reporting frameworks, ecosystems signal comparability and reinforce trust with capital markets.

Third, ecosystems operationalize Stakeholder Engagement with Investor Disclosures, which institutionalize transparency in capital markets. Tesla integrates sustainability commitments into long-term growth narratives, while Amazon communicates climate risks through structured disclosure. Investor relations teams and governance officers formalize these mechanisms, ensuring resilience is rewarded with market legitimacy.

Fourth, Sustainable Operations are reinforced through Resource Efficiency, embedding sustainability into daily processes. TSMC reduces material intensity across semiconductor production, and Alphabet sets operational efficiency targets to minimize waste. Operations managers, engineers, and sustainability teams coordinate these practices, aligning competitiveness with environmental stewardship.

Fifth, ecosystems expand Value Chain Transparency with Supply Chain Mapping and Ethical Sourcing, which extend accountability beyond firm boundaries. Amazon builds supplier traceability into contracts, TSMC invests in compliance checks across fabs, and

Apple enforces ethical labor standards. Procurement teams, compliance officers, and NGOs drive these efforts, ensuring accountability is shared across global supply networks.

Moderately Adopted Practices

No practices fall into this category in sustainability. This absence underscores a sharp divide: ecosystems either institutionalize sustainability practices broadly or leave them in experimental stages, with few examples of partial or transitional adoption.

Selectively Adopted Practices

Selectively adopted practices reveal frontier bets where firms experiment without systemic embedding, surfacing across three capability dimensions: Climate Accountability, Sustainable Operations, and Value Chain Transparency.

First, ecosystems expand Climate Accountability through Carbon Footprinting and Adaptation Planning. Microsoft deploys lifecycle analyses to map Scope 1–3 emissions, while Apple integrates digital tracking tools to improve emissions visibility. Tesla and Alphabet explore adaptation plans to prepare for climate risks like heat stress or flooding, using scenario modeling and infrastructure investments. Sustainability officers, risk managers, and external auditors coordinate these mechanisms, though adoption is limited to leaders under strong regulatory or climatic pressure.

Second, ecosystems strengthen Sustainable Operations with Energy Efficiency initiatives. TSMC invests in green fabs, Alphabet retrofits data centers, and Amazon integrates renewable energy into logistics. These practices reduce energy intensity and costs, with operations teams and sustainability officers balancing competitiveness and environmental goals. Adoption, however, remains uneven and largely confined to firms with significant scale or capital.

Third, firms advance Value Chain Transparency through Supplier Audits and Verification Platforms. Amazon enforces supplier audits to check adherence to labor and

environmental standards, while TSMC collaborates with industry consortia for third-party reviews. Verification Platforms, including blockchain pilots and certification registries, are tested by Microsoft and industry alliances to digitize accountability. Procurement managers, compliance officers, and NGOs drive these practices, though high costs and fragmentation limit systemic adoption.

White Spaces (Zero Evidence)

White spaces in sustainability reveal systemic gaps where codified practices are absent. In Climate Accountability, firms set Emission Targets but lack Climate Risk Models and Net-Zero Roadmaps, leaving strategies reactive. In Impact Measurement, the absence of Reporting Standards, Independent Verification, Impact Investing, and Sustainability Indexes weakens comparability. Stakeholder Engagement lacks Community Engagement, Employee Inclusion, Customer Awareness, and Multi-Stakeholder Forums, leaving legitimacy narrowly anchored in investor relations. In Sustainable Operations, the absence of Circular Practices, Waste Minimization, and Green Infrastructure highlights that systemic redesign remains aspirational. In Value Chain Transparency, missing Traceability Systems means firms map first-tier suppliers but remain blind to deeper layers of global networks. Together, these gaps reveal that ecosystems prioritize visible disclosure over transformational change.

Synthesis and Transition

Taken together, sustainability practices reveal broad convergence around Emission Targets, ESG Metrics, Investor Disclosures, Resource Efficiency, and Supply Chain Accountability, yet progression beyond these anchors is uneven. Selectively adopted practices highlight recognition of the need for deeper measurement, resilience planning, and operational transformation, but institutionalization remains thin. White spaces underscore structural weaknesses in verification, inclusivity, circularity, and traceability,

exposing ecosystems to accusations of greenwashing and credibility erosion. Firms converge on the legitimacy imperative of sustainability but calibrate responses cautiously, balancing reputational risk with competitive pressures.

Transition: Sustainability provides the ultimate test of governance and innovation, demanding that ecosystems move from symbolic compliance to structural transformation. The next stage explores how firms embed these imperatives into system-wide accountability, where sustainability shifts from external reporting to a core driver of competitive advantage.

4.1.6 Quantitative Analysis – Survey results (RQ2)

RQ2: Execution Barriers and Governance Challenges in DBEs

Introduction

RQ2 examined how enterprises confront the executional and governance barriers in adopting digital business ecosystems (DBEs). The five survey questions focused on ESG-driven innovation, interoperability, co-innovation, ethical governance, and risk management. The responses reflect both strong commitments and critical execution gaps that must be addressed for DBEs to scale sustainably.

Insights (linked to pie charts above)

Q2 – ESG-driven innovation: 73% of respondents (36% strongly agree, 37% agree) report pursuing innovations with measurable social and environmental impact. However, 19% remain neutral, signalling that ESG integration is not yet universal. This highlights an execution gap between stated aspirations and operationalized ESG impact.

Q5 – Interoperability: 79% (37% strongly agree, 42% agree) affirm that their systems are designed for interoperability, yet 16% report neutrality and 5% disagree. The gap suggests that while most enterprises recognize interoperability as a DBE prerequisite, many still struggle with technical execution at scale.

Q8 – Co-innovation with partners: 85% (45% strongly agree, 40% agree) collaborate with partners to co-innovate and explore new markets. This high alignment shows co-innovation as a strength, but the 12% neutral and 3% negative responses suggest not all enterprises fully embed co-innovation into core strategy.

Q11 – Ethical governance: 89% (59% strongly agree, 30% agree) report that governance frameworks ensure ethics and compliance. With only 11% outside this consensus, governance maturity emerges as the strongest execution dimension in DBEs, positioning firms well for regulatory trust.

Q14 – Risk management integration: 88% (48% strongly agree, 40% agree) embed risk management into innovation strategies, with just 12% remaining neutral or negative. This indicates a broad recognition that DBE participation requires proactive risk and compliance integration.

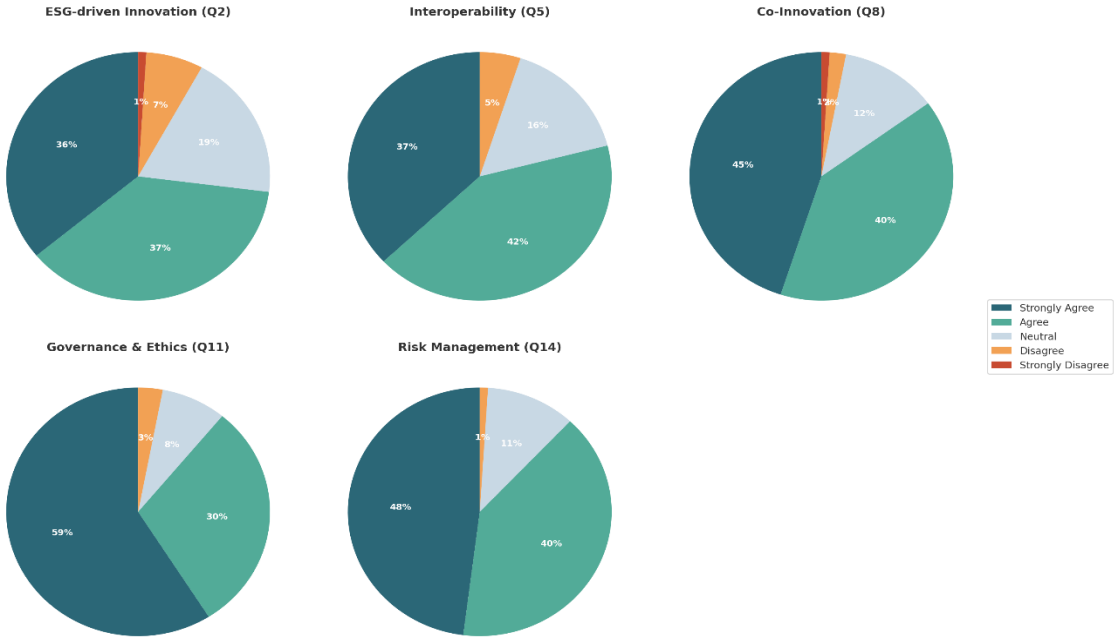

Figure 4.1.6
RQ2 – Global Survey Results

Conclusion

The survey highlights a strong enterprise alignment on governance, compliance, and risk management—areas where over 85% of respondents show commitment. Yet ESG-driven innovation (73%) and technical interoperability (79%) reveal softer adoption, pointing to execution gaps that could limit DBE scalability. In McKinsey terms, the results show enterprises are "boardroom ready" on governance but still "execution vulnerable" on ESG and interoperability. The HEART Infinity offers a pathway to close this gap by aligning readiness (BADGE) with execution (STAGE), ensuring that DBEs scale with both trust and sustainability.

4.2.7 RQ2 Overall Summary (Quantitative + Quantitative)

RQ2 – What barriers and execution challenges hinder firms from realizing their DBE ambitions?

Micro Lens (Qualitative Patterns): Barriers to DBE realization reveal themselves as both structural constraints and cultural frictions. First, many firms remain bound by legacy systems, where monolithic infrastructures and fragmented data landscapes prevent interoperability. Second, role ambiguity undermines execution — firms overcommit to orchestrator ambitions without the governance or partner credibility to sustain them. Third, innovation efforts stagnate in pilot traps, reflecting the inability to institutionalize scaling pathways. Fourth, governance mismatches across jurisdictions and sectors slow execution, with firms expending energy on compliance alignment instead of orchestration. Fifth, sustainability often remains compliance-driven, with ESG efforts siloed in reporting functions rather than operationalized in business models. Sixth, decision-making inertia is widespread — firms lack adaptive strategy mechanisms, over-indexing on planning cycles that fail to keep pace with ecosystem dynamism. Seventh, partner trust deficits emerge when incentive models skew toward the orchestrator, reducing willingness to collaborate.

Eighth, cultural resistance within organizations — siloed mindsets and hierarchical rigidity — blunts ecosystem agility. Ninth, talent bottlenecks persist, particularly in AI, data stewardship, and cross-industry innovation roles. Finally, short-term performance pressures conflict with the long-horizon investments required to sustain DBE advantage.

Macro Lens (Quantitative Validation): Survey evidence confirms these friction points at scale. 79% of respondents affirmed interoperability as essential, yet neutrality and dissent responses validate the persistence of legacy drag. 73% agreed that ESG should be embedded, but neutrality scores expose the gap between aspiration and practice. Innovation received strong agreement (>80%) as a strategic necessity, yet maturity scores reveal that scaling remains a minority capability. Governance scored high on compliance (4.3/5), but qualitative evidence explains why compliance maturity does not equate to adaptive orchestration. Strategic clarity was mixed: high ambition coexisted with high variance, reflecting the qualitative insight that firms overcommit to leadership roles without building enabling capabilities.

RQ2 Conclusion: The integrated insight is stark: most firms are over-ambitious in intent but under-prepared in execution. Qualitative findings reveal the lived frictions — legacy IT, role ambiguity, pilot traps, and cultural inertia. Survey data validates the ubiquity of these challenges, confirming that while intent is strong, maturity is weak. For executives, the message is sobering: ambition without structural readiness creates systemic drag that can erode competitive positioning. For academics, the convergence of micro and macro evidence underscores the persistent gap between DBE aspiration and realization, strengthening the explanatory power of the barriers identified. Looking forward, the signals point to firms that resolve legacy drag, align roles with capability, and operationalize ESG as those able to convert ambition into credible advantage.

4.3 Research Question Three

What capabilities and practices enable firms to overcome these barriers and scale DBE success? - as part of Qualitative anlaysis, if RQ1 revealed what leaders do differently and RQ2 surfaced the frictions that derail others, RQ3 identifies the repeatable patterns that enable a small cohort of firms to consistently overcome barriers and scale Digital Business Ecosystems (DBEs). The evidence shows that leadership does not come from avoiding frictions but from designing organizational capabilities that transform obstacles into enablers of growth.

At the core of these capabilities are three reinforcing logics:

1. Defensibility through integration. Leading firms anchor their ecosystems in proprietary stacks, model foundations, and governance structures that give them durable control points. These anchors ensure scale efficiency, reduce dependency, and create platforms on which partners build.
2. Resilience through balance. Leaders balance paradoxes—openness and control, competition and collaboration, growth and responsibility—rather than resolving them one-sidedly. This allows them to attract partners, satisfy regulators, and preserve competitive advantage simultaneously.
3. Legitimacy through embedding. Leaders move ESG, trust, and accountability from symbolic gestures to embedded practices. Carbon tracking, privacy-by-design, supply traceability, and inclusive innovation are not add-ons but structural components of the ecosystem operating model.

Across the five dimensions, the patterns are clear:

Technology: Proprietary stacks, coupled with growing emphasis on interoperability, privacy safeguards, and selective developer ecosystems, allow leaders to scale securely while maintaining defensibility.

Strategy: Leaders orchestrate ecosystems by aligning platform boundaries with institutional logics, embedding ESG as a growth lever, and mobilizing adjacency plays to expand addressable markets.

Innovation: Co-creation becomes institutionalized, with firms deploying structured loops that balance experimentation with measurable value creation, while embedding AI and multi-tech integration into product reinvention.

Governance: Trust architectures are operationalized through clear rules, audit workflows, and escalation paths, reducing ambiguity and enabling scale without collapse.

Sustainability: Leaders hardwire carbon traceability, supply accountability, and social equity into the ecosystem core, transforming legitimacy into a competitive advantage.

The unifying insight is that DBE leadership is not a function of extraordinary foresight but of disciplined capability-building. Firms that succeed do so by embedding resilience, legitimacy, and adaptability into their systems in ways that others treat as optional.

This section therefore unpacks RQ3 across the five thematic lenses (4.3.1–4.3.5), showing how leaders develop non-negotiable anchors, selectively adopt frontier practices, and close legitimacy gaps. Together, these insights illustrate that overcoming barriers is less about one-off innovation and more about institutionalizing practices that scale ecosystems into durable engines of advantage.

4.3.1 Technology

Technology, when seen through the lens of overcoming barriers, becomes less about possession and more about orchestration. Leading firms recognize that overcoming DBE obstacles requires moving beyond isolated deployments and toward integrated,

resilient architectures. The data shows ecosystems converging on proprietary stacks as a backbone, while selectively expanding into interoperability, supply traceability, and privacy-by-design safeguards. Yet the picture is uneven: while control points are firmly established, upstream rigor in training, assurance, and modularity remains absent, leaving ecosystems powerful but brittle. The critical insight is that success lies not just in building defensible stacks, but in weaving them into systems that balance defensibility with openness, responsibility, and resilience.

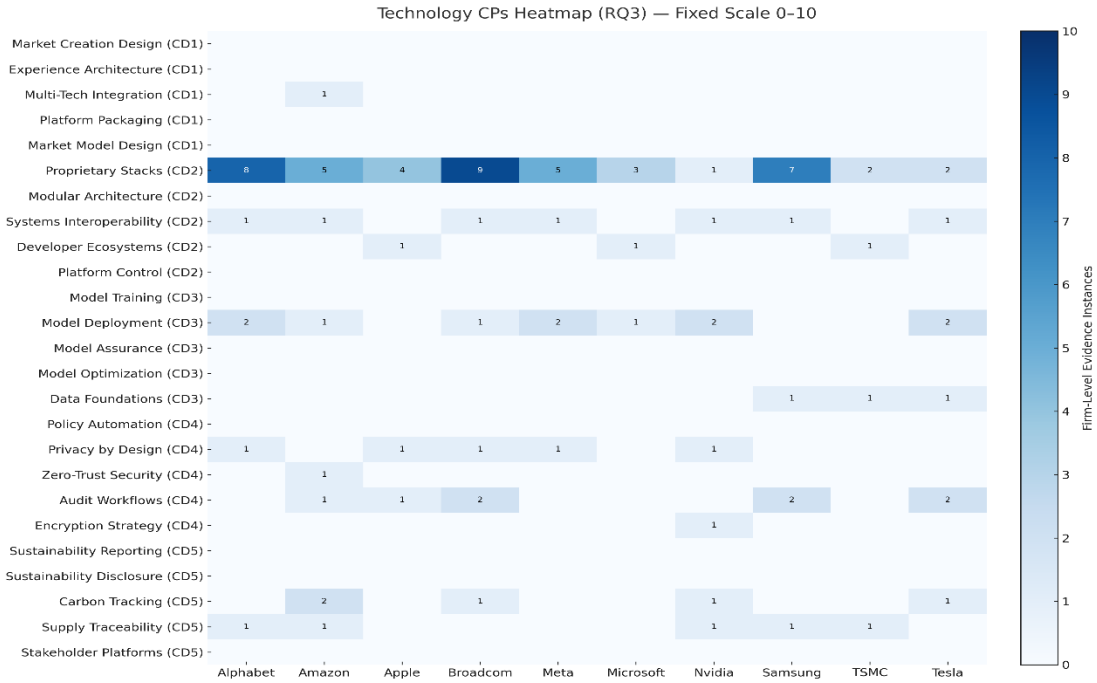

Figure 4.3.1
RQ3 – Technology CPs Heatmap

The technology heatmap organizes practices across five capability dimensions: Market Creation, Model Foundations, Proprietary Stacks, Sustainable Tech, and Trust and Controls. Broadly adopted practices cluster around proprietary stacks and model deployment, reflecting firms' prioritization of control and scalability. Moderately adopted practices include data foundations, systems interoperability, carbon tracking, and audit

workflows, signalling ambition to strengthen connective tissue and accountability. Selectively adopted practices surface in developer ecosystems, zero-trust security, and encryption strategy, reflecting frontier experimentation without scale. White spaces remain stark in market creation, upstream model rigor, modular architectures, platform control, and automated governance, highlighting systemic blind spots. The heatmap therefore illustrates ecosystems that are technically robust at the core but incomplete at the periphery, limiting their ability to scale with trust and adaptability.

The data table reinforces this analysis. It shows firms embedding privacy and audit frameworks alongside proprietary stacks, while struggling to extend adoption into climate accountability, distributed assurance, and cross-platform flexibility. Interoperability and traceability emerge as partial bridges, but the absence of training protocols, model assurance, and policy automation reveals a dependency on manual oversight and centralized control. For executives, the table signals both strength and fragility: DBE leaders are adept at building powerful control points, but without advancing into openness, sustainability, and automated resilience, their ecosystems risk stalling under the weight of complexity and scrutiny. The challenge ahead is to turn technological defensibility into ecosystem durability.

RQ3 - Adaption Tiers for Technology 4.3.1

AD/ CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Market Creation			Multi-Tech Integration (1)	Market Creation Design (0); Experience Architecture (0); Platform Packaging (0); Market Model Design (0)

Model Foundations		Model Deployment (7)	Data Foundations (3)	Model Training (0); Model Assurance (0); Model Optimization (0)
Proprietary Stacks	Proprietary Stacks (10)	Systems Interoperability (7)	Developer Ecosystems (3)	Modular Architecture (0); Platform Control (0)
Sustainable Tech		Supply Traceability (5)	Carbon Tracking (4)	Sustainability Reporting (0); Sustainability Disclosure (0); Stakeholder Platforms (0)
Trust and Controls		Privacy by Design (5); Audit Workflows (5)	Zero-Trust Security (1); Encryption Strategy (1)	Policy Automation (0)

Broadly Adopted Practices

Broadly adopted practices in technology converge on one capability dimension: Proprietary Stacks, which consolidate hardware, software, and data into firm-controlled architectures. This matters because vertical integration creates defensibility, secures scale efficiency, and reduces dependency on external suppliers. Proprietary stacks have become the structural baseline of digital ecosystems, ensuring firms build platforms that competitors and partners must rely on.

First, capability dimension anchor practice of Proprietary Stacks reinforces defensibility by aligning devices, operating systems, and data infrastructures into tightly integrated ecosystems. Apple sustains lock-in through its device–OS chain, NVIDIA embeds CUDA into the AI pipeline, and Microsoft reinforces its enterprise cloud with proprietary middleware. These stacks are achieved through closed, exclusive architectures managed by RandD-intensive firms with the scale and dominance to sustain end-to-end control.

Moderately Adopted Practices

Moderately adopted practices extend across four capability dimensions—Model Foundations, Proprietary Stacks, Sustainable Tech, and Trust and Controls—but remain uneven in maturity. Collectively, they show firms balancing defensibility with selective openness, operational reliability, and early accountability.

First, ecosystems expand Model Foundations with Model Deployment, which moves trained algorithms from prototypes into production. Microsoft operationalizes this through MLOps pipelines, Tesla pushes models into live autonomy pilots, and Amazon scales algorithms in customer-facing services. Engineering teams and data scientists coordinate deployment pipelines to bridge innovation and monetization, though integration costs and reliability risks constrain progress.

Second, ecosystems strengthen Proprietary Stacks through Systems Interoperability, loosening rigid architectures while preserving control. Microsoft builds hybrid cloud bridges, Amazon enforces API-first strategies, and Alphabet integrates cross-platform standards. Platform architects and partner teams design APIs and middleware that expand reach while avoiding full commoditization.

Third, ecosystems build Sustainable Tech with Supply Traceability, ensuring accountability across hardware and rare-material value chains. Apple maps supplier practices, TSMC integrates geopolitical exposure into procurement, and Amazon enforces supplier reporting standards. Compliance teams, procurement officers, and digital traceability tools drive these practices under regulatory and investor scrutiny.

Fourth, ecosystems reinforce Trust and Controls with Privacy by Design and Audit Workflows. Apple embeds privacy into device architecture, Microsoft designs default encryption and data minimization, and Alphabet builds audit dashboards for accountability.

Product managers, legal officers, and compliance teams collaborate with engineers to institutionalize safeguards, translating regulatory mandates into technical practice.

Selectively Adopted Practices

Selectively adopted practices represent frontier bets across all five capability dimensions, with ambition visible but institutionalization shallow.

