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Innovation and Innovative Practices in Digital Environments: The Generative Digital Innovation Practices (GDIP) Framework and a Digital Innovation Practice Index (DIPI)

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ABSTRACT

Innovation in digital environments differs fundamentally from innovation in the analog era: the object of innovation is malleable and re-programmable, the agency for innovation is distributed across ecosystems, and the boundary between the innovation process and its outcome is increasingly blurred. Despite a rich body of scholarship, the specific practices through which organizations actually innovate in digital settings remain scattered across separate literatures on digital transformation, digital entrepreneurship, agile development, and open innovation. This conceptual paper consolidates that fragmented evidence into a single, coherent architecture. It advances the Generative Digital Innovation Practices (GDIP) Framework, which identifies five interdependent innovative practices—combinatorial recombination, distributed co-creation, continuous experimentation, data-driven sensing, and adaptive orchestration—resting on three enabling strata (infrastructure, organizational, and strategic) and animated by dynamic capabilities. To render the framework diagnostic, the paper introduces the Digital Innovation Practice Index (DIPI), a weighted composite that incorporates a novel synergy adjustment reflecting the complementarity among practices. An illustrative application across three organizational archetypes demonstrates how the framework and index expose distinct innovation profiles and maturity gaps. All quantitative figures reported here are illustrative simulations calibrated to ranges reported in the literature and are intended to demonstrate the instrument rather than to present empirical findings. The framework contributes an integrative vocabulary for scholars and a practical diagnostic for managers and policymakers pursuing knowledge-economy objectives such as those articulated in UAE Vision 2071.

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1. Introduction

Digital technologies have moved from being tools that support innovation to becoming the very material from which innovations are made. When products, services, and processes are encoded in software and connected through networks, the economics and organization of innovating change in ways that established management theory did not anticipate (Nambisan, Lyytinen, Majchrzak, & Song, 2017; Yoo, Henfridsson, & Lyytinen, 2010). A car is no longer only a mechanical artifact but a platform that receives new features after it has been sold; a bank branch is displaced by an application programming interface; a retailer competes less on shelf space than on the quality of its recommendation algorithms. In each case the digital environment reshapes what it means to innovate.

Scholars have documented this shift under several headings. Research on digital innovation examines how the re-programmable, editable, and recombinable nature of digital artifacts alters innovation processes and outcomes (Fichman, Dos Santos, & Zheng, 2014; Kohli & Melville, 2019). Research on digital transformation examines how whole organizations reconfigure their value-creation logic in response to pervasive digitization (Vial, 2019; Hanelt, Bohnsack, Marz, & Antunes Marante, 2021). Research on digital entrepreneurship examines how new ventures form when the locus of agency and the boundaries of the firm become fluid (Nambisan, 2017). These literatures are individually mature yet collectively fragmented; a manager asking the simple question "what should we actually do differently to innovate in a digital environment?" finds no single, actionable answer.

This paper addresses that gap. It does not report a new empirical study; instead it makes a conceptual and integrative contribution of the kind that consolidates scattered knowledge into a usable structure. Two artifacts are advanced. The first is the Generative Digital Innovation Practices (GDIP) Framework, which distills the recurring behaviors described across the literature into five innovative practices and situates them within the organizational conditions that enable them. The second is the Digital Innovation Practice Index (DIPI), a measurement model that operationalizes the framework and introduces a synergy term to capture the well-documented observation that digital innovation practices reinforce one another rather than acting in isolation.

The paper is organized as follows. Section 2 reviews the theoretical background and specifies the research gap. Section 3 develops the GDIP Framework. Section 4 formalizes the DIPI, including its equations and maturity bands. Section 5 provides an illustrative application across three organizational archetypes, with all numeric values clearly labeled as illustrative simulations. Section 6 discusses theoretical, managerial, and policy implications; Section 7 states limitations and a research agenda; and Section 8 concludes.