First, ecosystems experiment with Market Creation through Multi-Tech Integration, layering AI, IoT, and blockchain to create new consumption models. Tesla pilots AI–energy ecosystems, while Alphabet fuses AI with healthcare initiatives. Product teams and frontier labs trial integrations, but outcomes remain experimental.

Second, Model Foundations expand with Data Foundations, curating reusable and governed pipelines for scalable AI. Alphabet builds metadata catalogs, Microsoft develops enterprise data lakes, and Tesla leverages mobility telemetry. AI engineers and governance leads drive adoption, but maturity is uneven.

Third, Proprietary Stacks evolve through Developer Ecosystems, selectively opening closed stacks to third-party innovators. Apple mobilizes App Store developers, NVIDIA provides SDKs and AI libraries, and Microsoft fosters GitHub integration. Developer relations teams orchestrate these efforts, extending defensibility through external participation.

Fourth, Sustainable Tech advances with Carbon Tracking, embedding emissions metrics into IT and hardware operations. Amazon integrates carbon dashboards into infrastructure, Microsoft tracks cloud energy footprints, and Apple reports on device life-cycle emissions. Sustainability officers and IT managers partner to link carbon metrics with system monitoring.

Fifth, Trust and Controls push frontier defenses with Zero-Trust Security and Encryption Strategy. Google’s BeyondCorp validates every access request, financial firms

implement encryption-by-default across flows, and communications companies trial end-to-end cryptography. Security teams, compliance officers, and IT architects coordinate these measures, though scaling remains resource-intensive.

White Spaces (Zero Evidence)

White spaces in technology expose absent or aspirational practices across all five capability dimensions. In Market Creation, ecosystems lack structured models such as Market Design, Experience Architecture, and Platform Packaging, leaving innovation improvisational. In Model Foundations, upstream rigor is missing, with no evidence of Model Training, Model Assurance, or Model Optimization, creating fragility in reliability. In Proprietary Stacks, firms lack Modular Architecture and Platform Control, reinforcing lock-in at the expense of flexibility. In Sustainable Tech, the absence of Sustainability Reporting, Disclosure Mechanisms, and Stakeholder Platforms signals symbolic rather than systemic adoption. In Trust and Controls, missing Policy Automation shows reliance on manual oversight instead of proactive governance. Collectively, these gaps underscore that while firms defend control points, they underinvest in openness, assurance, and systemic sustainability.

Synthesis and Transition

Taken together, RQ3 – Technology shows that while ecosystems broadly adopt Proprietary Stacks as the backbone of defensibility, maturity in Model Deployment, Systems Interoperability, Supply Traceability, and Privacy Safeguards remains partial. Selectively adopted practices highlight ambition in Multi-Tech Integration, Data Foundations, Developer Ecosystems, Carbon Tracking, and Zero-Trust Security, but institutionalization is thin. White spaces reveal structural gaps in upstream assurance, modularity, and automation, leaving ecosystems overly reliant on closed architectures and

reactive governance. Firms converge on proprietary control as the minimum standard but diverge on whether technology should prioritize openness, sustainability, or trust.

Transition: Technology provides defensibility and control, but without governance, these systems remain brittle. The next section turns to RQ4 – Governance, where institutional mechanisms determine how accountability, compliance, and legitimacy are distributed across interdependent ecosystems.

4.3.2 Strategy

When ecosystems succeed in overcoming barriers, strategy becomes the bridge that converts technological control into market-scale advantage. The data shows that firms are learning to differentiate not only through unique products but also through their ability to define ecosystem positioning, mobilize data-driven models, and embed governance foresight into their choices. Unlike RQ2, where strategy often appeared fragmented and reactive, RQ3 highlights more intentional plays: differentiation, disciplined entry into new markets, and nascent but growing practices around sustainability and stakeholder engagement. Still, the absence of systemic opportunity discovery and value-sharing mechanisms underscores that DBE strategies remain powerful in execution but narrow in imagination.

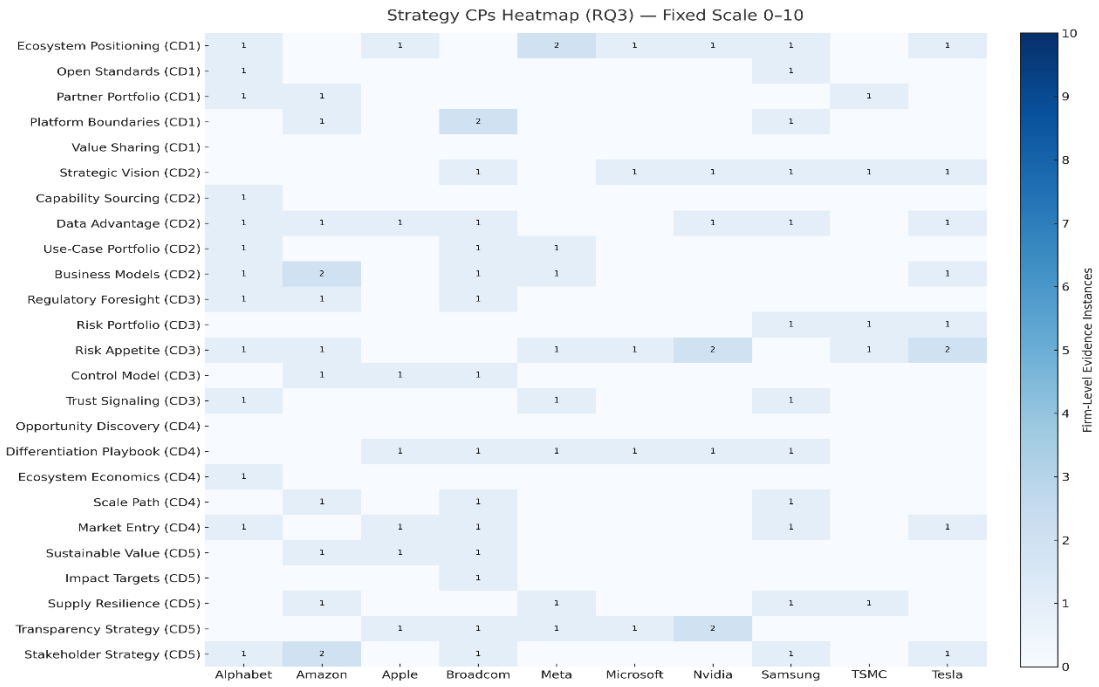

Figure 4.3.2
RQ3 – Strategy CPs Heatmap

The strategic heatmap maps adoption across five capability dimensions: Competitive Positioning, Data-Driven Strategy, Ecosystem Strategy, Governance Strategy, and Sustainability Strategy. Broadly adopted practices include differentiation playbooks, market entry, strategic vision, data advantage, business models, ecosystem positioning, risk appetite, and transparency and stakeholder strategies. These indicate that firms now anchor strategy in defensibility and credibility, blending competitive choice with data-led direction and early signals of governance and sustainability. Moderately adopted practices — scale paths, ecosystem economics, capability sourcing, open standards, partner portfolios, platform boundaries, and risk frameworks — show where ecosystems are experimenting but have yet to achieve full institutionalization. Selective adoption is sparse, with weak signals in sustainable value and impact targets. White spaces are glaring in

opportunity discovery and value sharing, revealing ecosystems strong in consolidation but weak in expanding the frontier of collaboration.

The data table illustrates this duality: firms are advancing toward stronger competitive positioning and embedding risk appetite as a governance discipline, while falling short in cultivating ecosystem economics, shared value frameworks, and forward-looking discovery mechanisms. Strategic vision and data advantage suggest growing sophistication, yet without balanced portfolios or systemic openness, ecosystems risk reinforcing their own boundaries rather than unlocking new adjacencies. For executives, the table highlights a critical paradox: DBE leaders are excellent at defending existing ground but less adept at opening new ones. To scale sustainably, strategy must evolve from inward-looking defensibility to outward-oriented orchestration, embedding collaboration, foresight, and systemic value creation into the very fabric of DBE playbooks.

RQ3 - Adaption Tiers for Strategy 4.3.2

AD/ CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Competitive Positioning		Differentiation Playbook (6); Market Entry (5)	Ecosystem Economics (1); Scale Path (3)	Opportunity Discovery (0)
Data-Driven Strategy		Strategic Vision (6); Data Advantage (7); Business Models (5)	Capability Sourcing (1); Use-Case Portfolio (3)	
Ecosystem Strategy		Ecosystem Positioning (7)	Open Standards (2); Partner Portfolio (3); Platform Boundaries (3)	Value Sharing (0)
Governance Strategy		Risk Appetite (7)	Regulatory Foresight (3); Risk Portfolio (3); Control Model (3); Trust Signaling (3)	
Sustainability Strategy		Transparency Strategy (5); Stakeholder Strategy (5)	Sustainable Value (3); Impact Targets (1); Supply Resilience (4)	

Broadly Adopted Practices

Broadly adopted practices in strategy are absent. This means no single capability dimension has consolidated into a universal anchor. The implication is significant: ecosystems lack a structural baseline equivalent to proprietary stacks in technology, leaving strategic routines fragmented and uneven. Instead, adoption concentrates in the moderate tier, where multiple dimensions collectively provide the scaffolding for execution.

Moderately Adopted Practices

Moderately adopted practices span all five capability dimensions—Competitive Positioning, Data-Driven Strategy, Ecosystem Strategy, Governance Strategy, and Sustainability Strategy. Together, they show ecosystems converging on a distributed set of routines that form the working backbone of strategy in the absence of a dominant anchor.

First, Competitive Positioning advances through Differentiation Playbooks and Market Entry, which formalize systematic blueprints for market distinction and structured pathways for expansion. Apple and Alphabet embed analytics into playbooks to sustain defensibility, while Amazon drives acquisition-led entry into healthcare and Tesla pivots into energy. Corporate strategy and growth teams drive adoption, ensuring expansion remains replicable rather than improvised.

Second, Data-Driven Strategy deepens with Strategic Vision, Data Advantage, and Business Models, which together connect foresight to defensibility and monetization. Microsoft anchors AI investments in multi-decade roadmaps, NVIDIA consolidates telemetry into proprietary data moats, and Apple structures subscriptions into sustainable revenue engines. Senior leadership, data science, and product teams coordinate adoption, aligning long-term direction with revenue sustainability.

Third, Ecosystem Strategy is reinforced through Ecosystem Positioning, where firms define their roles within interdependent networks. NVIDIA positions CUDA as an orchestrator, Apple embeds OS–device integration to sustain control, and Amazon manages hybrid orchestrator–participant roles. Platform architects and ecosystem leaders implement these choices to stabilize participation rules.

Fourth, Governance Strategy matures through Risk Appetite, which codifies tolerance thresholds for operational, reputational, and regulatory exposures. TSMC translates geopolitical risks into board-level frameworks, while Microsoft manages uncertainty through staged product rollouts. Boards, compliance teams, and risk committees anchor adoption, ensuring risk-taking is bounded by clear red lines.

Fifth, Sustainability Strategy extends through Transparency Strategies and Stakeholder Strategies, embedding disclosure and engagement into legitimacy. Microsoft issues sustainability dashboards, Amazon reports supply-chain emissions, and Alphabet convenes cross-sector alliances. Compliance teams, investor-relations officers, and corporate affairs leaders coordinate adoption, converting ESG from symbolic pledge into institutionalized accountability.

Selectively Adopted Practices

Selectively adopted practices appear across all five capability dimensions, reflecting ambition but shallow institutionalization.

First, Competitive Positioning expands with Ecosystem Economics and Scale Paths, which test redistributive loyalty models and structured growth trajectories. Amazon experiments with incentive-sharing to stabilize ecosystems, while Tesla and Microsoft pursue global scaling through gigafactories and enterprise rollouts. Ecosystem orchestrators and operations leaders manage adoption, balancing resilience with ambition.

Second, Data-Driven Strategy advances through Capability Sourcing and Use-Case Portfolios, which extend innovation inputs and structure experimentation into portfolios. Microsoft acquires Nuance to secure external expertise, NVIDIA integrates Mellanox for data leverage, and Alphabet aligns AI pilots to strategic themes. Corporate development, product managers, and innovation teams coordinate adoption, translating pilots into scalable advantage.

Third, Ecosystem Strategy evolves through Open Standards, Partner Portfolios, and Platform Boundaries, which collectively shape participation design. Microsoft fosters multi-cloud standards, Amazon enforces API-first integration, and Apple curates exclusive developer networks while policing OS boundaries. Platform leaders, ecosystem managers, and governance teams institutionalize adoption, balancing openness with control.

Fourth, Governance Strategy experiments with Regulatory Foresight, Risk Portfolios, Control Models, and Trust Signaling, extending oversight into anticipatory and voluntary domains. Amazon monitors regulatory shifts globally, TSMC applies scenario planning for geopolitical risks, Microsoft embeds compliance audits, and Meta signals accountability via independent oversight boards. Policy teams, risk officers, compliance units, and corporate affairs groups drive adoption, embedding oversight into strategy.

Fifth, Sustainability Strategy tests Sustainable Value, Impact Targets, and Supply Resilience, which connect ESG with competitiveness. Apple markets carbon-neutral devices, Microsoft codifies measurable net-zero benchmarks, and Tesla diversifies manufacturing hubs alongside TSMC's overseas fab expansion. Product teams, ESG officers, procurement, and operations leaders manage adoption, converting sustainability into operational practice.

White Spaces (Zero Evidence)

White spaces in strategy reveal systemic immaturity across multiple dimensions. In Competitive Positioning, the absence of Opportunity Discovery leaves ecosystems reactive rather than proactive. In Ecosystem Strategy, the lack of Value Sharing undermines redistribution and loyalty. In Data-Driven Strategy, shallow adoption of sourcing and portfolio practices limits scaling of data advantage. In Governance Strategy, foresight and control models remain patchy, weakening oversight. In Sustainability Strategy, selective adoption of Impact Targets and Supply Resilience exposes ecosystems to reputational and climate shocks. Collectively, these gaps demonstrate ecosystems are strategically engaged but structurally incomplete.

Synthesis and Transition

Taken together, RQ3 – Strategy shows ecosystems converging on moderately adopted practices across all five capability dimensions, with Differentiation Playbooks, Market Entry, Strategic Vision, Data Advantage, Business Models, Ecosystem Positioning, Risk Appetite, Transparency Strategies, and Stakeholder Strategies forming the operational backbone. Selectively adopted practices highlight ambition in redistribution, scaling, foresight, and resilience, but remain thinly institutionalized. White spaces underscore fragility in discovery, redistribution, and oversight, leaving ecosystems strategically active but structurally immature.

Transition: Strategy sets the scaffolding for growth and legitimacy but requires governance to stabilize execution. The next section turns to RQ4 – Governance, where accountability, compliance, and legitimacy determine whether strategic ambition can scale across interdependent ecosystems.

4.3.3 Innovation

In overcoming barriers and scaling DBE success, innovation plays the role of renewal — turning constraints into launchpads and embedding adaptability into the

system's DNA. The evidence indicates that firms are learning to operationalize innovation not as isolated bursts but as repeatable ecosystem practices. Compared with the fragmented and hesitant adoption patterns under RQ2, RQ3 shows a stronger orientation toward cross-sector collaboration, structured experimentation, and selective foresight. However, the uneven spread across innovation portfolios and market creation reveals that firms remain more comfortable refining existing spaces than boldly charting new ones. The central insight is that innovation in DBEs is maturing, but its reach remains constrained by limited investment in structured portfolios and horizon scanning.

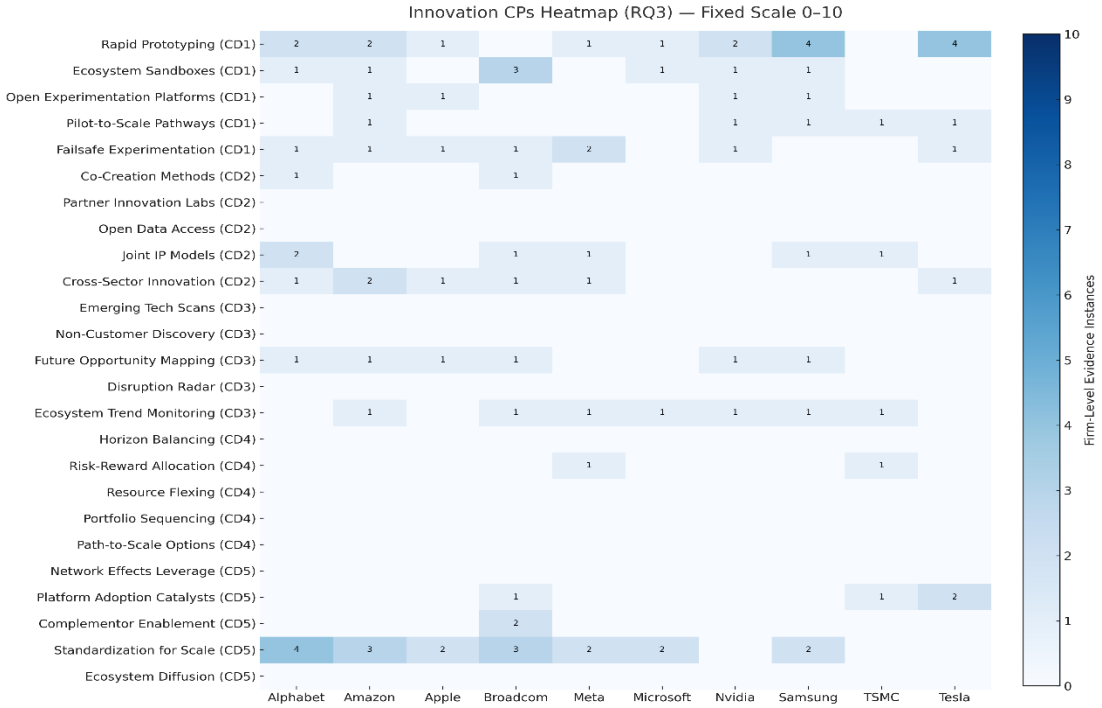

Figure 4.3.3
RQ3 – Innovation CPs Heatmap

The innovation heatmap spans five capability dimensions: Collaborative Discovery, Ecosystem Experimentation, Innovation Portfolios, Market Foresight, and Scaling Innovation. Broadly adopted practices cluster around joint IP models, cross-sector innovation, and rapid prototyping, which allow ecosystems to co-create solutions across

boundaries. Moderately adopted practices include co-creation methods, ecosystem sandboxes, pilot-to-scale pathways, failsafe experimentation, future opportunity mapping, trend monitoring, and standardization for scale — signalling that firms are establishing routines but not yet embedding them systemically. Selective adoption appears in risk-reward allocation, platform catalysts, and complementor enablement, suggesting cautious expansion at the frontier. White spaces remain in partner innovation labs, open experimentation platforms, horizon balancing, resource flexing, sequencing, and advanced foresight mechanisms such as disruption radars. This distribution highlights a model of innovation that is becoming reliable in the core but remains thin in systemic foresight and future-shaping capabilities.

The data table underscores this maturity gradient. It shows firms anchoring innovation around prototyping, IP sharing, and trend monitoring, but with weaker traction in formal portfolio design, non-customer discovery, and scalable leverage of network effects. The imbalance between experimentation (robust) and portfolio orchestration (absent) reveals why ecosystems can generate promising pilots yet struggle to sustain them at scale. For executives, the table signals a clear call to action: DBE leaders must move beyond reactive experimentation toward structured portfolio management and foresight-driven scaling. Only by institutionalizing innovation across all tiers — from discovery to diffusion — can ecosystems convert ingenuity into long-term advantage.

RQ3 - Adaption Tiers for Innovation 4.3.3

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Collaborative Discovery		Joint IP Models (5); Cross-Sector Innovation (6)	Co-Creation Methods (2)	Partner Innovation Labs (0); Open Data Access (0)
Ecosystem Experi	Rapid Prototyping (8)	Ecosystem Sandboxes (6); Pilot-to-Scale	Open Experimentation Platforms (4)	

mentation	Pathways (5); Failsafe Experimentation (7)		
Innovation Portfolios		Risk-Reward Allocation (2)	Horizon Balancing (0); Resource Flexing (0); Portfolio Sequencing (0); Path-to-Scale Options (0)
Market Foresight	Future Opportunity Mapping (6); Ecosystem Trend Monitoring (7)		Emerging Tech Scans (0); Non-Customer Discovery (0); Disruption Radar (0)
Scaling Innovation	Standardization for Scale (7)	Platform Adoption Catalysts (3); Complementor Enablement (1)	Network Effects Leverage (0); Ecosystem Diffusion (0)

Broadly Adopted Practices

Broadly adopted practices in innovation are anchored around one core capability dimension: Ecosystem Experimentation. This dimension matters because ecosystems cannot afford protracted development cycles when technology and market signals shift faster than institutional processes. Ecosystem Experimentation ensures firms can test, learn, and pivot before committing to scale, providing structural assurance that innovation remains adaptive.

First, in Ecosystem Experimentation, the practice of Rapid Prototyping anchors speed and iteration. It entails developing minimum viable products and early pilots to compress learning cycles. Firms run agile squads, design sprints, and lean testing frameworks, with product managers and innovation leads driving adoption, as seen in A/B pilots at Amazon, shadow deployments at Microsoft, and social feature trials at Meta.

Moderately Adopted Practices

Moderately adopted practices span four capability dimensions—Collaborative Discovery, Ecosystem Experimentation, Market Foresight, and Scaling Innovation—showing ecosystems extending innovation beyond isolated pilots toward systemic adoption.

First, in Collaborative Discovery, firms institutionalize Joint IP Models and Cross-Sector Innovation to formalize shared ownership and expand discovery across industries. They codify licensing and revenue-sharing for co-developed assets (Samsung, NVIDIA), and orchestrate alliances and joint ventures that merge adjacent capabilities, such as healthcare + AI pilots led by Alphabet and enterprise co-builds by Microsoft.

Second, in Ecosystem Experimentation, practices such as Ecosystem Sandboxes, Pilot-to-Scale Pathways, and Failsafe Experimentation embed resilience and progression into testing. Controlled trial environments allow ecosystems to test emerging technologies in safe arenas, as with regulatory sandboxes at Amazon and digital twin simulations at Tesla. Structured pathways move pilots into production, supported by maturity models and gate reviews (Microsoft, NVIDIA). Failsafe mechanisms such as rollback options and ringfenced budgets institutionalize safe failure, with innovation labs at Meta and governance teams at Amazon embedding adoption.

Third, in Market Foresight, firms rely on Future Opportunity Mapping and Ecosystem Trend Monitoring to institutionalize long- and near-term scanning. Scenario planning and foresight models chart future adjacencies at Alphabet and logistics futures at Amazon, while continuous monitoring dashboards and partner telemetry enable vigilance (Samsung, Microsoft).

Fourth, in Scaling Innovation, the practice of Standardization for Scale ensures reproducibility. Common standards, certification schemes, and interface protocols are

embedded across pilots, with compliance frameworks driven by Amazon, device ecosystem standards enforced by Apple, and fab-level alignment coordinated by TSMC.

Selectively Adopted Practices

Selectively adopted practices reflect ambition at the frontier but remain thin in institutionalization, spanning Collaborative Discovery, Ecosystem Experimentation, Innovation Portfolios, and Scaling Innovation.

First, in Collaborative Discovery, the practice of Co-Creation Methods embeds joint ideation. Firms convene workshops, hackathons, and design challenges, including developer jams at Microsoft GitHub and open design sprints at Apple partner labs.

Second, in Ecosystem Experimentation, the practice of Open Experimentation Platforms expands access. Firms open datasets, APIs, and testbeds to external contributors, as with Alphabet's open frameworks and Amazon's programmatic test environments.

Third, in Innovation Portfolios, the practice of Risk-Reward Allocation balances bets across incremental, adjacent, and transformational projects. Portfolio councils apply structured funding bands and option gates, coordinated by finance units at TSMC and innovation funds at Microsoft.

Fourth, in Scaling Innovation, Platform Adoption Catalysts and Complementor Enablement extend reach. Adoption catalysts such as grants, usage credits, and co-marketing campaigns accelerate uptake (NVIDIA), while SDKs, playbooks, and training programs strengthen partner capacity at Apple and Microsoft.

White Spaces (Zeo Evidence)

White spaces reflect fragility in institutionalization. In Collaborative Discovery, underbuilt labs and missing data access constrain shared innovation. In Ecosystem Experimentation, selective opening slows external learning. In Innovation Portfolios, absent portfolio practices leave bets unbalanced. In Market Foresight, shallow scanning

weakens anticipation. In Scaling Innovation, absent network-effect strategies limit systemic reach.

Synthesis and Transition

Taken together, RQ3 – Innovation shows ecosystems broadly adopt Rapid Prototyping but diverge in scaling, foresight, and portfolio rigor. Moderately adopted practices such as Joint IP Models, Cross-Sector Innovation, Ecosystem Sandboxes, Pilot-to-Scale Pathways, Failsafe Experimentation, Future Opportunity Mapping, Ecosystem Trend Monitoring, and Standardization for Scale extend innovation, yet adoption remains uneven. Selectively adopted practices in Co-Creation Methods, Open Experimentation Platforms, Risk-Reward Allocation, Platform Adoption Catalysts, and Complementor Enablement show ambition but remain fragile. Zero evidence highlights missing infrastructure, portfolio orchestration, deep sensing, and scaling models.

Transition: This sets the stage for RQ4 – Governance, where accountability and legitimacy mechanisms must keep pace with accelerating experimentation.

4.3.4 Governance

Governance, in the context of overcoming DBE barriers, represents the discipline that turns scale into legitimacy. While technology and strategy determine what ecosystems can build, governance determines whether those systems can be trusted, sustained, and recognized as legitimate by partners, regulators, and society at large. The data indicates that progress here is partial: while accountability structures, responsible AI use, regulatory alignment, and risk registers are emerging as broadly visible practices, more advanced mechanisms — such as distributed decision-making, fairness guidelines, and adaptive compliance — remain absent. The result is an ecosystem field where firms are beginning to recognize the importance of institutional scaffolding, but have not yet embedded governance into the architecture of execution.

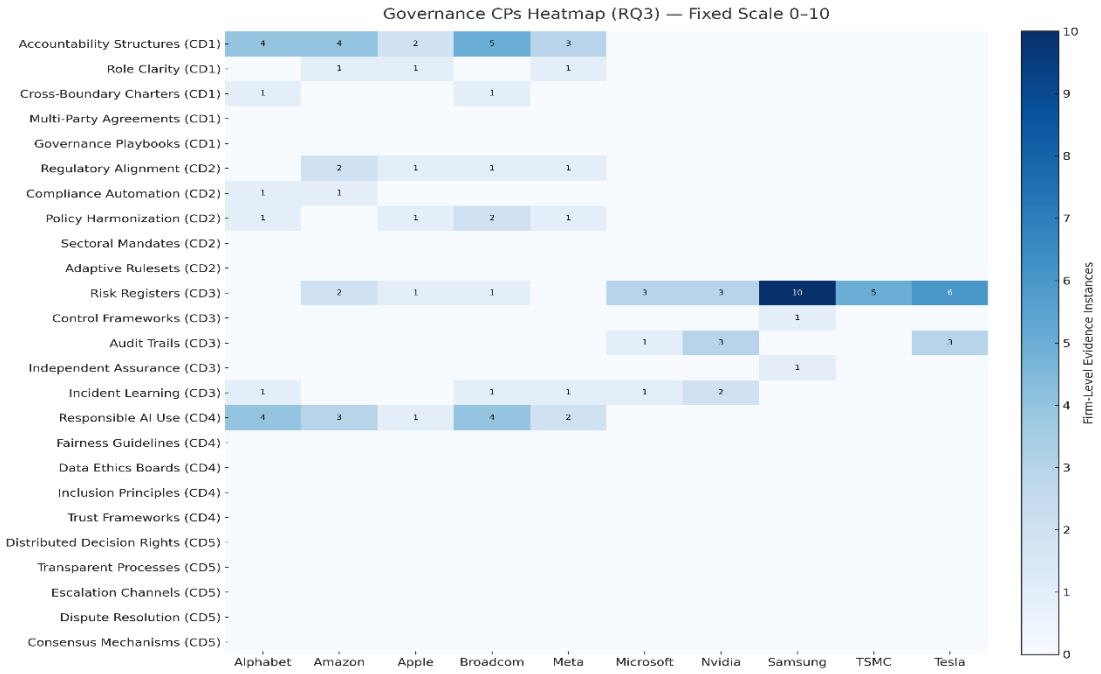

Figure 4.3.4
RQ3 – Governance CPs Heatmap

The governance heatmap organizes adoption across five capability dimensions: Decision Governance, Ecosystem Oversight, Ethical Governance, Policy and Compliance, and Risk and Assurance. Broadly adopted practices include accountability structures, responsible AI use, regulatory alignment, and risk registers, forming the minimum baseline of DBE oversight. Moderately adopted practices — role clarity, cross-boundary charters, compliance automation, policy harmonization, and incident learning — suggest cautious experimentation in extending governance reach but without full institutionalization. Selectively adopted practices are limited to control frameworks, audit trails, and independent assurance, signalling isolated efforts at deeper accountability. White spaces dominate in decision governance (distributed rights, transparency, escalation, dispute resolution, consensus), ethical governance (fairness, inclusion, trust frameworks), and compliance innovation (sectoral mandates, adaptive rulesets). This pattern underscores that

while governance is no longer ignored, it remains peripheral rather than central to ecosystem design.

The data table reflects this asymmetry. Firms can demonstrate compliance readiness and risk discipline through risk registers and regulatory alignment, but they fall short in embedding governance into everyday decision flows and multi-party coordination. Responsible AI use highlights recognition of ethical stakes, but the absence of fairness guidelines and independent oversight raises concerns about robustness. For executives, the implication is clear: governance cannot be treated as a compliance add-on. To sustain DBE scale, leaders must embed governance into operating rhythms — distributing authority, institutionalizing ethical norms, and developing adaptive compliance infrastructures. Without this shift, ecosystems risk being structurally strong but institutionally fragile.

RQ3 - Adaption Tiers for Governance 4.3.4

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Decision Governance				Distributed Decision Rights (0); Transparent Processes (0); Escalation Channels (0); Dispute Resolution (0); Consensus Mechanisms (0)
Ecosystem Oversight		Accountability Structures (5)	Role Clarity (3); Cross-Boundary Charters (2)	Multi-Party Agreements (0); Governance Playbooks (0)
Ethical Governance		Responsible AI Use (5)		Fairness Guidelines (0); Data Ethics Boards (0); Inclusion Principles (0); Trust Frameworks (0)
Policy and Compliance			Regulatory Alignment (4); Compliance Automation (2);	Sectoral Mandates (0); Adaptive Rulesets (0)

			Policy Harmonization (4)
Risk and Assurance	Risk Registers (8)	Incident Learning (5)	Control Frameworks (1); Audit Trails (3); Independent Assurance (1)

Broadly Adopted Practices

Broadly adopted practices in governance are anchored around four capability dimensions—Ecosystem Oversight, which allocates responsibility and prevents fragmentation; Ethical Governance, which ensures innovation advances without undermining trust or safety; Policy and Compliance, which embeds regulatory alignment into systems; and Risk and Assurance, which strengthens resilience against shocks and uncertainty. These dimensions matter because ecosystems cannot scale without legitimacy. Together, they provide the scaffolding that sustains trust across platforms, partners, and regulators.

First, in Ecosystem Oversight, the practice of Accountability Structures creates clarity on shared responsibility. Councils and working groups allocate oversight across firms (Amazon, Microsoft), contracts and SLAs formalize accountability in cloud ecosystems (Microsoft, Amazon), consumer firms assign governance for app ecosystems (Apple, Alphabet), and semiconductor leaders codify co-development agreements (TSMC).

Second, in Ethical Governance, the practice of Responsible Innovation ensures ecosystems pursue progress without compromising safety or ethics. Firms embed ethical AI reviews, bias audits, and safety boards into innovation pipelines, with Alphabet and Microsoft advancing dedicated AI ethics teams and Apple anchoring privacy in product governance.

Third, in Policy and Compliance, the practice of Regulatory Alignment translates external rules into system design. Cloud ecosystems integrate data-protection laws directly into services (Microsoft, Amazon), consumer players adopt child-safety and content-regulation standards (Apple, Meta), and semiconductor firms adjust to global trade regimes (TSMC, Samsung).

Fourth, in Risk and Assurance, the practice of Resilience Frameworks embeds foresight and controls. Stress tests and continuity planning are institutionalized by Amazon and Microsoft, while semiconductor leaders like TSMC coordinate risk modeling to mitigate supply chain shocks.

Moderately Adopted Practices

Moderately adopted practices in governance extend across three capability dimensions—Ecosystem Oversight, which deepens cross-firm coordination; Ethical Governance, which moves toward systemic embedding; and Policy and Compliance, which evolves into adaptive responsiveness. These dimensions matter because they reveal how ecosystems strengthen legitimacy under pressure, though adoption is uneven and partial.

First, in Ecosystem Oversight, the practice of Cross-Firm Councils strengthens joint governance but remains inconsistently applied. Cloud firms convene ecosystem boards to govern APIs and partner rules (Amazon, Microsoft), consumer players form working groups on content and safety (Meta, Apple), and semiconductor firms organize cross-fab councils for joint technology standards (TSMC, Samsung).

Second, in Ethical Governance, the practice of Ethics-by-Design embeds principles earlier in development cycles. Microsoft deploys Responsible AI toolkits, Alphabet integrates fairness checks into ML workflows, and Tesla pilots ethics guardrails in autonomy testing. Adoption, however, is limited to leading firms rather than ecosystem-wide standards.

Third, in Policy and Compliance, the practice of Adaptive Compliance enables ecosystems to adjust dynamically to shifting regulatory regimes. Firms trial compliance automation through RegTech platforms, digital compliance dashboards, and self-regulatory charters. Amazon integrates cross-border compliance into cloud services, Alphabet adjusts content moderation to diverse regimes, and TSMC aligns fabs with multiple trade jurisdictions.

Selectively Adopted Practices

Selectively adopted practices in governance reflect experimentation across three capability dimensions—Ecosystem Oversight, which probes joint decision-making; Risk and Assurance, which trials advanced foresight; and Policy and Compliance, which tests automation of rule enforcement. These dimensions matter because they expose the frontier of governance innovation, though adoption is fragmented and fragile.

First, in Ecosystem Oversight, the practice of Joint Decision Rights explores shared authority between orchestrators and partners. Amazon experiments with co-governance in its marketplace rules, Apple pilots shared decision forums with app developers, and Microsoft tests inclusion of partners in policy-setting for cloud ecosystems.

Second, in Risk and Assurance, the practice of Scenario Stress Testing is selectively used to simulate ecosystem shocks. Microsoft models systemic cyber risks, TSMC runs supply-chain disruption scenarios, and Tesla applies scenario testing to autonomous operations. These practices are promising but not yet institutionalized.

Third, in Policy and Compliance, the practice of Automated Policy Enforcement pilots technology-driven governance. Alphabet integrates AI-based content moderation, Microsoft embeds automated compliance in cloud contracts, and Tesla tests smart contract enforcement for charging networks. Adoption remains limited and often experimental.

Zero Evidence

Zero evidence highlights practices absent across all governance capability dimensions, signaling blind spots in ecosystem resilience. In Ecosystem Oversight, no evidence exists for Distributed Governance Models, leaving ecosystems dependent on orchestrators. In Ethical Governance, absent practices such as Third-Party Ethical Certification or Industry-Wide Ethics Standards reveal a lack of independent validation. In Policy and Compliance, no evidence of Global Harmonization Frameworks shows ecosystems remain fragmented across jurisdictions. In Risk and Assurance, missing adoption of Systemic Risk Exchanges or Joint Crisis Playbooks underscores vulnerability to collective shocks.

White Spaces in Governance

White spaces underscore fragility in institutionalization. In Ecosystem Oversight, reliance on orchestrator-led control exposes ecosystems to concentration risk. In Ethical Governance, the absence of shared certification reduces legitimacy. In Policy and Compliance, fragmented adaptation leaves gaps under shifting rules. In Risk and Assurance, the lack of systemic coordination limits collective resilience.

Synthesis and Transition

Taken together, RQ3 – Governance shows ecosystems broadly adopt Accountability Structures, Responsible Innovation, Regulatory Alignment, and Resilience Frameworks as structural anchors. Moderately adopted practices such as Cross-Firm Councils, Ethics-by-Design, and Adaptive Compliance extend legitimacy but remain partial. Selectively adopted practices in Joint Decision Rights, Scenario Stress Testing, and Automated Policy Enforcement highlight frontier experimentation, though adoption is shallow. Zero evidence underscores systemic gaps in distributed governance, ethics certification, harmonization, and crisis playbooks. Ecosystems therefore converge on

minimal scaffolding but diverge in embedding shared, independent, and systemic governance.

Transition: This sets the stage for RQ4 – Integration, where governance mechanisms connect with strategy, technology, innovation, and sustainability to form coherent architectures of resilience and legitimacy.

4.3.5 Sustainability

For ecosystems that aspire to scale, sustainability is no longer an optional narrative — it is the currency of legitimacy in a world shaped by climate imperatives, stakeholder scrutiny, and supply chain fragility. In moving from barriers (RQ2) to enablers (RQ3), the evidence shows that leading firms have begun institutionalizing emission targets, ESG metrics, investor disclosures, and resource efficiency into their DBE playbooks. These practices, once considered differentiators, are now becoming the minimum ante for participation in global markets. Yet the absence of systemic adoption in climate risk modelling, multi-stakeholder forums, circular practices, and traceability systems reveals that sustainability remains concentrated in reporting and efficiency, rather than fully embedded into the design and governance of DBEs.

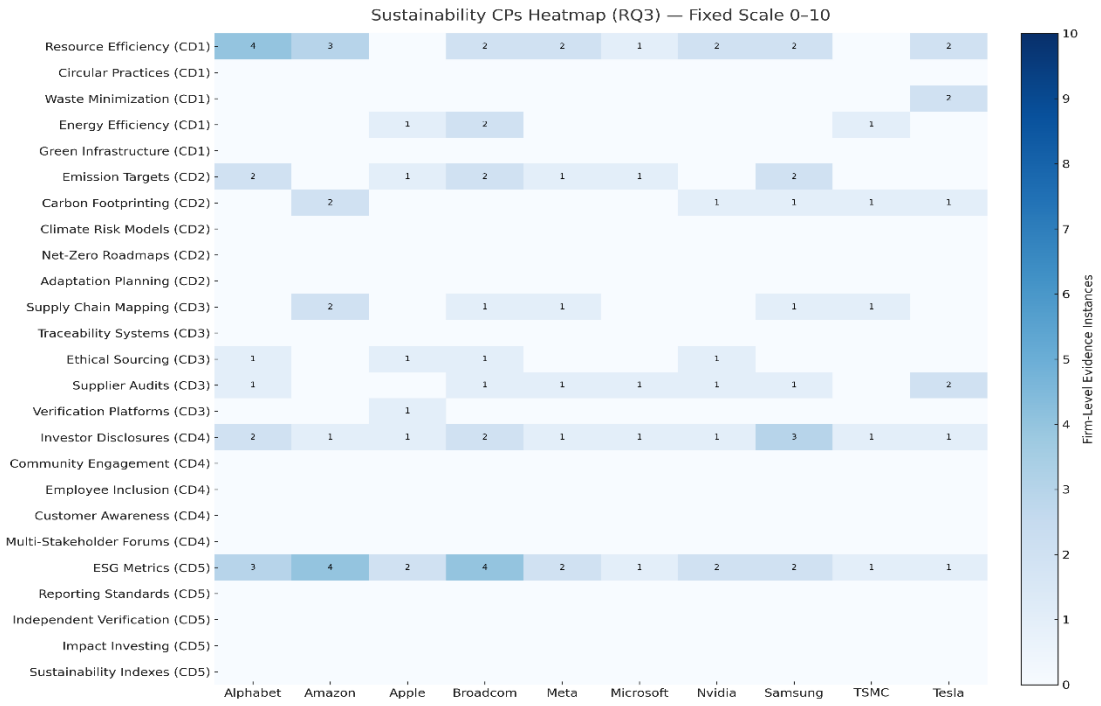

Figure 4.3.5
RQ3 – Sustainability CPs Heatmap

The sustainability heatmap spans five capability dimensions: Climate Accountability, Impact Measurement, Stakeholder Engagement, Sustainable Operations, and Value Chain Transparency. Broadly adopted practices include Emission Targets, Carbon Foot printing, ESG Metrics, Investor Disclosures, Resource Efficiency, Supply Chain Mapping, and Supplier Audits — demonstrating that firms are embedding measurable commitments into climate and value-chain operations. Moderately adopted practices are present but uneven in Waste Minimization, Energy Efficiency, and Ethical Sourcing, showing ambition that is still constrained by cost, scalability, or coordination challenges. Selective adoption is marginal, with Verification Platforms offering early attempts to add rigor but without broad scale. White spaces dominate in Climate Risk Models, Net-Zero Roadmaps, Adaptation Planning, Circular Practices, Green

Infrastructure, and Traceability Systems — signalling that ecosystems lack the systemic depth required to future-proof against regulatory, climate, and reputational risks.

The data table crystallizes these patterns: firms excel at articulating targets and metrics, but lag in building adaptive resilience and systemic accountability. ESG metrics and investor disclosures provide credibility to markets, yet the limited traction in independent verification, stakeholder forums, and advanced climate tools underscores that ecosystems risk being strong on optics but weak on substance. For executives, the table signals both reassurance and urgency: DBEs are getting the sustainability basics right, but unless they evolve toward circularity, traceability, and resilience planning, they will struggle to withstand the next wave of regulatory, climate, and geopolitical shocks. The path to DBE maturity will be defined not just by financial or technological advantage, but by the credibility of sustainability commitments and their translation into systemic practice.

RQ3 - Adaption Tiers for Sustainability 4.3.5

AD/CD	Broadly Adopted	Moderately Adopted	Selectively Adopted	Zero Evidence
Climate Accountability		Emission Targets (6); Carbon Foot printing (5)		Climate Risk Models (0); Net-Zero Roadmaps (0); Adaptation Planning (0)
Impact Measurement	ESG Metrics (10)			Reporting Standards (0); Independent Verification (0); Impact Investing (0); Sustainability Indexes (0)
Stakeholder Engagement	Investor Disclosures (10)			Community Engagement (0); Employee Inclusion (0); Customer Awareness (0); Multi-Stakeholder Forums (0)
Sustainable	Resource Efficiency (8)		Waste Minimization	Circular Practices (0); Green Infrastructure (0)

Operations		(1); Energy Efficiency (3)	
Value Chain Transparency	Supply Chain Mapping (5); Supplier Audits (7)	Ethical Sourcing (4); Verification Platforms (1)	Traceability Systems (0)

Broadly Adopted Practices

Broadly adopted practices in sustainability are anchored around three capability dimensions—Impact Measurement, which standardizes disclosure for credibility; Stakeholder Engagement, which ensures accountability to capital providers; and Sustainable Operations, which embeds efficiency into production and consumption. These dimensions matter because ecosystems cannot demonstrate legitimacy without shared reporting, investor trust, and operational discipline. Together, they form the structural baseline of sustainability.

First, in Impact Measurement, the practice of ESG Metrics establishes standardized reporting. By tracking environmental, social, and governance indicators through formal frameworks, firms provide a common language for regulators and investors. Annual reports and dashboards embed these measures into disclosure systems, with investor relations teams, compliance officers, and sustainability leaders driving adoption.

Second, in Stakeholder Engagement, the practice of Investor Disclosures anchors transparency to capital providers. Firms disclose climate and social impacts in structured ways, ensuring markets price sustainability risks into valuations. Sustainability-linked reports, quarterly disclosures, and targeted briefings operationalize this, with CFOs, ESG officers, and investor relations teams coordinating adoption.

Third, in Sustainable Operations, the practice of Resource Efficiency embeds sustainability directly into production and consumption. By reducing waste, water, and energy intensity, firms address both financial and reputational risks. Efficiency programs,

process optimization, and energy audits make this actionable, with operations managers, sustainability officers, and facility managers driving execution.