2. Theoretical Background

2.1 From analog to digital innovation

Traditional theories of innovation assume that the artifact being innovated is relatively stable once produced and that the firm is the principal locus of innovative agency. Digital technology unsettles both assumptions. Yoo et al. (2010) argue that pervasive digitization gives rise to a layered modular architecture in which devices, networks, services, and contents are only loosely coupled, so that a component created in one layer can be recombined with components from others without central coordination. This architecture makes digital artifacts inherently generative: they invite unanticipated recombination and continuous re-programming. Nambisan et al. (2017) build on this insight to argue that digitization dissolves the definitional boundaries of innovation, redistributes agency beyond the focal firm, and collapses the traditional sequence in which a process yields a finished outcome.

These theoretical moves matter because they imply that the practices of innovating must also change. If outcomes are never truly finished, then continuous experimentation and post-launch iteration become central rather than exceptional. If agency is distributed, then orchestrating external contributors becomes a core competence. Fichman et al. (2014) capture the significance of this reorientation by proposing digital innovation as a "fundamental and powerful concept" that should organize how the field is taught and studied, precisely because it recurs across products, services, processes, and business models.

2.2 The digital environment as a locus of innovation

The "digital environment" is more than a set of tools; it is a socio-technical setting characterized by programmable infrastructure, abundant data, low-cost connectivity, and platform intermediation. Vial (2019), synthesizing 282 works, defines digital transformation as a process in which organizations respond to environmental change by combining information, computing, communication, and connectivity technologies to alter their value-creation paths. Verhoef and colleagues (2021) refine this by distinguishing three stages—digitization, digitalization,

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and digital transformation—and by emphasizing that genuine transformation entails business-model innovation rather than mere technology adoption. Within Emirates Scholar's own journal, Elkhatibi and Benabdeouahed (2024) illustrate the environment concretely: their study of conversational virtual agents shows how a digital channel becomes both a site of service delivery and a source of innovation, with adoption shaped by anthropomorphism, social presence, trust, and facilitating conditions.

Complementing that work, Guelzim and Mdarbi (2024), also in this journal, examine digital influencing as an emergent marketing practice enabled by social-media environments, underscoring that innovation in digital settings frequently takes the form of new practices and roles rather than new physical artifacts. Together these contributions locate innovation not in a laboratory but in the everyday operation of digital channels, platforms, and data flows.

2.3 Innovative practices: a fragmented landscape

Across the literature, a recognizable but dispersed set of behaviors recurs. Kohli and Melville (2019) review digital innovation across seven dimensions spanning initiation, development, implementation, exploitation, and the internal and external environments, revealing how many separate research streams describe overlapping activities. Svahn, Mathiassen, and Lindgren (2017), in their study of Volvo Cars' connected-car initiative, show that incumbents must manage four competing concerns—existing versus requisite capabilities, product versus process focus, internal versus external collaboration, and control versus flexible governance—each of which corresponds to a practice that must be deliberately cultivated. Sebastian et al. (2017) describe how large, established firms navigate transformation by building an operational backbone and a digital services platform, again pointing to specific, repeatable practices.

The strategic-management literature supplies the connective tissue. Teece (2007) specifies dynamic capabilities—sensing opportunities, seizing them, and reconfiguring assets—as the microfoundations of sustained performance under rapid innovation. Warner and Wäger (2019) translate this directly to the digital context, presenting digital transformation as an ongoing process of strategic renewal built from nine microfoundations. These capabilities are not themselves practices; rather, they are the mechanism through which practices are combined and continually adjusted.

2.4 Research gap and contribution

Three observations motivate the present contribution. First, the practices of digital innovation are described repeatedly but are never assembled into a single, parsimonious set. Second, the enabling conditions—infrastructure, organization, and strategy—are treated separately from the practices they support. Third, there is no lightweight instrument that lets an organization locate itself on these practices and reason about where to invest next. The GDIP Framework and the DIPI respond to these three gaps by integrating the practices, layering them onto their enablers, and rendering them measurable.