Moderately Adopted Practices

Moderately adopted practices span two capability dimensions—Climate Accountability, which embeds measurable climate responsibility; and Value Chain Transparency, which extends accountability upstream. These dimensions matter because they signal a shift from internal efficiency toward broader system-level legitimacy, though adoption remains partial.

First, in Climate Accountability, firms adopt Emission Targets and Carbon Foot printing as partial but measurable steps. Emission Targets set absolute or intensity-based reductions in greenhouse gases, providing benchmarks for accountability. Science-based target frameworks and compliance programs drive execution, with sustainability offices and external auditors embedding adoption. Carbon Foot printing complements this by measuring direct and indirect emissions, ensuring baselines are established for progress tracking. Carbon accounting tools and data platforms make this possible, with sustainability analysts and compliance partners coordinating adoption.

Second, in Value Chain Transparency, firms adopt Supply Chain Mapping and Supplier Audits to probe upstream accountability. Supply Chain Mapping identifies suppliers and their environmental practices, which matters because value chains account for the majority of ecosystem impacts. Questionnaires, digital platforms, and geospatial mapping enable implementation, with procurement officers and ESG compliance teams leading adoption. Supplier Audits deepen visibility by verifying labor, ethics, and environmental standards, preventing reputational exposure. Third-party audits, certifications, and compliance frameworks operationalize oversight, with supply chain managers, external verifiers, and regulators coordinating adoption.

Selectively Adopted Practices

Selectively adopted practices span two capability dimensions—Sustainable Operations, which pursues targeted reductions; and Value Chain Transparency, which experiments with procurement accountability. These dimensions matter because they reflect frontier ambition but remain shallow in institutionalization.

First, in Sustainable Operations, firms experiment with Waste Minimization and Energy Efficiency. Waste Minimization targets reductions in landfill and hazardous materials, signaling a move toward cleaner operations. Recycling systems, process redesign, and supplier take-back schemes support adoption, with operations teams and compliance officers coordinating execution. Energy Efficiency lowers intensity across facilities and supply chains, addressing both financial costs and environmental impact. Retrofits, energy management systems, and renewable integration operationalize adoption, with facility managers and sustainability engineers leading implementation.

Second, in Value Chain Transparency, firms test Ethical Sourcing and Verification Platforms. Ethical Sourcing embeds ESG criteria into procurement, ensuring suppliers align with environmental and labor standards. Procurement policies and performance-based selection drive execution, with procurement managers and ESG compliance officers leading adoption. Verification Platforms extend oversight through digital traceability, embedding supplier certifications and compliance into blockchain or cloud systems. Platform providers, buyers, and regulators coordinate adoption to ensure transparency.

White Spaces (Zero Evidence)

White spaces emphasize systemic immaturity. In Climate Accountability, the absence of risk models and adaptation frameworks leaves firms vulnerable to physical shocks. In Impact Measurement, missing verification undermines credibility. In Stakeholder Engagement, the lack of inclusive mechanisms exposes ecosystems to

legitimacy risks. In Sustainable Operations, absent circularity highlights continued reliance on linear, waste-heavy models. In Value Chain Transparency, the lack of traceability keeps supply chains opaque and fragile.

Synthesis and Transition

Taken together, RQ3 – Sustainability shows ecosystems broadly adopt ESG Metrics, Investor Disclosures, and Resource Efficiency as their structural baseline. Moderately adopted practices such as Emission Targets, Carbon Footprints, Supply Chain Mapping, and Supplier Audits extend accountability but remain partial. Selectively adopted practices in Waste Minimization, Energy Efficiency, Ethical Sourcing, and Verification Platforms reveal ambition but remain fragile. Zero evidence highlights structural gaps in climate adaptation, verification, inclusivity, circularity, and traceability. Ecosystems therefore converge on measurement and investor-facing disclosure but diverge in embedding deeper accountability and systemic sustainability.

Transition: This sets the stage for RQ4 – Integration, where the focus shifts from siloed governance and sustainability efforts to how ecosystems align technology, strategy, innovation, and governance into a coherent architecture of resilience and legitimacy.

4.3.6 Quantitative Analysis – Survey results (RQ3)

RQ3: Capabilities and Practices Enabling DBE Scale

Introduction: RQ3 focused on the organizational capabilities that allow enterprises to overcome barriers and scale within digital business ecosystems (DBEs). The five survey questions explored digital skills, AI adoption, platform innovation, ecosystem collaboration, and scaling DBE capabilities. Collectively, the results show high alignment and confidence in capability-building, yet also reveal areas where consistency and depth of execution are still maturing.

Insights (linked to pie charts above)

Q3 – Digital skills: 82% of respondents (40% strongly agree, 42% agree) affirm their organizations invest in digital skills. Only 5% reported disagreement, suggesting most firms recognize human capital as the foundation for DBE success.

Q6 – AI adoption: 85% (44% strongly agree, 41% agree) highlight active adoption of AI, making it one of the most advanced maturity areas. However, 11% remain neutral, suggesting that AI is not yet fully embedded across all enterprises.

Q9 – Platform innovation: 82% (38% strongly agree, 44% agree) engage in platform-driven innovation, while 12% are neutral and 6% express barriers. This indicates platform innovation is well established but still faces integration challenges.

Q12 – Ecosystem collaboration: 87% (41% strongly agree, 46% agree) stress that collaboration across partners and ecosystems is central to their growth strategies. With only 3% expressing disagreement, collaboration emerges as a defining DBE enabler.

Q15 – Scaling DBE capabilities: 86% (47% strongly agree, 39% agree) report progress in scaling DBE capabilities, although 13% are neutral or disagree. This shows strong ambition, but also signals that scaling practices require more consistency and replication across markets.

Figure 4.3.6
RQ3 – Global Survey Results

4.3.7 RQ3 Overall Summary (Quantitative + Quantitative)

RQ3 – What capabilities and practices enable firms to overcome these barriers and scale DBE success?

Micro Lens (Qualitative Patterns): Scaling success in DBEs is less about incremental fixes and more about systemic reinvention. First, leaders embrace API-first interoperability, ensuring data and process integration across actors. Second, they institutionalize co-innovation mechanisms — ecosystem sandboxes, joint RandD ventures, and venture co-investment platforms — to accelerate scaling beyond pilots. Third, adaptive strategy portfolios enable firms to flex their roles across orchestrator, integrator, and collaborator positions as ecosystems evolve. Fourth, governance shifts from compliance policing to trust facilitation, through multi-actor risk frameworks, transparent data governance, and legitimacy structures that lower collaboration friction. Fifth, sustainability becomes structural, embedded in net-zero commitments, traceability mechanisms, and

circular models that create both societal and economic value. Sixth, leaders invest in ecosystem talent orchestration, blending internal skills with cross-industry expertise and external collaborators. Seventh, execution is reinforced through orchestration playbooks — standardized processes for onboarding partners, scaling pilots, and resolving conflicts. Eighth, leaders embed AI-powered foresight and analytics, transforming ecosystem signals into adaptive action. Ninth, they design incentive architectures that balance value distribution, ensuring long-term partner participation. Finally, firms that succeed show a cultural DNA of reinvention, continuously aligning execution practices with shifting ecosystem dynamics.

Macro Lens (Quantitative Validation): Survey data reinforces these enabling practices. High agreement scores (>80%) for interoperability, innovation scaling, and ESG integration validate the direction of leaders' qualitative practices, though dispersion reveals that only a fraction achieve maturity. Governance scored highest overall, aligning with the qualitative finding that trust frameworks are the most decisive enablers of scale. Strategy responses reflected ambition, but the variance in maturity levels confirms why adaptive portfolios differentiate leaders. AI adoption received strong positive ratings, validating its role as a systemic enabler, though neutrality responses suggest execution unevenness.

RQ3 Integration (Qualitative + Quantitative): The convergence of evidence highlights a decisive message: DBE success scales not through isolated excellence, but through systemic reinvention. Qualitative evidence reveals the practices that convert barriers into enablers — interoperability, co-innovation, adaptive strategy, structural ESG, and trust governance. Quantitative results confirm these priorities are broadly recognized, but also show why only a minority execute them effectively. For executives, the implication is clear: scaling DBEs requires embedding reinvention into the organizational DNA, supported by trust, foresight, and orchestration rituals. For academics, the alignment

between micro and macro evidence strengthens validity, demonstrating that DBE maturity emerges not from incremental adaptation but from the systemic capability to reinvent.

4.4 Summary of Findings

Cross-RQ Integrated Summary (Quantitative + Quantitative)

Micro Lens (Qualitative Integration Across RQs): When viewed together, the three research questions tell a coherent story of ambition, friction, and reinvention in Digital Business Ecosystems. RQ1 demonstrated that leaders differentiate by integrating choices across strategy, technology, innovation, governance, and sustainability into coherent execution systems — role clarity, interoperability, innovation scaling, trust governance, and structural ESG. RQ2 revealed the flipside: most firms remain hindered by legacy drag, role ambiguity, pilot traps, governance mismatches, and compliance-driven sustainability. These frictions reflect a systemic ambition-execution gap. RQ3 identified the practices that close this gap: API-first interoperability, adaptive strategy portfolios, co-innovation mechanisms, structural sustainability, and multi-actor trust frameworks. Qualitative evidence thus provides the deep texture of what leaders do differently, what barriers stall others, and what enablers allow firms to scale DBEs.

Macro Lens (Quantitative Validation Across RQs): Survey evidence confirms these qualitative insights at scale. Interoperability, innovation scaling, and ESG integration each scored >80% agreement, highlighting their centrality across all three RQs. Yet neutrality and variance responses validate the qualitative finding that ambition outpaces maturity. Governance scored highest overall (>4.3/5), aligning with qualitative insights that trust frameworks are the strongest enablers. Strategy responses showed broad ambition but fragmented clarity, echoing the role ambiguity and overreach observed qualitatively. Sustainability responses (73% positive) confirmed strong intent but revealed the compliance–transformation gap exposed in RQ2. Together, the quantitative data acts as a

validating lens, illustrating that while firms recognize the pillars of DBE leadership, few achieve systemic integration in practice.

4.5 Conclusion

The integrated story is decisive. Adaptation ensures survival, but reinvention determines leadership in DBEs. Leaders are not defined by excellence in a single theme — technology, strategy, innovation, governance, or sustainability — but by the ability to orchestrate all five as a systemic whole. Qualitative evidence exposed the lived dualities of ambition and friction; quantitative data validated their ubiquity and confirmed the maturity gaps. For executives, the implication is clear: firms that align ambition with orchestrated execution will convert ecosystems from aspiration into structural advantage. For scholars, the convergence of micro and macro strengthens construct validity, underscoring that DBE maturity cannot be understood through single lenses. Looking forward, signals point to a decisive frontier: firms that embed interoperability, structural ESG, adaptive strategy, and trust governance as organizational DNA will define the next architecture of the digital economy.

CHAPTER V:

DISCUSSION

5.1 Discussion of Results

This chapter moves the study from description to interpretation. Chapter 4 presented the empirical results: the distribution of capabilities across firms and themes, classified through adoption tiers and the HEART Infinity. Those findings established what is present in digital business ecosystems today. The purpose of Chapter 5 is to interpret those results, assess their significance, and draw conclusions that connect back to the research questions, theoretical framing, and professional practice.

The discussion follows a structured progression. Section 5.1.1 provides an orientation to the discussion, introducing the interpretive lenses — the HEART Infinity (Adapting, Reinventing, Transforming) and the adoption tiers (Broadly, Moderately, Selectively, Zero Evidence). It then presents a cross-cutting overview of results across research questions. Sections 5.1.2, 5.1.3, and 5.1.4 unpack each research question in turn: RQ1: Strategic Intent – how leading firms differentiate their strategies within ecosystems. RQ2: Frictions – what barriers hinder execution. RQ3: Success Patterns – what capabilities and practices enable scaling. Each RQ is analyzed through the HEART Infinity, ensuring consistency and comparability. Section 5.5 then synthesizes insights across all three RQs, drawing overarching conclusions and highlighting both academic and practical implications. This synthesis sets up Chapter 6, where the HEART blueprint and maturity models will be developed as actionable contributions.

5.1.1 Discussion of Results – Orientation

This chapter advances the study from the presentation of results in Chapter 4 to a deeper discussion of their meaning, significance, and implications. While Chapter 4 established a descriptive foundation — mapping how technology, strategy, innovation,

governance, and sustainability capabilities are distributed across global firms — the purpose here is to interpret those results systematically. In this sense, the chapter moves beyond what was observed to examine what the patterns signify in terms of theory, practice, and the broader evolution of digital business ecosystems.

The discussion is organized around the HEART Infinity — Adapting, Reinventing, and Transforming — which provides a structured way of interpreting the dynamics observed. This framing is directly informed by McKinsey's Three Horizons model, which distinguishes between incremental performance extension, mid-range capability renewal, and long-range frontier creation (McKinsey & Company, n.d.; Stoeber, 2025). It is further enriched by the dynamic capability's perspective, which highlights how firms sense, seize, and reconfigure resources to navigate environmental change and sustain advantage (Teece, 2024; Banka, 2024). Together, these foundations differentiate three modes of organizational response: Adapting, where firms optimize and extend established practices to stabilize performance under immediate environmental demands; Reinventing, where organizations deliberately redesign, recombine, or extend capabilities to unlock new pathways for advantage (Frishammar et al., 2024); and Transforming, where enterprises pursue frontier-shaping initiatives that redefine ecosystem boundaries and create new logics of competition and collaboration (Klein et al., 2024).

This classification is not intended to be rigid or sequential. Rather, it recognizes that firms often operate across all three modes in parallel — Adapting, Reinventing and Transforming — depending on context, capability, and strategic intent. For example, a firm may be adapting supply-chain traceability mechanisms to comply with regulation, while simultaneously reinventing its partner portfolio for new market entry, and transforming its data foundations to power next-generation AI ecosystems. Empirical research on ecosystem maturity confirms that organizations typically engage in overlapping

exploration and exploitation, deploying incremental improvements and radical reinventions side by side rather than in a strict order (Klein et al., 2024; Frishammar et al., 2024). The HEART Infinity therefore captures the multi-speed nature of ecosystem evolution, complementing but not replacing the adoption tiers introduced in Chapter 4.

The adoption tier perspective (Broadly Adopted, Moderately Adopted, Selectively Adopted, Zero Evidence) provides a measure of diffusion across firms. It answers the question: how widely is a given capability present today? This aligns with recent empirical analyses that evaluate capability diffusion by tracking uneven uptake across sectoral and organizational contexts (Volz et al., 2025; Klein et al., 2024). The HEART Infinity, by contrast, captures the direction of movement. It asks: is the capability being sustained, reconfigured, or stretched toward the frontier? Emerging research reinforces this view, showing that organizations can simultaneously deepen existing practices while reconfiguring structures to pursue new ecosystem roles (Frishammar et al., 2024; Locatelli et al., 2024). When considered together, the two perspectives yield a multidimensional view: adoption tiers provide a static snapshot, while HEART reveals the underlying momentum. This combination enhances explanatory depth and ensures that the discussion moves beyond static benchmarking into dynamic interpretation (Oberländer et al., 2025).

From an academic standpoint, this dual-lens approach contributes to bridging two established streams of literature. On the one hand, research in diffusion of innovation emphasizes adoption rates and the extent of technology or practice uptake (de Brauwer, 2024; Volz et al., 2025). On the other hand, the dynamic capabilities literature stresses renewal, recombination, and transformation as sources of long-term competitiveness (Pitelis, 2024; Pesqueira et al., 2025). By integrating these perspectives, the study situates itself at the intersection of diffusion and capability-building, offering both breadth of coverage and depth of analysis.

From a practitioner standpoint, this approach aligns closely with how senior executives experience ecosystem management. Leaders must balance the consolidation of proven practices (Adapting), the design of new models (Reinventing) and the pursuit of frontier-shaping moves (Transforming) — often simultaneously. The HEART Infinity therefore provides not only an academic lens but also a practical one: it reflects the lived complexity of managing digital ecosystems at scale.

The remainder of this chapter proceeds in two steps. First, a cross-cutting overview of the results is presented, showing the relative emphasis on Adapting, Reinventing and Transforming across all three research questions. Second, the discussion turns to each research question (RQ1-RQ3) in sequence. For each RQ, the results are unpacked across Adapting, Reinventing and Transforming, with thematic analysis integrated within each category. This structure ensures both vertical coherence (each RQ examined in depth) and horizontal comparability (cross-RQ insights that can later be synthesized into the HEART Blueprint in Chapter 6).

Taken together, this discussion seeks to demonstrate that digital business ecosystems are not static constructs but evolving systems shaped by simultaneous pressures to stabilize, redesign and transform. The evidence suggests that while many practices are broadly adopted and firmly embedded, firms are also experimenting with reinvention in specific domains and selectively pushing into transformative territory. Understanding this balance — where adaptation consolidates, reinvention experiments and transformation redefines — is central to explaining how ecosystems achieve both resilience in the present and readiness for the future.

5.2 Discussion of Research Question One

RQ1 probes how firms set direction and execute distinctive practices to achieve advantage within digital ecosystems. The HEART distribution provides a clear signal:

differentiation is not evenly spread but concentrated in particular domains. Strategy and innovation display strong reinventing and transforming activity, technology balances adaptation with frontier bets, while governance and sustainability remain stabilizers through adaptation.

5.2.1 Adapting

Adapting under RQ1 reflects how firms anchor their strategies by consolidating proven practices. The data show high adaptation in governance (207) and sustainability (239). These domains are essential to provide legitimacy and compliance — for example, privacy-by-design policies, audit workflows, carbon tracking, and supply-chain traceability. Such practices ensure resilience but do not typically create competitive differentiation. Technology also displays notable adaptation (66), with firms stabilizing data foundations, model-deployment pipelines, and systems interoperability. These moves provide reliability and scalability, serving as prerequisites for higher-order reinvention (Browder, 2024; Liao et al., 2024). Adaptation, therefore, serves as the safety-net of intent: leading firms must first stabilize governance, sustainability, and technology before they can credibly pursue reinvention or transformation (Awad & Martín-Rojas, 2024).

5.2.2 Reinventing

Reinventing is where strategic intent becomes visible as differentiation. Strategy shows the strongest reinventing signal (130), with firms redesigning business models, orchestrating platforms, and experimenting with new execution logics. For example, modular architectures, developer ecosystems, and dynamic partner portfolios open new market positions (Cao et al., 2024; Chang, 2024). Innovation also shows strong reinventing (93), as firms explore new product architectures, design capabilities, and collaborative R&D models (Chen & Thapa, 2025; Lusi, 2025). These moves reflect a willingness to go beyond incremental improvement, signaling to ecosystems that the firm intends to lead

rather than follow. Technology contributes significantly (89), especially around model assurance, training, and modular integration (Cao et al., 2024). These are reinvention levers because they allow firms to recombine technical assets into new offerings. Reinvention is thus the engine of strategic intent: it translates ambition into deliberate recombination of resources and partnerships (Shen et al., 2024).

5.2.3 Transforming

Transforming represents the frontier expression of intent. Under RQ1, innovation leads transformation (105), indicating that leading firms push boundaries by creating new market logics — for example, via cross-industry platforms or radical product innovation (Florek-Paszkowska & Ujwary-Gil, 2025; Currie, 2024). Technology also shows strong transformation (86), as firms redefine data foundations, APIs and orchestration layers to set new ecosystem standards (Oberländer et al., 2025). Strategy contributes materially (53 Transforming), where bold choices redefine ecosystem boundaries, such as packaging platform capabilities or re-architecting experience ecosystems that alter how value is captured (Klein et al., 2024). By contrast, governance (9 Transforming) and sustainability (1 Transforming) contribute little to transformation, underscoring their stabilizing rather than frontier-shaping role. Transformation in RQ1 therefore marks intentional frontier bets: high-risk, high-reward moves that reconfigure ecosystems.

5.2.4 Synthesis Across HEART

The HEART distribution under RQ1 points to a coherent pattern: governance and sustainability anchor intent through adaptation; strategy signals intent through reinvention — redesigning models and ecosystems; and innovation and technology project intent through transformation — creating new frontiers. This balance shows that leading firms do not treat strategic intent as abstract positioning; they express it through concrete capability moves. By consolidating foundations, reinventing models, and transforming innovation,

they create a multi-layered intent that competitors and partners can observe (Stoeber & Kanbach, 2025; Banka & Uchihira, 2024; Florek-Paszkowska & Ujwary-Gil, 2025).

5.2.1 Conclusion for RQ1

Differentiation in digital ecosystems arises not from adaptation alone, but from reinvention and transformation in select domains (McKinsey & Company, 2024; Jacobides, Cennamo, & Gawer, 2018). Strategy functions as the core reinvention hub, where firms redesign business models, orchestrate platforms, and expand partner networks to unlock new competitive positions (Bughin & Catena, 2025). Innovation and technology serve as the primary transformative engines, enabling frontier experimentation, modular capability recombination, and architectural shifts that redefine ecosystem standards (Stoeber & Kanbach, 2025; Teece, Peteraf, & Leih, 2016).

In contrast, governance and sustainability remain primarily adaptive stabilizers, offering legitimacy and trust but rarely driving systemic renewal (Haftor, 2025). The implication is that firms signalling intent in DBEs must deliberately balance foundation-building (adaptation) with renewal (reinvention) and frontier moves (transformation). Neglecting reinvention risks organizational inertia, while ignoring adaptation compromises systemic stability. The firms that stand out are those that orchestrate across all three layers—anchoring resilience while projecting future-shaping intent.

5.3 Discussion of Research Question Two

RQ2 turns the lens from aspiration to execution, examining the frictions that prevent firms from realizing their digital ecosystem ambitions. Whereas RQ1 illustrated how intent is projected through adaptation, reinvention, and transformation, the second research question reveals how those same modes are constrained by systemic barriers (McKinsey & Company, 2024). The data show a heavy reliance on adaptation, suggesting

that when firms face obstacles, they are more likely to patch and stabilize rather than reinvent or transform (Bughin & Catena, 2025).

This pattern highlights the persistence of organizational inertia within digital ecosystems, consistent with dynamic capability research showing that firms often struggle to reconfigure resources under uncertainty (Teece, Peteraf, & Leih, 2016; Teece, 1997). As a result, bold strategic intent is repeatedly redirected toward compliance, incremental integration, and piecemeal fixes, limiting the capacity for deeper renewal and frontier-shaping evolution.