3. The Generative Digital Innovation Practices (GDIP) Framework

3.1 Overview and design logic

The GDIP Framework organizes digital innovation into three interacting elements: five innovative practices that constitute the observable behavior of innovating; three enabling strata that supply the conditions for those practices; and a dynamic-capability engine that senses, seizes, and reconfigures across the whole. The framework is termed generative to signal its debt to the generativity of digital artifacts described by Yoo et al. (2010): each practice is a way of harnessing that generativity so that the organization can produce a stream of innovations rather than a single one. Figure 1 presents the architecture.

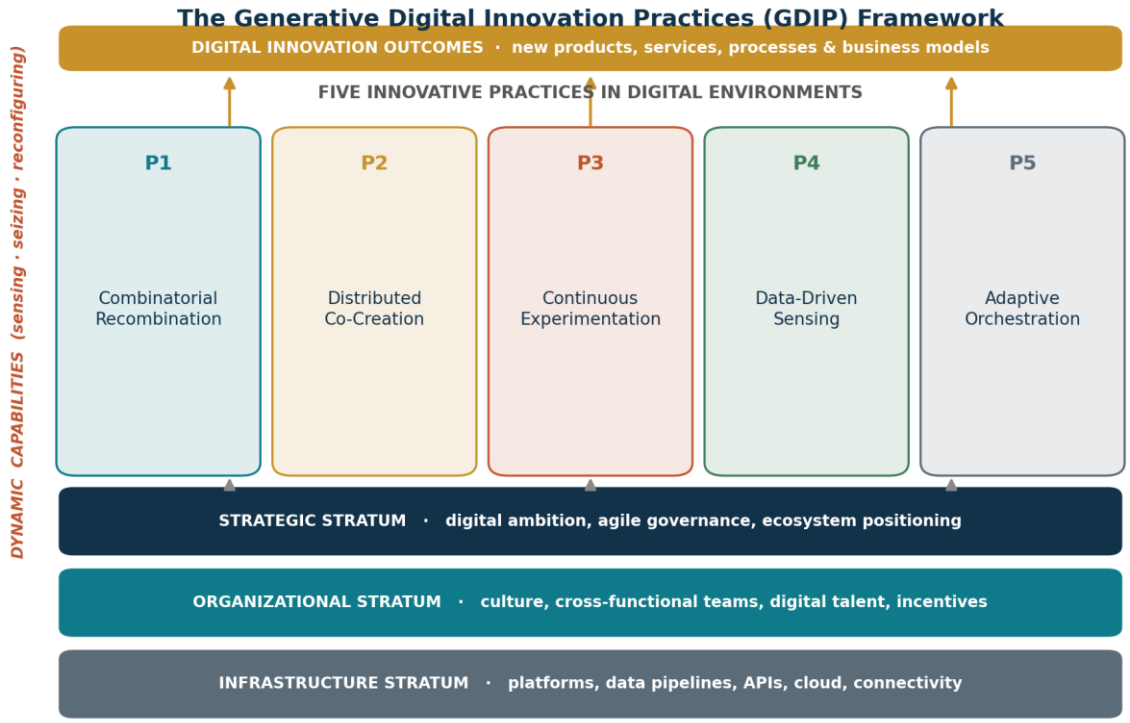

Figure 1. The Generative Digital Innovation Practices (GDIP) Framework. Five innovative practices rest on three enabling strata and are animated by dynamic capabilities that convert practice into digital innovation outcomes.

3.2 The five innovative practices

The five practices are derived by consolidating recurring behaviors across the literature reviewed in Section 2. Each is defined below and grounded in prior work; Table 1 summarizes their indicators and theoretical anchors.

P1. Combinatorial recombination. Innovating by reassembling existing digital and physical components—modules, data sets, application programming interfaces, and services—into novel offerings. This practice operationalizes the layered modular architecture (Yoo et al., 2010), in which the low cost of recombining loosely coupled components makes recombination, rather than invention from scratch, the dominant mode of value creation.

P2. Distributed co-creation. Innovating with actors outside the focal firm—users, complementors, platform participants, and partners—so that agency for innovation is deliberately shared. This practice reflects the redistribution of innovative agency emphasized by Nambisan (2017) and the internal-versus-external collaboration concern identified by Svahn et al. (2017).

P3. Continuous experimentation. Innovating through rapid, low-cost, reversible trials—prototypes, minimum viable products, A/B tests, and staged rollouts—so that learning replaces up-front certainty. Because digital outcomes are editable and rarely "finished" (Nambisan et al., 2017), experimentation shifts from a discrete phase to a permanent operating mode.

P4. Data-driven sensing. Innovating from the systematic capture and analysis of data—behavioral traces, telemetry, and real-time feedback—to detect opportunities and evaluate outcomes. This practice instantiates the sensing microfoundation of dynamic capabilities (Teece, 2007) in a digital register and connects to the analytics-centered accounts of digital innovation reviewed by Kohli and Melville (2019).

P5. Adaptive orchestration. Innovating through governance that balances control with flexibility and continually rebalances competing concerns as conditions change. This practice draws on Warner and Wäger's (2019) account of strategic renewal and on the control-versus-flexible-governance tension documented by Svahn et al. (2017); it is the practice through which the other four are aligned and re-aligned over time.

Table 1. The five innovative practices of the GDIP Framework.

Practice	Definition	Illustrative indicators & grounding
P1 · Combinatorial recombination	Reassembling modular digital and physical components into novel offerings.	API reuse, mash-ups, product–service bundles; Yoo et al. (2010).
P2 · Distributed co-creation	Sharing innovative agency with users, complementors, and partners.	Developer ecosystems, crowdsourcing, partnerships; Nambisan (2017).
P3 · Continuous experimentation	Rapid, reversible trials that substitute learning for up-front certainty.	MVPs, A/B tests, staged rollouts; Nambisan et al. (2017).
P4 · Data-driven sensing	Capturing and analyzing data to detect opportunities and assess outcomes.	Telemetry, analytics, feedback loops; Kohli & Melville (2019).
P5 · Adaptive orchestration	Governance that balances control with flexibility and rebalances over time.	Agile governance, portfolio steering; Warner & Wäger (2019).

3.3 The three enabling strata

Practices do not float free; they depend on conditions that must be provisioned. The framework distinguishes three enabling strata, shown as the horizontal bands in Figure 1. The infrastructure stratum comprises the programmable foundations—platforms, data pipelines, application programming interfaces, cloud services, and connectivity—without which recombination and data-driven sensing are impossible. The organizational stratum comprises culture, cross-functional teams, digital talent, and incentives; Sebastian et al. (2017) show that the absence of these organizational conditions, not technology, is what most often stalls transformation in established firms. The strategic stratum comprises digital ambition, agile governance, and ecosystem positioning, and corresponds to the strategic-renewal logic of Warner and Wäger (2019). The strata are cumulative: weaknesses lower down constrain the practices above them.

3.4 Dynamic capabilities as the transforming engine

The vertical axis of Figure 1 represents the dynamic-capability engine. Following Teece (2007), the organization must sense opportunities and threats, seize them through timely commitment of resources, and reconfigure its asset base as circumstances evolve. In the GDIP Framework these capabilities are what convert dormant practices into a sustained flow of innovation outcomes: sensing feeds P4, seizing energizes P1–P3, and reconfiguring is enacted through P5. This positioning is consistent with Hanelt et al. (2021), whose systematic review concludes that digital transformation pushes firms toward malleable organizational designs capable of continuous adaptation. The engine also explains why the practices are complementary rather than substitutable, a property that the measurement model in Section 4 makes explicit through a synergy term.