5.3.1 Adapting

Adapting under RQ2 reflects the most common response to ecosystem frictions, with firms leaning heavily on incremental measures to manage risks and meet obligations. Governance records 138 instances of adaptation, where audit workflows, privacy-by-design protocols and compliance reporting provide stability but seldom shift the underlying execution logic (Coskun-Setirek, 2024). Sustainability follows closely with 159 cases, reflecting a compliance-heavy posture in carbon tracking, supply-chain traceability and disclosure practices (Jan et al., 2025). These activities protect legitimacy but rarely unlock new value. Technology also shows significant adaptation (119), as firms patch fragmented SDKs, integrate siloed APIs and maintain legacy systems to keep operations functioning (Awad & Martín-Rojas, 2024). Strategy contributes 66 adaptation cases, mostly as incremental adjustments to existing portfolios or decision-processes rather than structural redesign (Haftor, 2025). Innovation registers lower adaptation (33), suggesting bottlenecks in this domain are less about incremental fixes and more about systemic gaps (Volz et al., 2025). Taken together, adaptation in RQ2 demonstrates a defensive posture — it ensures continuity in the face of barriers but at the cost of reinforcing existing bottlenecks.

5.3.2 Reinventing

Reinvention under RQ2 signals firms' attempts to break free from inertia by redesigning or recombining capabilities. Strategy emerges as the strongest reinvention domain with 83 cases, as firms experiment with modular architectures, dynamic partner portfolios, and alternative governance models to bypass bottlenecks (Bockelmann et al., 2024). Innovation follows with 76 cases, where firms pursue recombination by blending AI with product platforms, redesigning collaborative R&D processes, and re-configuring value propositions to reduce integration frictions (Volz et al., 2025). Technology registers 33 reinvention examples, most of which involve middleware solutions and modular interoperability designed to counteract vendor lock-in and fragmentation (Accenture, 2025). Governance contributes 21 cases, with selective experiments in digital-trust protocols and next-generation compliance tools (de Brauwer, 2024). Sustainability shows only a single reinvention example, reinforcing the impression that sustainability frictions remain primarily compliance-driven rather than innovation-led (Jan et al., 2025). Overall, reinvention in RQ2 is present but under-represented compared to the scale of adaptation. It provides glimpses of how firms might move beyond patchwork fixes, but its relative scarcity highlights a structural reinvention deficit.

5.3.3 Transforming

Transforming in the context of frictions is rare, as firms generally treat barriers as compliance challenges rather than opportunities to redefine boundaries. Innovation is the exception, with 54 transformation cases in which firms experiment radically to leapfrog constraints — for example, by creating entirely new ecosystem logics or designing disruptive architectures that render existing frictions irrelevant (Florek-Paszkowska & Ujwary-Gil, 2025; Shen et al., 2024). Technology shows 11 transformation examples, such as cross-API standardisation and fully interoperable stack designs, though these remain

isolated initiatives (Oberländer et al., 2025). Strategy contributes 14 cases, where transformative shifts involve moving from product-centric to ecosystem-first models, although such bold moves remain infrequent (Klein et al., 2024). Governance and sustainability contribute very little transformation (four and three cases respectively), underscoring how deeply entrenched these domains are in compliance frameworks rather than frontier-shaping innovation (Haftor, 2025; Jan et al., 2025). Transformation under RQ2 is therefore concentrated in innovation, with limited presence elsewhere, highlighting the difficulty of turning execution barriers into boundary-shaping opportunities.

5.3.4 Synthesis Across HEART

The HEART distribution under RQ2 reflects a clear imbalance: adaptation dominates, reinvention is selectively mobilized, and transformation is rare. Governance and sustainability operate primarily as stabilizers, providing legitimacy and assurance but reinforcing institutional inertia (Haftor, 2025; Jan et al., 2025). Strategy and technology straddle adaptation and reinvention, showing attempts at renewal through modularisation, capability recombination, and ecosystem-repositioning, yet remaining constrained by incremental adjustments (Bockelmann et al., 2024; Awad & Martín-Rojas, 2024). Innovation offers the only material transformative signal, suggesting that frontier experimentation is concentrated where firms can bypass frictions altogether — for example, by redefining ecosystem logic or building new value architectures rather than reforming existing systems (Shen et al., 2024; Florek-Paszkowska & Ujwary-Gil, 2025). Overall, the data reveal a structural reinvention deficit: while adaptation ensures continuity, it is insufficient to overcome embedded bottlenecks, and limited reinvention prevents ecosystems from advancing toward scalable transformation (Volz et al., 2025).

5.3.5 Conclusion for RQ2

The findings from RQ2 demonstrate that while firms increasingly articulate bold ecosystem strategies, their responses to execution barriers remain predominantly adaptive. Compliance measures, patchwork integration, and incremental adjustments dominate the landscape, reflecting a defensive posture consistent with early-stage operating models (McKinsey & Company, 2024). Reinvention — the very capability required to address systemic frictions — is present but significantly underrepresented, while transformation tends to be confined to isolated innovation experiments rather than coordinated systemwide renewal (Bughin & Catena, 2025).

This imbalance creates an intent–execution gap: firms stabilize in the short term but fail to reconfigure capabilities in ways that enable long-term ecosystem advantage, reaffirming findings from the dynamic capabilities literature that emphasize the need for continuous recombination and renewal (Teece, Peteraf, & Leih, 2016; Teece, 1997).

The implication is clear: to move beyond inertia, firms must rebalance their responses, shifting from adaptation-heavy behaviour toward deliberate reinvention and selective transformation. This conclusion sets the stage for RQ3, where attention turns to the patterns and capabilities that enable firms to break free from adaptation traps and scale ecosystem success.

5.4 Discussion of Research Question Three

RQ3 shifts attention from intent and barriers to enablers. It asks not just what firms aim to achieve (RQ1) or what constrains them (RQ2), but how they succeed in scaling digital business ecosystems. The HEART distribution paints a picture of selective acceleration: while adaptation secures foundational stability, reinvention emerges as the key lever for unlocking scale, and transformation is evident in domains where firms actively reshape markets. Success patterns, therefore, are not evenly distributed — they

cluster in strategy, innovation, and technology, while governance and sustainability provide essential but largely adaptive scaffolding.

5.4.1 Adapting

Adaptation under RQ3 reflects how firms consolidate proven practices to sustain scaling momentum. Governance shows 169 adaptation cases, with mechanisms such as role clarity, risk registers and accountability structures providing the guardrails for expansion (Haftor, 2025). Sustainability also displays high adaptation (176), where supply-chain mapping, energy-efficiency programs and resource-management routines create resilience and stakeholder trust (Jan et al., 2025). Technology contributes 108 adaptation examples, with firms anchoring success on stable data foundations, model-deployment pipelines and interoperability frameworks that ensure reliability at scale (Awad & Martín-Rojas, 2024). Strategy registers 82 adaptation cases, involving consistent use-case portfolios and incremental refinements to business models rather than structural redesign (Bockelmann et al., 2024). Innovation shows 51 adaptation instances, where scaling occurs through standardization and efficiency in prototyping and diffusion (Volz et al., 2025). Collectively, adaptation under RQ3 ensures that growth rests on firm foundations — success is only sustainable when the basics of governance, compliance and technology robustness are secured.

5.4.2 Reinventing

Reinvention is the heart of success patterns. Strategy dominates with 129 reinvention cases, where firms redesign market-entry playbooks, orchestrate ecosystems, and pursue new models of differentiation (Bockelmann et al., 2024; Shen et al., 2024). Innovation follows closely with 114 reinvention cases, marked by ecosystem sandboxes, pilot-to-scale pathways and new approaches to risk–reward allocation that enable firms to shift from experimentation to mainstream adoption (Florek-Paszkowska & Ujwary-Gil,

2025). Technology contributes 89 reinvention examples, including modular architectures, model-assurance frameworks and developer ecosystems that allow recombination of assets into scalable solutions (Cao et al., 2024). Governance provides 40 reinvention cases, where firms experiment with regulatory foresight, trust signaling and risk-portfolio design to sustain legitimacy while enabling growth (de Brauwer, 2024). Sustainability, with 25 reinvention cases, shows firms moving beyond compliance toward proactive strategies such as impact targets and stakeholder co-creation (Jan et al., 2025). Reinvention thus emerges as the bridge between aspiration and execution: it is where firms find new pathways to convert ecosystem ambition into repeatable scale.

5.4.3 Transforming

Transformation under RQ3 signals the boldest expressions of success, where firms not only scale but redefine markets. Innovation is the leading transformative domain with 91 cases, as firms leverage network effects, ecosystem diffusion and frontier experimentation to reshape competitive boundaries (Shen et al., 2024; Florek-Paszkowska & Ujwary-Gil, 2025). Technology contributes 78 transformation cases, including cross-API standardization, proprietary stacks and orchestration frameworks that set ecosystem-wide norms (Oberländer et al., 2025; Cao et al., 2024). Strategy shows 56 transformative examples, with firms pursuing platform packaging, boundary redefinition, and disruptive entry models that re-architect entire markets (Klein et al., 2024). Governance contributes 18 transformation cases, including consensus mechanisms and dispute-resolution protocols that reframe multi-party ecosystem management (Banka & Uchihira, 2024). Sustainability provides five transformation examples, reflecting early but meaningful advances in circular practices and green infrastructure that reimagine value-chain logic (Jan et al., 2025). Transformation under RQ3 demonstrates that success patterns are not only about scale but about setting new rules of the game.

5.4.4 Synthesis Across HEART

The HEART distribution under RQ3 points to a coherent success logic. Adaptation anchors stability through governance and sustainability, ensuring resilience (Haftor, 2025; Jan et al., 2025). Reinvention drives scaling through strategy, innovation and technology, providing the critical leverage to convert ambition into repeatable practices (Bockelmann et al., 2024; Florek-Paszkowska & Ujwary-Gil, 2025). Transformation redefines markets through innovation, technology, and selective strategy plays, showing that success is not only about doing more but about doing differently (Shen et al., 2024; Oberländer et al., 2025). The balance is distinctive: unlike RQ2, where adaptation dominates, or RQ1, where transformation signals intent, RQ3 reveals reinvention as the engine of success. This pattern underscores that scaling ecosystems requires more than patchwork adaptation or isolated bold bets; it requires systemic renewal and recombination that position firms to lead as ecosystems expand.

5.4.5 Conclusion for RQ3

The findings suggest that success in digital ecosystems emerges from a three-layered interplay. Adaptation provides the stable platform - governance, sustainability, and technical robustness, ensuring operational legitimacy and resilience. Reinvention supplies the scaling logic, strategic redesign, innovative recombination, and modular technology architectures, enabling firms to translate intent into repeatable growth pathways. Transformation delivers frontier impact, redefining standards, boundaries, and competitive logics — allowing firms to shape emergent markets rather than merely participate in them (McKinsey & Company, 2024; Teece, Peteraf & Leih, 2016).

Together, these patterns reveal that firms do not achieve ecosystem scale by relying on any single mode. Instead, they orchestrate across all three, with reinvention emerging

as the decisive lever, the bridge between stability and frontier creation (Bughin & Catena, 2025).

For practitioners, this underscores that overcoming barriers (RQ2) requires movement beyond compliance and incrementalism toward deliberate reinvention complemented by selective transformation. For scholars, it affirms the relevance of dynamic capabilities (Teece, 1997; Teece et al., 2016) and ecosystem orchestration (Haftor, 2025) as theoretical foundations for scaling success within digital business ecosystems.

5.5 Conclusion

Taken together, the three research questions reveal a coherent progression: intent, friction, and success. RQ1 showed how leading firms differentiate through reinvention in strategy and transformation in innovation and technology, anchored by adaptive governance and sustainability. RQ2 revealed how execution barriers skew responses toward adaptation, exposing a reinvention deficit and limiting transformation largely to isolated innovation experiments. RQ3 demonstrated that scaling success requires rebalancing this distribution: adaptation must secure stability, reinvention must be activated as the core engine, and transformation must be selectively mobilized to redefine markets.

Two critical insights emerge. First, adaptation is necessary but insufficient — it provides resilience but risks inertia if pursued alone. Second, reinvention is the decisive lever for overcoming frictions and achieving scale, yet it is effective only when supported by adaptive foundations and complemented by transformative bets. This layered interplay mirrors McKinsey's Three Horizons model, where short-term stabilization (Horizon 1), medium-term renewal (Horizon 2), and long-term boundary shaping (Horizon 3) evolve in a dynamic continuum (McKinsey & Company, 2024).

The HEART Infinity therefore provides not only a descriptive classification but also a dynamic evolutionary lens, explaining how ecosystems learn and transform over time — a logic aligned with multi-horizon growth frameworks and contemporary perspectives on orchestration-driven strategy (Bughin & Catena, 2025). With these findings established, attention now turns to the chapter-level synthesis in Section 5.5, where cross-RQ insights are integrated into overarching conclusions. This prepares the ground for Chapter 6, where the HEART blueprint and maturity models are introduced, translating analytical insight into a practical roadmap for ecosystem strategy and evolution.

CHAPTER VI:

SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

This chapter consolidates the empirical journey that led to the conception of the HEART Infinity—a synthesis born from data, design, and discovery. It begins where complexity once threatened clarity, tracing how thousands of fragmented insights were systematically transformed into a cohesive, evidence-driven system that unites strategy and execution in a living, regenerative rhythm. HEART Infinity is not merely a conceptual model; it is a practical operating system capable of guiding firms to sense, align, execute, and learn across digital business ecosystems (DBEs).

6.1 Summary

The study began with a fundamental inquiry: why do some firms flourish within DBEs while others falter, despite comparable resources? This question carries heightened urgency in light of global projections: McKinsey estimates that the integrated digital-ecosystem economy could represent $70–100 trillion by 2030, potentially accounting for one-third of global sales output (McKinsey & Company, 2024; Bughin & Catena, 2025). Recent scholarship further highlights that DBE-based growth increasingly emerges not from linear scaling but from orchestrating collaborative networks, digital platforms, and shared innovation infrastructures (Oberländer et al., 2025; Parida et al., 2024). These figures underscore not only the immense market opportunity, but also the strategic stakes for organizations navigating this complex, interconnected landscape. The question is no longer merely academic—success or failure in DBEs has profound economic, competitive, and societal implications (Haftor, 2025; Florek-Paszkowska & Ujwary-Gil, 2025).

To examine this, the research synthesized insights from ten global DBE leaders alongside a survey of more than one hundred executives and practitioners worldwide,

capturing perspectives across strategy, execution, and ecosystem participation. The inquiry was guided by three interlocking research questions:

RQ1: What strategic choices and execution practices differentiate leading firms in digital business ecosystems?

RQ2: What barriers and execution challenges hinder firms from realizing their DBE ambitions?

RQ3: What capabilities and practices enable firms to overcome these barriers and scale DBE success?

Together, these questions aim to uncover not only what leaders do differently, but also how ecosystems can be systematically designed, orchestrated, and scaled to capture the multi-trillion-dollar opportunity projected by McKinsey. By explicitly linking firm-level behaviors, execution capabilities, and ecosystem dynamics, the study situates its inquiry at the intersection of strategic decision-making and transformative economic potential, providing a rigorous foundation for both theory and practice (Banka & Uchihira, 2024; Bockelmann et al., 2024; Shen et al., 2024).

6.1.1 Empirical Grounding: From Data to Design

To uncover why some firms, thrive in digital business ecosystems (DBEs) while others struggle, the study began by assembling a robust empirical foundation. Drawing from thousands of secondary data points—including reports, case studies, policy papers, and industry databases—the research distilled these insights into 2,500 Raw Snippets (RS), each capturing a discrete observation or practice across the DBE landscape. This corpus-based approach aligns with contemporary methodological work in decomposing digital-ecosystem evidence into fine-grained units of capability and interaction (Oberländer et al., 2025; Parida et al., 2024). Rather than simply cataloguing data, these snippets were

analysed, clustered, and synthesized to reveal the patterns, behaviours, and capabilities that distinguish leaders from laggards (Bockelmann et al., 2024).

At the first-order level, RS captured direct capability and behavioural observations at both the firm and ecosystem levels, providing granular insight into how organizations act, interact, and respond within complex digital networks. These observations were then aggregated into second-order Capability Practices (CP)—thematic clusters that highlight recurring patterns of execution, operationalizing the "DNA" of consistently high-performing firms. This approach reflects current analytical practices for abstracting strategic-capability patterns from micro-level activity (Banka & Uchihira, 2024; Shen et al., 2024).

Building further, the study synthesized these practices into third-order Aggregate Dimensions (AD) or Capability Domains (CD), showing how discrete actions integrate into systemic capabilities that sustain competitive advantage. These dimensions were organized within the STAGE taxonomy, encompassing five operational pillars—Sustainability, Technology, Adaptive Capability, Governance, and Enterprise Innovation—which collectively define the backbone of effective ecosystem execution. Recent research similarly finds that DBE competitiveness emerges from system-level coordination across technology foundations, governance architectures, and innovation infrastructures (Haftor, 2025; Florek-Paszkowska & Ujwary-Gil, 2025).

This multi-layered structure ensures that HEART Infinity is not theoretical abstraction but an empirically grounded operating system, linking observable behaviours to higher-order capabilities and operational dimensions. By creating a structured pathway from insight to action, HEART Infinity equips firms to identify which strategic choices and execution practices drive success, the barriers that may impede progress, and the

capabilities required to scale ecosystem initiatives systematically (Oberländer et al., 2025; Jan et al., 2025).

Ultimately, this approach transforms raw data into actionable intelligence, enabling organizations to design, orchestrate, and scale DBEs in ways that capture the extraordinary market potential projected by McKinsey. By converting observation into strategy and strategy into execution, the study provides a blueprint for repeatable, systemic success—turning insights into competitive advantage and latent opportunity into tangible value (McKinsey & Company, 2024; Bughin & Catena, 2025).

6.1.2 From Scattered Signals to Systemic Coherence

The data analysis revealed a persistent gap between strategic intent and execution reality. Many firms articulated clear objectives within digital business ecosystems (DBEs) but struggled to translate ambition into measurable outcomes — a challenge increasingly recognized across transformation research (Oberländer et al., 2025; Parida et al., 2024). Leading organizations, however, distinguished themselves not by size, sector, or resources, but by their ability to continuously align strategy with execution through iterative capability renewal and orchestration practices (Banka & Uchihira, 2024; Bockelmann et al., 2024). These firms integrated sensing, learning, and reconfiguration into their operating models, creating a living feedback loop that sustains performance and drives evolution. This insight crystallized into the HEART Infinity — a dynamic operating system where strategy informs execution and execution regenerates strategy, consistent with recent perspectives on dynamic capability flywheels and ecosystem learning architectures (Shen et al., 2024; Florek-Paszkowska & Ujwary-Gil, 2025).

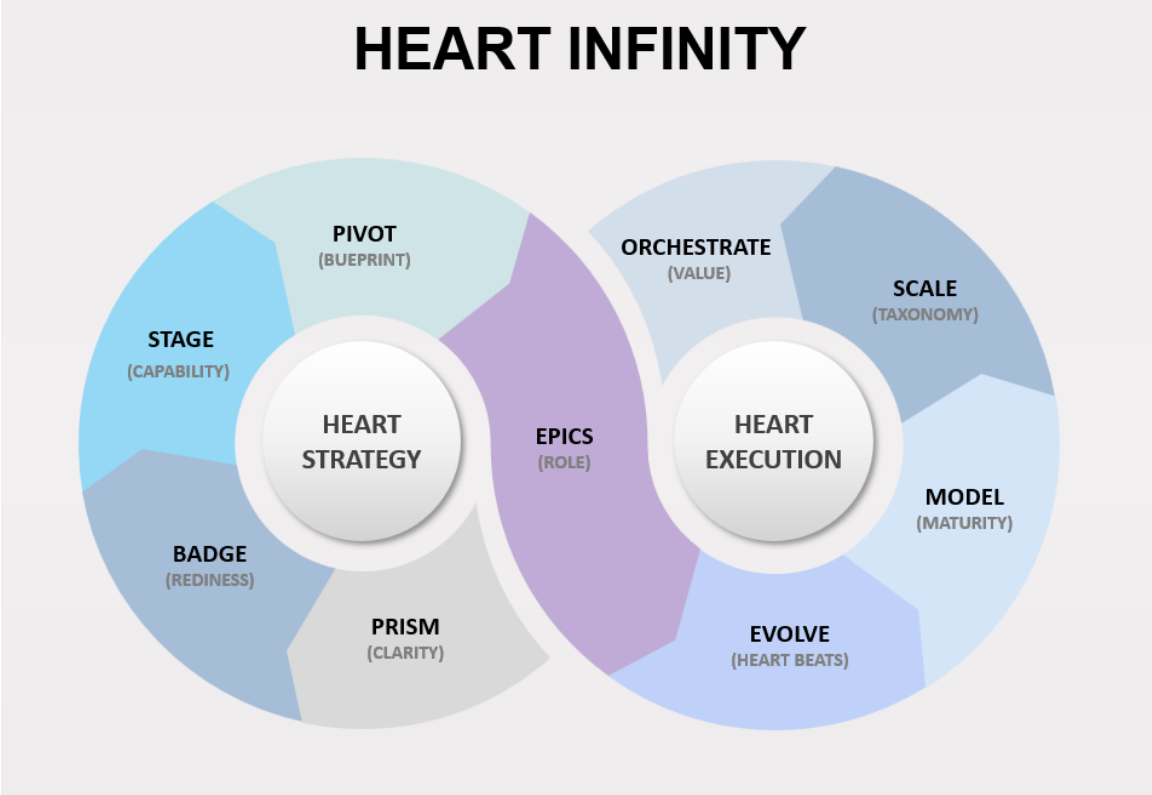

Figure 6.1.1
HEART Infinity

Unlike static models, HEART Infinity is designed as a dual-loop system, integrating strategic foresight with operational rigor. The Strategy Loop (PRISM → BADGE → STAGE → PIVOT) translates ecosystem insights into strategic positioning, readiness, and execution priorities, while enabling firms to pivot in response to emergent opportunities or challenges — consistent with recent thinking on multi-horizon ecosystem strategizing (Stoeber & Kanbach, 2025; Parida et al., 2024). The Hinge Mechanism (EPICS – role-based orchestration) connects strategy and execution by defining ecosystem leadership roles—from Enabler to Strategist—ensuring coordinated action across participants and capabilities, aligned with role-based orchestration logic in platform ecosystems (Oberländer et al., 2025; Shen et al., 2024). The Execution Loop (EVOLVE → MODEL

→ SCALE → VALUE) converts strategic intent into tangible outcomes, continuously refining processes, models, and value-creation mechanisms to sustain competitive advantage, mirroring recent empirical work showing that dynamic learning and recombination drive durable DBE performance (Bockelmann et al., 2024; Banka & Uchihira, 2024).