3.5 Distinguishing the practices from adjacent constructs

Because the digital-innovation vocabulary is crowded, it is worth clarifying what the five practices are not. They are not technologies: a firm can own advanced infrastructure yet enact few of the practices, which is precisely the traditional-firm profile discussed in Section 5. They are not stages in a linear maturity model; the practices operate concurrently and continuously rather than in sequence, which distinguishes the GDIP Framework from stage models such as the digitization–digitalization–transformation progression of Verhoef et al. (2021), a progression the framework treats as a description of enabling conditions rather than of the practices themselves. Nor are the practices equivalent to dynamic capabilities: sensing, seizing, and reconfiguring are the mechanisms that mobilize the practices, whereas the practices are the concrete, observable behaviors through which innovation is enacted (Teece, 2007). Keeping these distinctions sharp prevents the common conflation of having digital tools, being at a certain maturity stage, and actually innovating.

The framework also clarifies a frequent source of confusion between digital innovation and digital transformation. In the terms used here, the five practices are the engine of digital innovation, while transformation is the organization-wide change in value-creation logic that results when those practices become pervasive and self-reinforcing (Vial, 2019; Hanelt et al., 2021). A firm can innovate digitally in a bounded initiative without transforming; transformation is what occurs when the practices saturate the enabling strata and reshape the strategic stratum itself. The DIPI, introduced next, is

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designed to make that trajectory visible as movement between maturity bands.

4. The Digital Innovation Practice Index (DIPI)

4.1 Measurement logic

A framework becomes diagnostic only when it can be measured. The DIPI translates the five practices into a single composite score on a 0–100 scale, while preserving the underlying profile so that strengths and gaps remain visible. Each practice P_i is assessed on a normalized 0–1 scale from a small battery of indicators of the kind listed in Table 1; the indicators can be gathered through survey items, audit checklists, or platform analytics. The composite is deliberately simple so that it can be applied repeatedly and communicated to non-specialist decision-makers.

4.2 Formal specification

The base index is a weighted sum of the five normalized practice scores, expressed on a percentage scale:

$$\mathrm{DIPI}_{\mathrm{base}} = \sum_{i=1}^{5} w_i P_i$$

where w_i are non-negative weights that sum to one and $P_i \in [0, 1]$. Equal weighting ($w_i = 0.20$) is a reasonable default, but weights can be tuned to a sector or strategy—an infrastructure-heavy firm may weight P_1 and P_4 more strongly, for example. Because digital innovation practices are complementary (Nambisan et al., 2017; Svahn et al., 2017), a purely additive score understates the value of a balanced profile. The DIPI therefore applies a synergy adjustment:

$$\mathrm{DIPI} = \mathrm{DIPI}_{\mathrm{base}}\,(1 + \lambda S) = \left(\sum_{i=1}^{5} w_i P_i\right)(1 + \lambda S)$$

Here $S \in [0, 1]$ is a synergy index capturing the degree to which practices are jointly present, and $\lambda \geq 0$ is a sensitivity parameter governing how strongly complementarity is rewarded (a conservative default is $\lambda = 0.25$). The synergy index is defined as the average of the pairwise minima of the practice scores, which is high only when practices are simultaneously strong:

$$S = \frac{2}{k(k-1)} \sum_{i<j} \min(P_i, P_j), \qquad k = 5$$

The pairwise-minimum construction embodies a Liebig's-law-of-the-minimum intuition: a pair of practices contributes to synergy only to the extent of its weaker member, so lopsided profiles are penalized relative to balanced ones with the same additive base. When all practices are equal the synergy index equals that common value; when any practice is near zero the synergy contribution of every pair involving it collapses.

4.3 Maturity bands

To aid interpretation, DIPI scores are mapped to four maturity bands (Table 2). The bands are ordinal descriptors, not sharp thresholds, and are intended to prompt discussion about the next investment rather than to certify a level.

Table 2. DIPI maturity bands.