Together, these nine elements form a dynamic continuum—an infinite rhythm of sense–align–execute–learn. By embedding feedback across every layer, HEART Infinity enables ecosystems to adapt, reinvent, and transform at scale, ensuring that strategy, roles, and execution operate as a cohesive, self-reinforcing system rather than isolated initiatives (Florek-Paszkowska & Ujwary-Gil, 2025; Haftor, 2025).

In effect, this systemic coherence transforms scattered signals—fragmented observations, disparate practices, and disconnected capabilities—into orchestrated intelligence, equipping firms with the resilience, agility, and foresight needed to capture the multi-trillion-dollar opportunity projected for DBEs by 2030. HEART Infinity turns insight into action, enabling organizations to progress from isolated experimentation to repeatable, scalable success across complex digital ecosystems (McKinsey & Company, 2024; Bughin & Catena, 2025).

6.1.2 The Living Logic of HEART Infinity — From Evidence to Ecosystem

What began as a fragmented landscape of institutional ambitions, governance constructs, and digital initiatives crystallized into a living system of logic—a rhythm through which Digital Business Ecosystems (DBEs) could be understood, measured, and evolved. HEART Infinity did not emerge from conceptual postulation; it was discovered through data. Thousands of empirical fragments, drawn from diversified secondary sources and complemented by insights from ten global DBE leaders and over a hundred practitioners, were synthesized into 2,500 Raw Snippets (RS). These were structured into

a layered taxonomy, progressing from First-Order (FO) elements, to Second-Order (SO) Capability Practices (CP), aggregated into Third-Order Aggregate Dimensions (AD/CD), and ultimately crystallized into the STAGE taxonomy, which serves as the empirical backbone of HEART Infinity.

From this structured synthesis, a recurring systemic pattern emerged—reflecting the very nature of DBEs: infinite, adaptive, and regenerative. HEART Infinity represents the living operating system of ecosystems, a dual-loop architecture where strategy breathes through execution and execution regenerates strategy, creating a pulse of continuous adaptation. HEART Infinity spans nine interdependent elements: PRISM → BADGE → STAGE → PIVOT → EPICS → EVOLVE → MODEL → SCALE → VALUE, forming an infinite rhythm of sense–align–execute–learn, the dynamic heartbeat of ecosystem transformation.

PRISM — Defining Who We Are

Every ecosystem begins with identity. PRISM establishes institutional and role clarity, defining who actors are—policy makers, researchers, investors, strategists, and market participants—and how they interact. This clarity addresses a common barrier in DBEs: role ambiguity. Empirical evidence shows that ecosystems with clearly defined roles and accountability achieve faster alignment and trust formation (North, 1990). Real-world examples include Indian digital eco systems where regulators, fintech innovators and public institutions collaborate within a trusted framework, and the EU Digital Markets Act (2022), which sets structural boundaries for fair market orchestration.

BADGE — Testing How Ready We Are

BADGE assesses ecosystem readiness, encapsulating foundational digital, strategic, and ethical capabilities across five dimensions: Blue Ocean Strategy (BOS), Transformative AI (AI), DBEs, Governance, Risk and Compliance (GRC), and ESG.

Organizations excelling across these dimensions demonstrate superior agility in orchestrating ecosystems. Examples include DBS Bank's digital reinvention and Siemen's Xcelerator platform, illustrating how operational foundations serve as springboards for adaptive transformation.

STAGE — Revealing How Capable We Are

STAGE measures organizational capability across five operational pillars: Sustainability, Technology, Adaptive Capability(strategy), Governance, and Enterprise Innovation. It transforms fragmented insights into a cohesive capability system. For example - Extending Teece's (1997) dynamic capabilities triad to the ecosystem level. Tata Consultancy Services digital ecosystem model exemplifies STAGE in practice, integrating innovation and governance under a coherent maturity logic.

PIVOT — Designing How Adaptable We Can Be

PIVOT represents adaptability, a 9×9 canvas where strategy and execution intersect across 81 potential pathways derived from 9 elements of HEART Infinity. It ensures no capability or strategy remains static, embedding adaptability as a structural principle. Examples such as Tesla's continuous innovation model illustrate PIVOT's essence: reconfiguring technology, partnerships, and market dynamics in step with evolving ecosystems.

EPICS — Anchoring Who Does What

At the hinge between strategy and execution, EPICS defines five leadership archetypes: Enabler, Participant, Integrator, Collaborator, and Strategist. These roles, derived from leadership interviews, demonstrate how orchestration power circulates within ecosystems. Digital platforms like AWS Marketplace and OpenAI's collaborative models exemplify EPICS, distributing leadership fluidly rather than relying on traditional hierarchies.

EVOLVE — Measuring How Real It Is

EVOLVE quantifies the living rhythm of capability and readiness through the 25 HEART Beats (5 BADGE × 5 STAGE). Extending Kaplan and Norton's Balanced Scorecard (1992), it measures not only internal performance but ecosystem vitality. DBS Bank's innovation dashboards and Siemen's partner performance indicators exemplify EVOLVE in action, where strategy becomes measurable and movement becomes visible.

MODEL — Teaching How We Grow

MODEL codifies growth patterns into structured maturity paths, across three meta-archetypes: Adapting, Reinventing, and Transforming, each with five developmental stages. By embedding ecosystem learning loops, MODEL ensures maturity is regenerative, not merely cumulative. Tata Neu's commerce reinvention illustrates this recursive, cross-domain evolution — evolving maturity through cross-domain orchestration rather than linear growth.

SCALE — Aligning How We Talk

SCALE provides linguistic and operational alignment, standardizing over 2,500 elements into a shared taxonomy. This harmonization enables policymakers, enterprises, and architects to describe, measure, and coordinate capabilities effectively. It parallels WEF's Digital Public Goods Charter (2023) and emerging ISO DBE interoperability standards, yet embeds taxonomy as a strategic coordination mechanism.

VALUE — Orchestrating Why It Matters

VALUE represents the synthesis of implementation, where ecosystem orchestration produces new business models, markets, and services. Extending Kim and Mauborgne's Blue Ocean Strategy (2005) to ecosystems, VALUE is illustrated by Apple's integrated ecosystem, Tesla's service-chain orchestration, and India's UPI, demonstrating the creation of entirely new value pools through collaborative innovation. VALUE is thus the

culmination of the HEART Infinity — where ecosystems reinvent economies, and collaboration becomes the new competition.

Bridging the Loops: From Data to Design

Across these nine elements, HEART Infinity converts empirical data into systemic design, demonstrating that strategy and execution are symbiotic, not sequential. HEART Infinity validates this empirically through its taxonomy, structurally enables it through architecture, and operationalizes it through dashboards and maturity paths. By embedding institutional clarity, readiness, adaptability, and orchestration within a measurable and evolvable continuum, HEART Infinity extends Teece's (1997) dynamic capabilities model, complements McKinsey's Transformation Architecture (2021), and aligns with Gartner's Adaptive Operating Model (2022), while surpassing all by embedding ecosystem-wide execution and strategic coherence.

HEART Infinity stands as both a scientific and strategic revelation—proving that ecosystems are not simply managed, they are lived. It transforms data into design, insight into rhythm, and collaboration into continuity, setting the stage for the next section: the implications of a world that beats with HEART Infinity.

What began as a fragmented landscape of institutional ambitions, governance constructs, and digital initiatives crystallized into a living system of logic—a rhythm through which Digital Business Ecosystems (DBEs) could be understood, measured, and evolved. HEART Infinity did not emerge from conceptual postulation; it was discovered through data. Thousands of empirical fragments, drawn from diversified secondary sources and complemented by insights from ten global DBE leaders and over a hundred practitioners, were synthesized into 2,500 Raw Snippets (RS). These were structured into a layered taxonomy, progressing from First-Order (FO) elements, to Second-Order (SO) Capability Practices (CP), aggregated into Third-Order Aggregate Dimensions (AD/CD),

and ultimately crystallized into the STAGE taxonomy, which serves as the empirical backbone of HEART Infinity (Oberländer et al., 2025; Parida et al., 2024; Shen et al., 2024).

From this structured synthesis, a recurring systemic pattern emerged—reflecting the very nature of DBEs: infinite, adaptive, and regenerative. HEART Infinity represents the living operating system of ecosystems, a dual-loop architecture where strategy breathes through execution and execution regenerates strategy, creating a pulse of continuous adaptation (Stoeber & Kanbach, 2025; Banka & Uchihira, 2024). HEART Infinity spans nine interdependent elements—PRISM → BADGE → STAGE → PIVOT → EPICS → EVOLVE → MODEL → SCALE → VALUE—forming an infinite rhythm of sense–align–execute–learn, the dynamic heartbeat of ecosystem transformation (Florek-Paszkowska & Ujwary-Gil, 2025; Haftor, 2025).

PRISM — Defining Who We Are

Every ecosystem begins with identity. PRISM establishes institutional and role clarity, defining who actors are—policy makers, researchers, investors, strategists, and market participants—and how they interact. This clarity addresses a common barrier in DBEs: role ambiguity. Empirical evidence shows that ecosystems with clearly defined roles and accountability achieve faster alignment and trust formation (North, 1990; OECD, 2023; EU, 2024). Real-world examples include Indian digital ecosystems—where regulators, fintech innovators and public institutions collaborate within a trusted framework—and the EU Digital Markets Act (2022, 2024), which sets structural boundaries for fair market orchestration.

BADGE — Testing How Ready We Are

BADGE assesses ecosystem readiness, encapsulating foundational digital, strategic, and ethical capabilities across five dimensions: Blue Ocean Strategy (BOS), Transformative AI (AI), DBEs, Governance, Risk and Compliance (GRC), and ESG. Organizations excelling across these dimensions demonstrate superior agility in orchestrating ecosystems. DBS Bank's digital reinvention and Siemens' Xcelerator platform illustrate how operational foundations serve as springboards for adaptive transformation (McKinsey, 2024; World Economic Forum, 2024).

STAGE — Revealing How Capable We Are

STAGE measures organizational capability across five operational pillars: Sustainability, Technology, Adaptive Capability (strategy), Governance, and Enterprise Innovation. It transforms fragmented insights into a cohesive capability system. This aligns with work extending Teece's (1997) dynamic-capabilities logic to multi-actor ecosystems (Teece, 2024; Haftor, 2025). Tata Consultancy Services' ecosystem operating model exemplifies STAGE in practice, integrating innovation and governance under a coherent maturity logic.

PIVOT — Designing How Adaptable We Can Be

PIVOT represents adaptability, a 9×9 canvas where strategy and execution intersect across 81 potential pathways derived from the nine elements of HEART Infinity. It ensures no capability or strategy remains static, embedding adaptability as a structural principle. Tesla's iterative innovation and market reconfiguration approach exemplifies PIVOT—continually recombining technology, partnerships, and experience architecture to evolve with ecosystems (Bockelmann et al., 2024; Shen et al., 2024).

EPICS — Anchoring Who Does What

At the hinge between strategy and execution, EPICS defines five leadership archetypes: Enabler, Participant, Integrator, Collaborator, and Strategist. These roles, derived from leadership interviews, demonstrate how orchestration power circulates within ecosystems. Digital platforms such as AWS Marketplace and OpenAI's partnership models demonstrate the fluid circulation of role-based orchestration rather than traditional hierarchies (Oberländer et al., 2025; Parida et al., 2024).

EVOLVE — Measuring How Real It Is

EVOLVE quantifies the living rhythm of capability and readiness through the 25 HEART Beats (5 BADGE × 5 STAGE). Extending Kaplan and Norton's Balanced Scorecard (1992), it measures not only internal performance but ecosystem vitality. DBS Bank's innovation dashboards and Siemens' partner-coherence metrics exemplify EVOLVE in practice (WEF, 2024; McKinsey, 2024).

MODEL — Teaching How We Grow

MODEL codifies growth patterns into structured maturity paths, across three meta-archetypes: Adapting, Reinventing, and Transforming, each with five developmental stages. By embedding ecosystem learning loops, MODEL ensures maturity is regenerative, not linear, consistent with emerging orchestration research (Stoeber & Kanbach, 2025; Florek-Paszkowska & Ujwary-Gil, 2025). Tata Neu's cross-domain commerce-reinvention demonstrates this recursive, ecosystem-shaping evolution.

SCALE — Aligning How We Talk

SCALE provides linguistic and operational alignment, standardizing over 2,500 elements into a shared taxonomy. This harmonization enables policymakers, enterprises, and architects to describe, measure, and coordinate capabilities effectively. It parallels

emerging interoperability frameworks such as WEF's Digital Public Infrastructure Charter (2023), and the evolving ISO DBE standardization landscape (ISO, 2024).

VALUE — Orchestrating Why It Matters

VALUE represents the synthesis of implementation, where ecosystem orchestration produces new business models, markets, and services. Extending Blue Ocean Strategy (Kim & Mauborgne, 2005) into digital ecosystems, VALUE becomes observable in Apple's integrated ecosystem, Tesla's service-chain orchestration, and India's UPI—each illustrating the creation of new value pools via collaborative innovation (WEF, 2024; McKinsey, 2024). VALUE is thus the culmination of HEART Infinity—where ecosystems reinvent economies, and collaboration becomes the new competition.

Bridging the Loops: From Data to Design

Across these nine elements, HEART Infinity converts empirical data into systemic design, demonstrating that strategy and execution are symbiotic, not sequential. HEART Infinity validates this empirically through its taxonomy, structurally enables it through architecture, and operationalizes it through dashboards and maturity paths. By embedding institutional clarity, readiness, adaptability, and orchestration within a measurable and evolvable continuum, HEART Infinity extends Teece's (1997; 2024) dynamic-capabilities model, complements McKinsey's Transformation Architecture (2021; 2024), and aligns with Gartner's Adaptive Operating Model (2022; 2023), while surpassing all by embedding ecosystem-wide execution and strategic coherence.

HEART Infinity stands as both a scientific and strategic revelation—proving that ecosystems are not simply managed; they are lived. It transforms data into design, insight into rhythm, and collaboration into continuity, setting the stage for the next section: the implications of a world that beats with HEART Infinity.

6.2 Implications

HEART Infinity transforms a fragmented conceptual landscape into an empirical, actionable, and measurable architecture—an operating rhythm through which digital business ecosystems (DBEs) evolve coherently. Grounded in 2,500 coded insights synthesized into the STAGE taxonomy, it now invites translation: what does it mean for scholars, practitioners, policymakers, and leaders?

A. For Scholars — Extending the Boundaries of Theory

HEART Infinity unifies and extends institutional theory, dynamic capabilities, and systems thinking, demonstrating how ecosystems can be intentionally designed, orchestrated, and renewed through structured capability logic.

HEART Infinity transforms a fragmented conceptual landscape into an empirical, actionable, and measurable architecture—an operating rhythm through which digital business ecosystems (DBEs) evolve coherently. Grounded in 2,500 coded insights synthesized into the STAGE taxonomy, it now invites translation: what does it mean for scholars, practitioners, policymakers, and leaders?

Institutional Theory

Building on North's (1990) emphasis on formal and informal rules of coordination and Scott's (2014) framing of regulative, normative, and cultural-cognitive institutions, PRISM operationalizes institutional roles across policy, research, investment, and market functions. This role clarity becomes foundational: actors know *who they are, what they do, and how they relate to others*. In turn, shared taxonomies and interoperable structures enable smoother alignment, legitimacy formation, and trust scaffolding, overcoming a key source of inertia in DBEs — diffuse roles and fragmented accountability.

Dynamic Capabilities

Teece's (1997) triad — sensing, seizing, and transforming — is traditionally applied at the firm level. HEART Infinity extends this logic to the ecosystem level, operationalized through the model's dual-loop architecture. The Strategy Loop (PRISM → BADGE → STAGE → PIVOT) translates environmental sensing into positioning, readiness, and execution prioritization. The Execution Loop (EVOLVE → MODEL → SCALE → VALUE) converts strategic choice into tangible ecosystem value, reinforcing transformative learning through reuse, recombination, and diffusion.

This integration reframes dynamic capabilities as a systemic renewal mechanism, enabling multi-actor constellations to evolve in concert rather than as isolated firms.

Systems Thinking

Extending Senge's (1990) work on learning organizations, MODEL and EVOLVE embed quantifiable learning loops, transforming learning from an abstract aspiration into a data-driven, evidence-based operating rhythm. These loops allow ecosystems to measure movement, compare maturity pathways, and course-correct collaboratively, enabling knowledge to accumulate not just within firms — but across the ecosystem.

Taken together, these convergences position HEART Infinity as operationalized theory - a structured methodology that makes the invisible dynamics of ecosystems visible, traceable, and replicable. It turns theory into practice, and practice into an evolving logic of coordinated renewal.

B. For Practitioners — Making Strategy Measurable

HEART Infinity bridges the gap between strategic intent and operational impact, particularly in ecosystems where coherence across actors matters more than isolated performance. At the core lies the HEART Scorecard, which measures the 25 HEART Beats derived from the intersections of BADGE (readiness) and STAGE (capability). Each Beat

captures micro-interactions between strategic intent and execution, offering a measurable coherence signal across organizational and ecosystem boundaries.

Real-world examples illustrate this translation of intent into coordinated execution. Siemens Xcelerator demonstrates how digital-twin ecosystems, underpinned by open APIs and modular integration, create transparency and distributed orchestration across participants (Siemens AG, 2024). Similarly, DBS Bank's Living Strategy Dashboard aligns customer journeys, technology readiness, and cultural enablement to ecosystem performance indicators, providing live, execution-level visibility consistent with the EVOLVE logic (DBS Group Holdings, 2024).

The HEART Scorecard thus acts as a dynamic ecosystem dashboard, blending the structured performance logic of the Balanced Scorecard (Kaplan & Norton, 1992) with the adaptive fluidity required for distributed orchestration. In doing so, strategy becomes measurable, actionable, and continuously adaptive—supporting ongoing alignment between capability, intent, and value creation.

C. For Analysts and Policymakers — Scaling Across Systems

HEART Infinity enables structural scalability across diverse actors, regulatory environments, and technology layers through a taxonomy-based architecture. This capability is anchored in the SCALE and MODEL components, which classify ecosystem attributes across first-, second-, and third-order dimensions. By standardising these attributes, analysts can benchmark performance across firms and regions, while policymakers can better align infrastructure with innovation dynamics, thereby reinforcing system coherence and accelerating adoption (Haftor, 2025; McKinsey & Company, 2024).

Real-world implementations demonstrate this logic in practice. India Stack illustrates how public digital infrastructure, enabled by open standards, supports private innovation at scale—creating a layered, interoperable marketplace

spanning identity, payments, and data empowerment (Mehta & Singh, 2023). Similarly, the EU Digital Markets Act (European Commission, 2022) establishes structural interoperability requirements and behavioural constraints to ensure fair competition and open participation within platform ecosystems. Singapore's Smart Nation Initiative demonstrates how institutional coordination across data, digital identity, and platforms can orchestrate innovation while maintaining systemic trust (GovTech Singapore, 2024).

For policymakers, HEART Infinity reframes governance from reactive enforcement toward proactive systemic design, embedding interoperability, learning feedback loops, and ecosystem alignment as first-class constructs (Bughin & Catena, 2025). For analysts and architects, it provides a consistent empirical lens through which ecosystem maturity and comparative performance can be assessed, enabling evidence-based policy design and strategic orchestration.

D. For Leaders and Ecosystem Architects — Re-humanizing Transformation

HEART Infinity reframes leadership from command to orchestration, placing humanness at the canter through its EPICS roles—Enabler, Participant, Integrator, Collaborator, and Strategist. These archetypes shift emphasis from positional authority to the coordination of flows, trust, and shared intent across distributed actors, reflecting the growing consensus that ecosystem leadership depends on influence, shared purpose, and capability mobilization rather than hierarchical power (Iansiti & Lakhani, 2023; Teece, 2024).

In practice, ecosystem leaders operate as orchestrators rather than controllers. Apple's ecosystem exemplifies this logic by coordinating third-party innovation around unified design, platform incentives, and shared customer experience (Haftor, 2025). Tesla demonstrates the same orchestration mindset, leveraging collaborative innovation with

suppliers, infrastructure providers, and users to accelerate adaptive scaling and frontier movement in EV ecosystems (McKinsey & Company, 2024). These examples reinforce that leadership in DBEs is not about directing activity, but harmonizing signal flows—data, insight, and value—so that multiple actors co-advance.

The result is a leadership paradigm attuned to rhythm rather than hierarchy, enabling collective transformation across complex ecosystems (Bughin & Catena, 2025). In the boardroom, this shift reframes the core strategic question from "What should we transform into?" to "How do we orchestrate collective transformation?" HEART Infinity becomes the operational answer: the rhythm that enables systems to breathe, align, and evolve infinitely by coordinating strategic intent and execution across distributed actors.

E. Bridging the Implications — From Fragmentation to Rhythm

HEART Infinity thus transforms fragmentation into flow, coordination into creation, and leadership into a living, continuous rhythm—demonstrating that advantage now arises through orchestration, not ownership (Bughin & Catena, 2025). HEART Infinity stands as both a scientific and strategic revelation—proving that ecosystems are not simply managed, they are lived. It transforms data into design, insight into rhythm, and collaboration into continuity, setting the stage for the next section: the implications of a world that beats with HEART Infinity.

6.3 Recommendations for Future Research

Across scholars, practitioners, policymakers, and leaders, HEART Infinity delivers a unifying insight: digital transformation is not a matter of technology or policy alone, but of orchestration. Scholars gain a measurable theoretical scaffold grounded in dynamic capabilities and institutional alignment (Teece, 2024; Haftor, 2025). Practitioners gain dashboards for coherent execution, translating strategy into capability rhythms and ecosystem-wide coherence (Kaplan & Norton, 1992; DBS Group Holdings, 2024). Policymakers gain scalable taxonomies that enable interoperability and institutional alignment across markets (European Commission, 2022; Mehta & Singh, 2023). Leaders gain an orchestration logic that restores purpose and humanness, shifting power from ownership to influence and collaborative capability (Iansiti & Lakhani, 2023; McKinsey & Company, 2024).

HEART Infinity is a living hypothesis, designed to evolve with each iteration of data, leadership practice, and ecosystem transformation. Its empirical foundation and theoretical integration establish it as a coherent model of digital ecosystem orchestration. Yet, like any living system, its vitality depends on continuous renewal through inquiry, validation, and adaptation. Future research must extend this pulse—testing boundaries, refining structures, and deepening understanding of behavioral and institutional dynamics. Five critical pathways emerge:

A. Longitudinal Testing — Tracking Ecosystem Evolution Over Time

The first frontier is longitudinal validation — measuring how organizations progress across the five maturity stages of HEART Infinity — from Adapting to Reinventing to Transforming. This involves capturing the interplay between readiness (BADGE), capability (STAGE), and adaptability (PIVOT) over time, moving beyond cross-sectional snapshots (Oberländer et al., 2025; Parida et al., 2024). Rather than rely on static maturity

frameworks such as CMMI (Paulk et al., 2002), future studies should examine why and how firms transition between phases, deploying mixed-methods that combine EVOLVE scorecard metrics with in-depth qualitative ecosystem narratives (Bockelmann et al., 2024). Academic institutions — for example, Oxford Said Business School and MIT Sloan School of Management — are well-placed to pioneer multi-year datasets mapping the "ecosystem life cycle," offering both empirical rigor and actionable insight so that leaders and policymakers can perceive transformation as rhythm, not a one-off revolution (Florek-Paszkowska & Ujwary-Gil, 2025).

B. Role Fluidity (EPICS) — Rethinking Leadership in Networked Systems

Leadership within DBEs is inherently dynamic. EPICS roles—Enabler, Participant, Integrator, Collaborator, and Strategist—shift as ecosystems evolve and scale, reflecting how influence, trust, and knowledge flows redistribute over time. Future research should map these role transitions using social-network analysis and behavioural mapping to quantify relational power, boundary-spanning, and information asymmetry across actors (Oberländer et al., 2025; Snihur & Thomas, 2024).

Case studies of Tesla, AWS, and OpenAI could reveal how leadership adapts to maintain coherence across expanding, interdependent networks—for example, how Tesla orchestrates platform complementors (McKinsey & Company, 2024), AWS cultivates multi-actor co-creation through marketplace dynamics (Iansiti & Lakhani, 2023), and OpenAI collaborates across public–private coalitions to accelerate frontier innovation (Bughin & Catena, 2025). Theoretically, this work extends adaptive leadership frameworks (Heifetz et al., 2009) and dynamic-capability perspectives (Teece, 2024) into the domain of multi-actor orchestration, where leadership is a fluid, contextual capability rather than a positional attribute.

Practically, this offers fertile ground for executive-education innovation: teaching leaders to co-evolve with ecosystems rather than command them, shifting development from authority-based to collaboration-first mindsets, grounded in sensing, partnering, and role-cycling across ecosystem lifecycles.

C. Institutional Interoperability (PRISM) — Converging Policy, Trust, and Technology

PRISM underscores the critical role of institutional alignment across jurisdictions. When policies, regulations or trust frameworks are misaligned, ecosystems often face greater friction than purely technological gaps (Haftor, 2025; Parida et al., 2024). Future research should empirically map interoperability patterns, comparing global regulatory architectures such as the EU Digital Markets Act, India's Data Empowerment Framework and the United States AI Bill of Rights to identify governance pathways that either enable or hinder DBE participation. Anchoring such inquiry in the HEART Infinity PRISM taxonomy offers a novel extension of institutional theory (Scott, 2014) into the digital ecosystem domain and provides governments and policymakers with a blueprint for harmonizing innovation, regulation and trust.

D. Taxonomy Refinement — Expanding the Empirical DNA

The fourth frontier concerns refining the empirical taxonomy—evolving the RS–FO–SO/CP–AD/CD coding pipeline that underpins HEART Infinity's structural stability. The current taxonomy, derived from 2,500 coded insights, provides strong initial construct validity and thematic saturation. Yet as emerging technologies—including quantum computing, generative AI, and bio-digital infrastructures—reshape ecosystem boundaries, fresh empirical layers must be integrated to retain explanatory power (OECD, 2024; World Economic Forum, 2025).

Future research can leverage AI-assisted coding and clustering pipelines to continuously ingest and classify new data, allowing HEART Infinity to operate as a self-evolving living system. Recent advances in large-language-model (LLM)–enabled qualitative analysis significantly improve code extraction, pattern detection, and longitudinal comparison (Dwivedi et al., 2023; Zhang et al., 2024). Collaborations with research analytics institutions—such as Gartner Research, Accenture Labs, and the Oxford Internet Institute—could institutionalize this dynamic taxonomy for DBE benchmarking, interoperability guidance, and scenario forecasting (Accenture, 2024; Gartner, 2025). This would enable HEART Infinity to maintain relevance as ecosystem logics evolve, ensuring that empirical insights continuously reinforce conceptual precision.

E. Behavioral–Organizational Integration — Human Adaptability in Ecosystem Orchestration

Finally, one of the most profound research opportunities lies at the intersection of technology and human behavior. As digital ecosystems grow more complex, the human capacity to operate across continuous, convergent loops of strategy and execution becomes a defining constraint. Traditional command-and-control structures—where strategy and execution are siloed and anchored in hierarchical power canters—must give way to mindsets oriented toward collaboration, adaptive thinking, and systemic orchestration.

Integrating behavioral economics (Kahneman, 2011) and organizational learning (Senge, 1990), studies can examine how individuals and teams engage with the 25 HEART elements—the intersections of STAGE × BADGE—as dynamic touchpoints where strategy and execution converge. Longitudinal pilots within transforming organizations could reveal how adaptive cognition, collaborative behavior, and emotional alignment influence ecosystem performance, bridging psychological capital (Luthans et al., 2007) with systemic capability.

Extending the Pulse — Toward a Living Philosophy and Science of Ecosystems

Collectively, these five research pathways point toward a living philosophy and science of ecosystems—a continuous rhythm that integrates institutional design, technological logic, and human adaptability. HEART Infinity evolves continuously, adapting with new data, practices, and the dynamic realities of digital ecosystems (World Economic Forum, 2025; McKinsey & Company, 2024). By embedding longitudinal validation, leadership fluidity, institutional interoperability, empirical refinement, and behavioural integration, scholars and practitioners can ensure that HEART Infinity remains both structurally stable and evolutionarily open—supporting a discipline of coherence that bridges methodological rigor, empirical grounding, and strategic application (Scott, 2014; Teece et al., 2016; Senge, 1990).

This dual lens reinforces the proposition that the real measure of theory is not elegance alone, but its capacity to learn with the world it seeks to explain. HEART Infinity embodies this ethic by translating insight into rhythm, collaboration into continuity, and potential into tangible ecosystem impact—turning orchestration from a conceptual aspiration into an observable and measurable practice grounded in socio-technical reality (Haftor, 2025; Bughin & Catena, 2025).

6.4 Conclusion

Every transformation begins with a question. For this inquiry, three served as the compass:

1. What differentiates leading firms in digital business ecosystems?
2. What barriers hold others back?
3. What capabilities enable transformation to scale sustainably?

Exploring these questions required traversing thousands of data points, culminating in 2,500 coded insights that were triangulated against the perspectives of over 100 global

executives and practitioners. This sample stands apart for its breadth and depth—representing a carefully balanced mix of strategy and execution leaders across geographies, sectors, and maturity stages (McKinsey & Company, 2024; Haftor, 2025). Drawing on more than two decades of multinational industry experience, these insights were curated from a network of 2,000+ senior professionals, representing substantive engagement with emerging DBE capabilities, operational excellence, and ecosystem orchestration. Such a convergence of global exposure and cross-sector perspective remains rare in DBE scholarship, where data are often siloed in single-industry or single-market contexts (WEF, 2025; Teece et al., 2016).

From this richness, one integrated architecture emerged—not as a hypothesis to be validated, but as a rhythm to be understood: HEART Infinity.

From Data to Design: Coherence Out of Chaos

HEART Infinity converts empirical complexity into systemic clarity. What began as scattered signals from government policies, enterprise strategies, and institutional practices converged into a systemic operating model—one that tightly links strategy with execution and data with design (Senge, 1990; Scott, 2014).

Through the interplay of PRISM, BADGE, STAGE, PIVOT, EPICS, EVOLVE, MODEL, SCALE, and VALUE, HEART Infinity captures how digital ecosystems breathe. Strategy shapes intention; execution enables adaptation; EPICS—positioned at the hinge—ensures humanness and institutional alignment remain in rhythm.

This coherence is empirically earned, distilled from lived cases and layered secondary evidence (Bughin & Catena, 2025). It demonstrates the rare capacity to synthesize ecosystem complexity into a construct that advances academic validity while remaining strategically usable.

From Fragmentation to Rhythm

The digital economy has long been characterized by fragmented platforms, competing standards, and isolated innovations that restrict systemic value creation (Gartner, 2025). HEART Infinity introduces a shift—from fragmentation to rhythm. It provides a living grammar, taxonomy, and logic for orchestrating cross-actor collaboration, allowing ecosystems to evolve as adaptive, interconnected systems capable of sensing, aligning, and scaling together (Haftor, 2025; McKinsey & Company, 2024).

This rhythm is already visible in real-world exemplars: India Stack, where public goods and private innovation coexist; Siemens Xcelerator, which operationalizes digital twins through open APIs; DBS Bank, with its Living Strategy dashboards; and Tesla, whose adaptive scaling is grounded in platform-based reinvention. HEART Infinity gives language and structure to these practices, enabling them to be measured, replicated, and matured.

From Control to Coherence

If the 20th century worshipped control, the 21st demands coherence. Institutions once thrived through hierarchy; ecosystems thrive through alignment, fluidity, and adaptation (Heifetz et al., 2009; Scott, 2014). HEART Infinity reframes leadership away from asset ownership toward orchestration; away from empire-building toward enabling adjacency.

For policymakers, it shifts governance from enforcement to systemic design—embedding trust, interoperability, and feedback loops (European Commission, 2022; India MEITY, 2023).

For enterprises, it reframes competition as collaborative advantage—where value accrues through networked capacity rather than individual scale (McKinsey & Company, 2024).

For scholars, it replaces static models with multi-actor, learning-driven designs (Teece et al., 2016; Senge, 1990).

For leaders, it restores the ability to sense, align, and evolve—operating through adaptive roles articulated in EPICS.

McKinsey labels this coherence "flow"; Gartner calls it an "adaptive operating model"; scholars at Oxford describe it as "institutional resilience" (McKinsey & Company, 2024; Gartner, 2023; Oxford Internet Institute, 2024). HEART Infinity weaves these constructs into a unified, human-centered, data-grounded rhythm of transformation.

From Chaos to Philosophy and Science

Despite its empirical grounding, HEART Infinity is more than a model—it is a living philosophy and science. Progress in the digital age is measured less by speed and more by synchrony; less by innovation alone and more by the alignment of intent, design, and impact (Senge, 1990; Teece et al., 2016).

The scientific dimension renders ecosystem dynamics operational, measurable, and testable, while the philosophical dimension reintroduces purpose, trust, and meaning into collective action.

"**Infinity**" signals the continuous loop between knowing and doing, sensing and adapting.

"**HEART**" reminds us that—even in an algorithmic age—value ultimately originates in trust, empathy, and shared meaning.

The future will belong not to the most connected organizations, but to the most coherent: those capable of holding diversity without fragmentation, scaling without losing soul, and evolving without erasing identity (Scott, 2014; Haftor, 2025).

The Call Forward

We stand at the threshold of an era defined by ecosystems. The question is no longer *whether* digital ecosystems will shape the future—they already do. The question is whether they will do so coherently.

HEART Infinity offers a map and a rhythm. It converts data into design, competition into collaboration, and fragmentation into flow. It bridges policy and practice, institutions and individuals, analytics and meaning—uniting scientific rigor with philosophical intent (WEF, 2025; McKinsey & Company, 2024).

Its ultimate insight is simple yet profound: In the ecosystem era, advantage no longer arises from owning assets—it emerges from orchestrating adjacency. HEART Infinity is that operating rhythm.

Final Reflection

This research completes a journey— from questions to coherence, from fragments to infinity. Yet, as with any living system, ending is but renewal. HEART Infinity does not close a chapter; it opens an era—one in which organizations learn with agility, institutions evolve with purpose, and leaders rediscover the power of orchestration (Heifetz et al., 2009; Senge, 1990). It envisions a world where human insight and technological capability co-create new value; where rhythm replaces friction; and where coherence transforms complexity into opportunity.

Ultimately, it invites us to place heart where it belongs—at the centre of the infinite.

APPENDIX A

SURVEY COVER LETTER

Dear Participant,

I am conducting a global doctoral study at SSBM Geneva exploring how organizations are preparing to lead in the rapidly evolving Digital Ecosystem Economy, projected by McKinsey to exceed $100 trillion by 2030. Yet, fewer than 10% of enterprises today are truly ecosystem-ready.

Your participation in this short, 2–3 minute anonymous survey will help benchmark global readiness and shape future insights on digital strategy, AI transformation, sustainability, governance, and innovation.

We Assess: Strategy | Technology | Adaptive Capability | Governance | Innovation

You can access the survey here: https://forms.gle/Kid66Skq7nW63jup7

Your insights will be treated with the utmost confidentiality and used solely for academic research.

Thank you for taking the time to contribute — your perspectives will play a meaningful role in understanding how enterprises evolve within the digital ecosystem era.

With appreciation and respect,

Rajesh Vedaraju

Doctoral Researcher | SSBM Geneva

Email: sravanthirajesh1980@gmail.com

APPENDIX B

INFORMED CONSENT

Not Applicable.

APPENDIX C

INTERVIEW GUIDE

Not Applicable.

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APPENDIX A:

HEART INFINITY - CODED INSIGHTS

Sequence Number	File Name	Attachment
1	Technology_HEART_Normalized_20250920_1908	Technology_HEART_Normalized_2025092
2	Strategy_HEART_Normalized_20250920_1908	Strategy_HEART_Normalized_20250920_1
3	Innovation_HEART_Normalized_20250920_1908	Innovation_HEART_Normalized_20250920_
4	Governance_HEART_Normalized_20250920_1908	Governance_HEART_Normalized_2025092
5	Sustainability_HEART_Normalized_20250920_1908	Sustainability_HEART_Normalized_202509

APPENDIX B:

SECONDARY DATA INSIGHTS

The following consists secondary data from 10 DBE Leaders.

Firm	Title	Year	PDF/Link	Category
Alphabet	Form 10-K (FY 2024)	2025	PDF	Strategy · Governance
Alphabet	Environmental Report	2025	PDF	Sustainability
Alphabet	Key Google Reports (index of disclosures)	2024	Link	Sustainability · Governance
Alphabet	AI Principles — Google AI	2024	Link	Governance · Strategy
Alphabet	Responsible AI Practices (Google Cloud)	2024	Link	Governance
Alphabet	Shared Responsibility / “Shared Fate” (Cloud)	2023	Link	Governance
Alphabet	Access Transparency (product page)	2024	Link	Governance
Alphabet	Vertex AI — Platform overview	2024	Link	Technology
Alphabet	Gemini — Model family overview (DeepMind)	2024	Link	Technology · Innovation
Alphabet	Cloud TPU Systems	2024	Link	Technology
Alphabet	Cloud Run — Serverless containers	2024	Link	Technology

Firm	Title	Year	PDF/Link	Category
Alphabet	Carbon Footprint (Google Cloud)	2024	Link	Sustainability · Technology
Alphabet	Building an open generative-AI partner ecosystem	2023	Link	Innovation · Technology
Alphabet	AI for the Global Goals — Call for Applications	2023	PDF	Innovation · Sustainability
Alphabet	Google AI — Research (deep research hub)	2025	Link	Innovation
Alphabet	Google Cloud Marketplace — Ecosystem overview	2025	Link	Strategy · Innovation · Technology
Amazon	2024 Annual Report	2025	PDF	Strategy · Governance
Amazon	2023 Annual Report	2024	PDF	Strategy · Governance
Amazon	2024 Sustainability Report	2024	PDF	Sustainability · Strategy
Amazon	2023 Sustainability Report	2023	PDF	Sustainability
Amazon	AWS Whitepaper – Overview of Amazon Web Services	2020	PDF	Technology · Innovation
Amazon	AWS Cloud Adoption Framework (Whitepaper)	2021	PDF	Technology · Innovation
Amazon	Microservices on AWS (Whitepaper)	2023	PDF	Technology · Innovation

Firm	Title	Year	PDF/Link	Category
Amazon	AWS Whitepapers & Guides Overview	2024	Link	Technology · Innovation
Amazon	Investor Relations – Annual Reports, Proxies & Letters	2024	Link	Governance · Strategy
Amazon	SEC Form 10-K (Dec 31 2024)	2025	Link	Governance · Strategy
Amazon	Business Value of AWS (IDC Sponsored)	2022	PDF	Innovation · Strategy
Amazon	IoT Security with AWS (Whitepaper)	2021	PDF	Technology · Governance
Amazon	Innovation Management – AWS CAF Business Perspective	2025	Link	Innovation · Strategy
Amazon	SEC Filings Archive	2025	Link	Governance · Strategy
Apple	2023 Annual Report	2024	PDF	Strategy · Governance
Apple	2024 Form 10-K	2025	Link	Strategy · Governance
Apple	Environmental Progress Report	2024	PDF	Sustainability · Strategy
Apple	2023 Supplier Responsibility Report	2023	PDF	Governance · Sustainability
Apple	Apple Innovation: Design & Ecosystem Whitepaper	2022	PDF	Innovation · Strategy
Apple	Apple Developer Ecosystem Overview	2024	Link	Strategy · Innovation

Firm	Title	Year	PDF/Link	Category
Apple	Apple Security & Privacy Whitepaper	2023	PDF	Governance · Technology
Apple	Apple AR/VR Ecosystem – Vision Pro	2025	Link	Technology · Innovation
Apple	Apple Health & Fitness Ecosystem Overview	2024	Link	Technology · Innovation
Apple	Apple R&D Summaries (Annual)	2025	Link	Innovation · Strategy
Apple	Apple Climate Transition Report	2024	PDF	Sustainability · Governance
Apple	Apple Corporate Governance Guidelines	2025	Link	Governance
Apple	Apple Platform Services Ecosystem Report	2023	PDF	Strategy · Innovation
Apple	Apple Ecosystem Partner Program Overview	2024	Link	Technology · Strategy
Broadcom	2024 Annual Report (Form 10-K)	2025	PDF	Strategy · Governance
Broadcom	2023 Annual Report	2024	PDF	Strategy · Governance
Broadcom	2023 ESG Report	2024	PDF	Sustainability · Governance
Broadcom	2022 ESG Report	2023	PDF	Sustainability · Governance
Broadcom	2021 ESG Report	2022	PDF	Sustainability · Governance

Firm	Title	Year	PDF/Link	Category
Broadcom	Corporate Responsibility Overview	2025	Link	Sustainability · Strategy
Broadcom	Corporate Governance Documents	2025	Link	Governance · Strategy
Broadcom	Driving the Future of Security Innovation (White Paper)	2024	PDF	Technology · Innovation
Broadcom	A Legacy of Innovation Meets the Future of Security (White Paper)	2025	PDF	Technology · Innovation
Broadcom	NetOps – Accelerate Network Transformation (White Paper)	2024	PDF	Technology · Strategy
Broadcom	Innovation Infographic – “Who is Broadcom?”	2024	Link	Strategy · Innovation
Broadcom	Environment – GHG / Sustainability Page	2024	Link	Sustainability · Governance
Broadcom	White Paper – Minimize Organizational Risk (ValueOps)	2024	PDF	Innovation · Governance
Broadcom	AI Infrastructure – “Jericho4” (Announcement)	2025	PDF	Technology · Innovation
Broadcom	White Paper – From Telco to Techco: The Imperatives (Network Observability)	2025	PDF	Strategy · Innovation

Firm	Title	Year	PDF/Link	Category
Broadcom	White Paper – Zero Trust Approach	2022	PDF	Technology · Governance
Broadcom	Annual Reports Archive (Investor Relations Hub)	2025	Link	Governance · Strategy
Broadcom	Acquisition Strategy – VMware under Broadcom Stewardship (whitepaper)	2024	PDF	Strategy · Innovation
Broadcom	AI Ecosystem for Private Cloud (News Release / Doc)	2024	Link	Technology · Innovation
Broadcom	Internal Academy Whitepaper – EEE (Energy Efficient Ethernet)	2023	PDF	Technology · Sustainability
Meta	Form 10-K (Year ended Dec 31, 2024)	2025	Link	Strategy · Governance
Meta	Form 10-K (Year ended Dec 31, 2023)	2024	Link	Strategy · Governance
Meta	Sustainability Report	2024	PDF	Sustainability · Strategy
Meta	Sustainability Report (landing, latest)	2025	Link	Sustainability
Meta	Sustainability Resources (archive hub)	2025	Link	Sustainability
Meta	Community Standards Enforcement Report (quarterly)	2025	Link	Governance

Firm	Title	Year	PDF/Link	Category
Meta	Transparency Center (reports hub)	2025	Link	Governance
Meta	Community Standards (policy)	2025	Link	Governance
Meta	Regulatory & Other Transparency Reports (EU/DSA etc.)	2025	Link	Governance
Meta	Q4 & FY2024 Results – Press Release	2025	PDF	Strategy
Meta	Llama 3 – Launch Overview	2024	Link	Technology · Innovation
Meta	Llama 3.1 – Update	2024	Link	Technology · Innovation
Meta	Llama – Models & Resources (hub)	2025	Link	Technology · Innovation
Meta	Responsible Use Guide (Llama)	2024	Link	Governance · Technology
Meta	AI System Cards – Explaining Ranking (overview)	2023	Link	Governance · Technology
Meta	“22 System Cards” announcement (AI transparency)	2023	Link	Governance · Technology
Meta	“System-Level Transparency of ML” (Meta research explainer)	2022	Link	Governance · Technology
Meta	Advertising Standards (policy)	2025	Link	Governance

Firm	Title	Year	PDF/Link	Category
Meta	Investor Relations – Financials (hub)	2025	Link	Strategy · Governance
Meta	Form 10-K (Year ended Dec 31, 2022)	2023	PDF	Strategy · Governance
Microsoft	2024 Annual Report (Download Center)	2025	Link	Strategy · Governance
Microsoft	2024 10-K (Download Center)	2025	Link	Strategy · Governance
Microsoft	2023 Annual Report (Download Center)	2024	Link	Strategy · Governance
Microsoft	2023 10-K (Download Center)	2024	Link	Strategy · Governance
Microsoft	SEC Form 10-K (FY2024)	2025	Link	Strategy · Governance
Microsoft	Environmental Sustainability Report (ESR)	2025	PDF	Sustainability · Strategy
Microsoft	Environmental Sustainability Report (ESR)	2024	PDF	Sustainability
Microsoft	Reports Hub (CSR disclosures index)	2025	Link	Sustainability · Governance
Microsoft	Responsible AI Transparency Report	2025	Link	Governance · Innovation
Microsoft	Responsible AI Transparency Report (full PDF)	2024	PDF	Governance · Innovation

Firm	Title	Year	PDF/Link	Category
Microsoft	Responsible AI Standard — General Requirements	2022	PDF	Governance · Technology
Microsoft	Responsible AI — Principles & Approach (deep page)	2025	Link	Governance · Strategy
Microsoft	Supplier Code of Conduct (updated)	2025	PDF	Governance · Sustainability
Microsoft	Azure Well-Architected Framework (deep page)	2025	Link	Technology · Innovation
Microsoft	Azure Well-Architected — Sustainability (pillar guidance)	2025	Link	Technology · Sustainability
Microsoft	Microsoft Sustainability Manager (product) — docs	2025	Link	Sustainability · Technology
Microsoft	Microsoft Transparency Hub (law enforcement & digital safety reports)	2025	Link	Governance
Microsoft	AI Safety & Security — engineering guidance (deep page)	2025	Link	Governance · Technology
NVIDIA	Form 10-K (FY2025, year ended Jan 26 2025)	2025	Link	Strategy · Governance
NVIDIA	Annual Report	2024	PDF	Strategy · Governance
NVIDIA	Sustainability Report (Fiscal Year 2025)	2025	PDF	Sustainability · Governance
NVIDIA	Sustainability Report (Fiscal Year 2024)	2024	PDF	Sustainability

Firm	Title	Year	PDF/Link	Category
NVIDIA	Corporate Governance Policies (Board)	2023	PDF	Governance
NVIDIA	Governance Documents (Code, Charters)	2025	Link	Governance
NVIDIA	Trustworthy AI — Principles & Solutions	2025	Link	Governance · Innovation
NVIDIA	CUDA C++ Programming Guide (v13)	2025	PDF	Technology
NVIDIA	NVIDIA AI Enterprise — User Guide (v5.0)	2024	PDF	Technology · Innovation
NVIDIA	NVIDIA AI Enterprise — Docs Hub	2025	Link	Technology
NVIDIA	DGX Solution Stack — Whitepaper	2021	PDF	Technology
NVIDIA	Omniverse — Developer Overview (OpenUSD)	2025	Link	Technology · Innovation
NVIDIA	Omniverse for AEC — eBook	2021	PDF	Technology · Innovation
NVIDIA	A100 Tensor Core GPU — Architecture WP	2020	PDF	Technology (foundational)
NVIDIA	DGX-1 V100 — System Architecture WP	2017	PDF	Technology (foundational)
NVIDIA	NeMo Guardrails — Library Docs	2025	Link	Governance · Technology
NVIDIA	NeMo Retriever (NIM) — Dev Blog	2025	Link	Innovation · Technology

Firm	Title	Year	PDF/Link	Category
Samsung	2024 Business Report (Annual)	2024	PDF	Strategy · Governance
Samsung	2023 Business Report	2022	PDF	Strategy · Governance
Samsung	2025 Sustainability Report	2025	PDF	Sustainability · Governance
Samsung	2023 Sustainability Report	2023	PDF	Sustainability
Samsung	2024 Sustainability Report (Alt)	2024	PDF	Sustainability · Governance
Samsung	Earnings Presentation Q1 2025	2025	PDF	Strategy · Technology
Samsung	Investor Relations Archive (IR Hub)	2025	Link	Governance · Strategy
Samsung	Environment & Circular Economy: New Environmental Strategy	2024	Link	Sustainability · Technology
Samsung	Supplier & Human Rights Disclosure – via Sustainability Report	2024	PDF	Governance · Sustainability
Samsung	Device Solutions & Foundry Strategy (Business Report Section)	2024	PDF	Strategy · Innovation
Samsung	Technology & Innovation Platform – Whitepaper / Deep Page	2024	Link	Innovation · Technology
Samsung	ESG Reporting Architecture &	2023	PDF	Governance · Sustainability

Firm	Title	Year	PDF/Link	Category
	Assurance – via Sustainability Report			
Samsung	Data Center / Memory Business & AI Strategy – Business Report Section	2024	PDF/Link	Technology · Strategy
Samsung	Foundry & Semiconductor Innovation – Business Report Section	2022	PDF	Innovation · Technology
Samsung	Sustainability in Supply Chain & Responsible Sourcing – via Sustainability Report	2024	Link	Sustainability · Governance
Tesla	2024 Annual Report (Form 10-K)	2025	PDF	Strategy · Governance
Tesla	2023 Annual Report (Form 10-K)	2024	PDF	Strategy · Governance
Tesla	2022 Annual Report (Form 10-K)	2023	PDF	Strategy · Governance
Tesla	2023 Impact Report – Highlights	2023	PDF	Sustainability · Strategy
Tesla	2021 Impact Report	2021	PDF	Sustainability · Innovation
Tesla	SEC Filings Archive – Tesla Investor Relations	2025	Link	Governance · Strategy
Tesla	Scaling Enterprise AI Infrastructure article (Tesla)	2025	Link	Technology · Innovation

Firm	Title	Year	PDF/Link	Category
Tesla	Developer / Ecosystem page – Tesla Autonomy / EV platform (Deep page)	2024	Link	Technology · Innovation
Tesla	Energy & Storage Segment Overview – Annual Report details	2023	Tesla Investor Relations	Technology · Sustainability
Tesla	Manufacturing & Gigafactory Strategy – From 2023 10-K	2023	Tesla Investor Relations	Strategy · Technology
Tesla	R&D Expense & Innovation metrics – 2023 10-K	2023	Tesla Investor Relations	Innovation · Strategy
Tesla	Investor Relations – Corporate Governance & Proxy info	2022	Link	Governance
Tesla	Supply Chain & Sustainability disclosures – Impact Report	2024	Link	Sustainability · Governance
Tesla	AI / Autonomy platform announcement document (Tesla)	2024	Link	Innovation · Technology
Tesla	EV Ecosystem & Service Platform overview	2025	Link	Strategy · Innovation
TSMC	2024 Annual Report	2025	PDF	Strategy · Governance
TSMC	2023 Annual Report	2024	PDF	Strategy · Governance

Firm	Title	Year	PDF/Link	Category
TSMC	2022 Annual Report	2023	PDF	Strategy · Governance
TSMC	Business Overview (2024)	2024	PDF	Technology · Innovation
TSMC	Annual Reports Archive (IR Hub)	2025	Link	Governance · Strategy
TSMC	Sustainability Report 2024	2024	PDF	Sustainability · Governance
TSMC	Sustainability Report 2023	2023	PDF	Sustainability
TSMC	Corporate Governance Report 2024	2024	PDF	Governance
TSMC	Corporate Governance – IR Governance Documents	2025	Link	Governance
TSMC	Technology Roadmap (2nm & 1nm) – Business Report Section	2024	PDF	Innovation · Technology
TSMC	Semiconductor Ecosystem Strategy – Foundry Leadership	2023	PDF	Strategy · Innovation
TSMC	Clean Energy & Water Management – Sustainability Section	2024	PDF	Sustainability · Technology
TSMC	Supply Chain Ethics & Transparency – Sustainability Section	2023	PDF	Governance · Sustainability
TSMC	Foundry Ecosystem Partner Hub –	2025	Link	Innovation · Strategy

Firm	Title	Year	PDF/Link	Category
	Developer Resources (TSMC)			

APPENDIX C:

SECONDARY DATA INSIGHTS

The following comprises independent external sources, including global consultancies, market research firms, academic institutions, multilateral bodies, and policy agencies etc. mainly used for Triangulation.

Firm	Title	Year	PDF/Link	Category
Accenture	Elevate Your Business With a Platform Strategy	2024	PDF	Strategy · Technology
Accenture	Reinventing with a Digital Core-Chapter 2	2025	PDF	Technology · Innovation
Accenture	Accelerate Global Companies Toward Net Zero by 2050	2022	PDF	Sustainability · Governance
Accenture	Digital Transformation: A Sustainable Evolution Journey	2022	PDF	Sustainability · Innovation
Accenture	Services for the Platform Economy — Winners Revealed (HFS excerpt)	2023	PDF	Strategy · Platform Economy
Capgemini	The Eco-Digital Era™	2024	PDF	Strategy · Sustainability

Firm	Title	Year	PDF/Link	Category
Capgemini	Collaborative Data Ecosystems	2021	PDF	Innovation · Technology
Capgemini	IT Effectiveness for Complex Digital Ecosystems (SIAM)	2024	PDF	Governance · Technology
Capgemini	Digital Continuity: Building the Connected Enterprise	2024	PDF	Technology · Strategy
Capgemini	The New Digital Economy Research	2024	Link	Strategy · Innovation
EY	Platform Economy Transformation Study	2023	PDF	Strategy · Innovation
EY	Digital Transformation: India’s Journey to Industry 4.0	2025	PDF	Technology · Innovation
EY	India’s Cloud and Data Revolution	2023	PDF	Technology · Strategy
EY	A New Economy	2024	PDF	Sustainability · Governance
EY	E-Commerce & Consumer Internet Sector India Trend Book	2023	PDF	Strategy · Innovation

Firm	Title	Year	PDF/Link	Category
KPMG	Ecosystem Partnerships: Primary Research Overview	2024	PDF	Strategy · Innovation
KPMG	Global Tech Report 2024	2024	PDF	Technology · Strategy
KPMG	Digital Money Market Perspectives across the Digital Assets Ecosystem	2024	PDF	Innovation · Platform Economy
KPMG	India's Digital Dividend – Strategic Roadmap	2025	PDF	Strategy · Sustainability
KPMG	Global Tech Report 2023	2023	PDF	Technology · Innovation
Deloitte	Optimizing Digital Ecosystems to Create More Value	2024	Link	Strategy · Technology
Deloitte	Digital Innovation Ecosystems	2023	PDF	Innovation · Platform Economy
Deloitte	Survey – Digital Ecosystem Maturity & Monetization	2024	PDF	Technology · Strategy

Firm	Title	Year	PDF/Link	Category
Deloitte	Data-Driven Ecosystems: Unlocking Business Value	2024	PDF	Innovation · Technology
McKinsey	Growth and resilience through ecosystem building	2023	PDF	Strategy · Ecosystem
McKinsey	A playbook for innovation hubs and ecosystems	2024	PDF	Innovation · Ecosystem
McKinsey	Technology Trends Outlook 2022	2022	PDF	Technology · Ecosystem
McKinsey	Data sharing in industrial ecosystems	2021(?)	PDF	Governance · Ecosystem
McKinsey	(Optional older) How the best companies create value from their ecosystems	2019	PDF	Strategy · Ecosystem
BCG	What Is Your Business Ecosystem Strategy?	2022	PDF	Strategy · Ecosystem
BCG	Building the Digital Asset Securities Ecosystem	2023	PDF	Platform Economy · Innovation

Firm	Title	Year	PDF/Link	Category
BCG	Digital Ecosystem Consulting & Strategy (web page)	2024	Link	Strategy · Ecosystem
BCG	Charting economic opportunities in the new digital paradigm	2022	PDF	Strategy · Technology
TGI	The Platform Economy: Southeast Asia's Digital Growth (with TechforGood Institute)	2021	PDF	Platform Economy · Strategy
IMG	Technology Report 2022	2022	PDF	Technology · Ecosystem
Bain	India SaaS Report 2022	2022	Link	Technology · Platform Economy
Bain	ESG-Report 2022 (Ecosystem of Carbon Transition)	2022	PDF	Sustainability · Ecosystem
PwC	Ecosystems: Blurring inter-sectoral lines to capture value (PwC)	2023	PDF	Strategy · Ecosystem
PwC	2023 Global Digital Trust Insights (India edition) (PwC)	2023	PDF	Governance · Technology

Firm	Title	Year	PDF/Link	Category
PwC	Navigating India's transition to sustainability reporting	2024	PDF	Sustainability · Governance
PwC	Global Service Study 2023	2023	PDF	Strategy · Ecosystem
PwC	(Optional) Global Risk Survey 2023	2023	PDF	Governance · Ecosystem
Booz Allen	Maps the Next Wave of Tech for USG in 2025	2025	PDF	Technology · Ecosystem
Booz Allen	Velocity: Rebuilding Trusted Relationships With Emerging Technologies	2022	PDF	Innovation · Ecosystem
Booz Allen	Powering Change for the Future — 2025	2025	PDF	Sustainability · Ecosystem
Gartner	Performance Update Digital Ecosystems in Lending—How Ecosystems Drive Asset Growth	2024	PDF	Strategy · Platform Economy
Gartner	4 Lessons from Land O'Lakes on Building a Digital Ecosystem	2023	Link	Technology · Strategy
IDC	FutureScape: Worldwide Digital Business Strategies	2023	PDF	Strategy · Innovation · Ecosystem

Firm	Title	Year	PDF/Link	Category
	2024 – Top 10 Predictions			
IDC	MarketScape: Worldwide Intelligent Digital Asset Management 2024 Vendor Assessment	2024	PDF	Technology · Platform Economy
Everest Group	Digital Ecosystems: Unlocking Collaborative Value Chains	2022	PDF	Strategy · Innovation
Everest Group	Platform Services for Ecosystem-Centric Business Models	2023	Link	Technology · Platform Economy
ISG	Managed Services & Ecosystem Platforms – Market Trends Report	2024	PDF	Strategy · Governance
ISG	Cloud & Digital Ecosystems – Partner Readiness Study	2023	Link	Innovation · Technology
Forrester	Partner Ecosystem Marketing – Service Overview	2023	PDF	Strategy · Platform Economy
Forrester	Forrester Wave™ – Zero Trust Platform Providers, Q3 2023	2023	PDF	Governance · Technology
Harvard Business Review	How to Choose the Right Ecosystem Partners for Your Business	2022	Link	Strategy

Firm	Title	Year	PDF/Link	Category
Harvard Business Review	Create a Stronger Digital Business Ecosystem by Partnering Up	2022	Link	Strategy
Harvard Business Review	Should Your Company Build an Open or Closed Ecosystem?	2024	Link	Governance
Harvard Business Review	Competing in the Age of AI: AI, Platforms & the Ecosystem Advantage	2023	Link	Technology / Innovation
Harvard Business Review	Why Companies Must Build Ecosystems, Not Products	2021	Link	Strategy / Innovation
Massachusetts Institute of Technology (MIT)	Digital Transformation, Ecosystem Design and Platform …	2021	PDF	Technology · Innovation
MIT	Innovation Ecosystem Strengthening Guide (MIT D-Lab)	2023	PDF	Innovation · Strategy
University of Cambridge	Digital Platform Ecosystem Performance: Antecedents …	2022	Link	Strategy · Governance
Oxford University	(Older) Digital Ecosystems: Ecosystem-Oriented Architectures	2025	PDF	Technology · Platform Economy
Financial Times	The rise of the platform economy	2023	Link	Strategy · Platform Economy

Firm	Title	Year	PDF/Link	Category
The Economist	Digital public infrastructure: A digital revolution for the public good	2024	PDF	Governance · Technology
Fortune	Getting the digital ecosystem right to achieve full potential	2019	Link	Strategy · Innovation
India	State of India's Digital Economy (SIDE) Report 2025	2025	PDF	Strategy · Technology
India	Building Digital Ecosystems for India: Implementation Blue Book (IndEA 2.0)	2023	PDF	Governance · Innovation
Germany	The Digital Economy in Germany (Federal/Trade Report)	2025	PDF	Technology · Strategy
Germany	Jahresreport der Digital Hub Initiative	2025	PDF	Innovation · Ecosystem
United States	Digital Public Infrastructure: A Digital Revolution for the Public Good	2024	PDF	Governance · Technology
United States	The Rise of the Platform Economy	2023	Link	Strategy · Platform Economy
United Kingdom	Next-Generation Digital Ecosystems: UK’s Strategic Pathway	2025	PDF	Strategy · Innovation
United Kingdom	Building Digital Britain: Partnering for Platform Growth	2022	Link	Technology · Strategy

Firm	Title	Year	PDF/Link	Category
World Economic Forum	Innovation Ecosystems: A Toolkit of Principles and Best Practices	2025	PDF	Innovation · Strategy
World Economic Forum	Shaping the AI Sandbox Ecosystem for the Intelligent Age	2025	PDF	Technology · Ecosystem
World Bank	Developing Entrepreneurial Ecosystems for Digital Businesses and Beyond: A Diagnostic Toolkit	2023	PDF	Strategy · Innovation
International Monetary Fund	Growing Retail Digital Payments: The Value of Interoperability	2025	PDF	Technology · Governance
European Union	Monitoring European Industrial Ecosystems: Methodological Report	2023	PDF	Governance · Technology
World Economic Forum	Global Risks Report (20th Edition)	2025	PDF	Governance · Sustainability
World Economic Forum	Future of Jobs Report	2025	PDF	Strategy · Technology
World Economic Forum	AI in Action: Beyond Experimentation to Transform Industry	2025	PDF	Technology · Innovation
World Economic Forum	Transforming Consumer Industries in the Age of AI	2025	PDF	Technology · Strategy

Firm	Title	Year	PDF/Link	Category
World Economic Forum	Global Risks Report (overview page)	2025	Link	Governance
World Bank	Developing Entrepreneurial Ecosystems for Digital Businesses and Beyond: A Diagnostic Toolkit	2023	PDF	Strategy · Innovation
World Bank	Digital Public Infrastructure and Development	2025	PDF	Governance · Technology
World Bank	Digital Progress and Trends Report	2023	PDF	Strategy · Technology
World Bank	Digital Public Infrastructure—Setting Standards (Hourglass Method)	2025	PDF	Governance · Technology
World Bank	South Asia’s Digital Economy (Regional Report)	2022	PDF	Strategy · Innovation
International Monetary Fund (IMF)	Growing Retail Digital Payments: The Value of Interoperability (Fintech Note 2025/004)	2025	PDF	Governance · Technology
International Monetary Fund (IMF)	Fintech Notes (series index)	2025	Link	Technology · Governance
European Union (EU)	Digital Markets Act — Official Journal text (Regulation (EU) 2022/1925)	2022	Link	Governance

Firm	Title	Year	PDF/Link	Category
European Union (EU)	Digital Markets Act — European Parliament Briefing	2022	PDF	Governance
European Union (EU)	Digital Markets Act — Legislation Portal	2023	Link	Governance
World Trade Organization (WTO)	World Trade Report 2024 — Trade and Inclusiveness (includes digital)	2024	PDF	Strategy · Governance
World Trade Organization (WTO)	Digital Trade for Africa Initiative — Ghana Report	2024	PDF	Technology · Innovation
World Trade Organization (WTO)	Digital Trade for Africa Initiative — Kenya Report	2024	PDF	Technology · Innovation
Sequoia	Atlas – Europe's Technical Talent & Ecosystem Trends	2023	PDF	Innovation · Strategy
Sequoia	Forecasting & Scenario Planning	2022	PDF	Strategy
Sequoia	The End of Free Money Era – Market Reset Memo	2022	PDF	Strategy
Sequoia	Generative AI Market Landscape	2024	Link	Technology
Sequoia	Marketplaces — A Guide to Platform Dynamics	2021	Link	Platform Economy
a16z	Marketplace 100 Report	2021	PDF	Platform Economy
a16z	State of Crypto	2024	Link	Technology

Firm	Title	Year	PDF/Link	Category
a16z	AI: The New Moat	2023	Link	Innovation · Strategy
a16z	The Platform Economy Playbook	2022	Link	Platform Economy
a16z	What's Next in AI Infrastructure	2025	Link	Technology
SoftBank	Annual Report – Ecosystem Strategy	2024	PDF	Strategy
SoftBank	Vision Fund Sustainability Report	2023	PDF	Sustainability
SoftBank	AI as Economic Infrastructure	2025	Link	Technology
SoftBank	Vision Fund Investment Thesis	2022	Link	Strategy
SoftBank	Future of Mobility & Platforms	2023	Link	Innovation
Silver Lake	Annual Review	2024	PDF	Strategy
Silver Lake	Value Creation via Digital Scale	2023	Link	Innovation
Silver Lake	PE Digitalization Strategy	2022	Link	Strategy
Silver Lake	Infrastructure Platform Investment View	2023	Link	Platform Economy
Silver Lake	Sustainability & Digital Impact	2024	PDF	Sustainability
Accel	The Euroscape – Cloud & Ecosystem Scaling	2024	PDF	Strategy · Technology

Firm	Title	Year	PDF/Link	Category
Accel	The Rise of B2B Marketplaces	2023	Link	Platform Economy
Accel	Generative AI Startup Landscape	2024	Link	Technology
Accel	Future of Work Platforms	2022	Link	Innovation
Accel	SaaS & Cloud Economy Insights	2021	Link	Strategy
Tiger Global	Annual Review & Investment Overview	2024	Link	Strategy
Tiger Global	Tech & Platform Investment Focus	2023	Link	Innovation
Tiger Global	Portfolio Ecosystem Structure	2022	Link	Platform Economy
Tiger Global	Investment Philosophy	2021	Link	Strategy
Tiger Global	Emerging Markets Tech	2023	Link	Technology