DIPI range	Band	Characteristic posture
0–25	Nascent	Isolated digital projects; practices ad hoc; infrastructure and talent gaps dominate.
26–50	Emerging	Some practices established but unevenly; experimentation and sensing not yet routine.
51–75	Advancing	Most practices routine and mutually reinforcing; orchestration becomes the binding constraint.
76–100	Generative	Practices deeply complementary; the organization sustains a continuous flow of digital innovation.

4.4 A step-by-step assessment protocol

The DIPI is intended to be applied through a lightweight, repeatable protocol so that scores are comparable over time and across units. A five-step procedure is proposed:

Step 1 — Convene. Assemble a small cross-functional panel—spanning technology, product, operations, and strategy—so that each practice is judged by those closest to it, mitigating the single-informant bias common in maturity assessments.

Step 2 — Score practices. Score each of the five practices on its indicator battery (Table 1), normalizing to the 0–1 scale. Where platform analytics exist, use them to anchor otherwise subjective judgments.

Step 3 — Compute. Compute the base index from Equation (1), the synergy index from Equation (3), and the synergy-adjusted DIPI from Equation (2), capping the result at 100.

Step 4 — Interpret. Map the score to a maturity band (Table 2) and, critically, inspect the full practice profile (as in Figure 2) to identify the weakest practice, since the synergy term implies the largest marginal gains come from raising the laggard.

Step 5 — Repeat. Re-assess periodically to track movement between bands, treating the DIPI as a directional compass for investment rather than a fixed grade.

This protocol keeps the instrument practical while preserving the diagnostic richness of the underlying profile. It also makes the assessment auditable, which matters if the DIPI is to inform resource-allocation decisions or to be aggregated across an organization or, in a policy setting, across a sector.

5. Illustrative Application

Note on data. The values in this section are illustrative simulations calibrated to plausible ranges reported in the digital-transformation literature (Vial, 2019; Verhoef et al., 2021; Hanelt et al., 2021). They are presented solely to demonstrate how the GDIP Framework and the DIPI operate and must not be read as empirical results for any specific organization.

5.1 Three organizational archetypes

Consider three archetypes that recur in the literature. A digital-native firm was founded on programmable infrastructure and treats all five practices as routine. An incumbent transformer is an established organization actively rebuilding its capabilities, strong on sensing but still constrained by legacy governance—the profile described by Svahn et al. (2017) and Sebastian et al. (2017). A traditional firm has adopted digital tools but not yet the practices, and sits in the earlier digitization stage of Verhoef et al. (2021).

5.2 Practice profiles

Figure 2. plots illustrative practice scores for the three archetypes on the five GDIP dimensions. The digital-native profile is high and balanced; the incumbent transformer is moderate with a characteristic dip in continuous experimentation and adaptive orchestration; the traditional firm is uniformly low. The value of retaining the full profile, rather than collapsing immediately to a single number, is evident: two organizations can share a similar additive base while differing sharply in balance, and it is balance that the synergy term rewards.

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Figure 2. Illustrative GDIP practice profiles for three organizational archetypes (simulated values calibrated to literature ranges).

5.3 Computing the DIPI

Applying equal weights (w_i = 0.20) and the synergy sensitivity λ = 0.25 to the illustrative profiles yields the values in Table 3. The worked example shows how the base index, the synergy index S, and the adjusted DIPI combine to place each archetype in a maturity band. The synergy adjustment widens the gap between the balanced digital-native profile and the uneven incumbent profile, which is the intended behavior.

Table 3. Illustrative DIPI computation (equal weights; λ = 0.25). All values are simulated.

Archetype	Base DIPI	Synergy S	Adjusted DIPI	Band
Digital-native	85.2	0.79	102.0 → 100	Generative
Incumbent transformer	60.6	0.44	67.3	Advancing
Traditional firm	32.4	0.18	33.9	Emerging

Note: the digital-native adjusted score is capped at 100. Values are illustrative simulations, not empirical measurements.

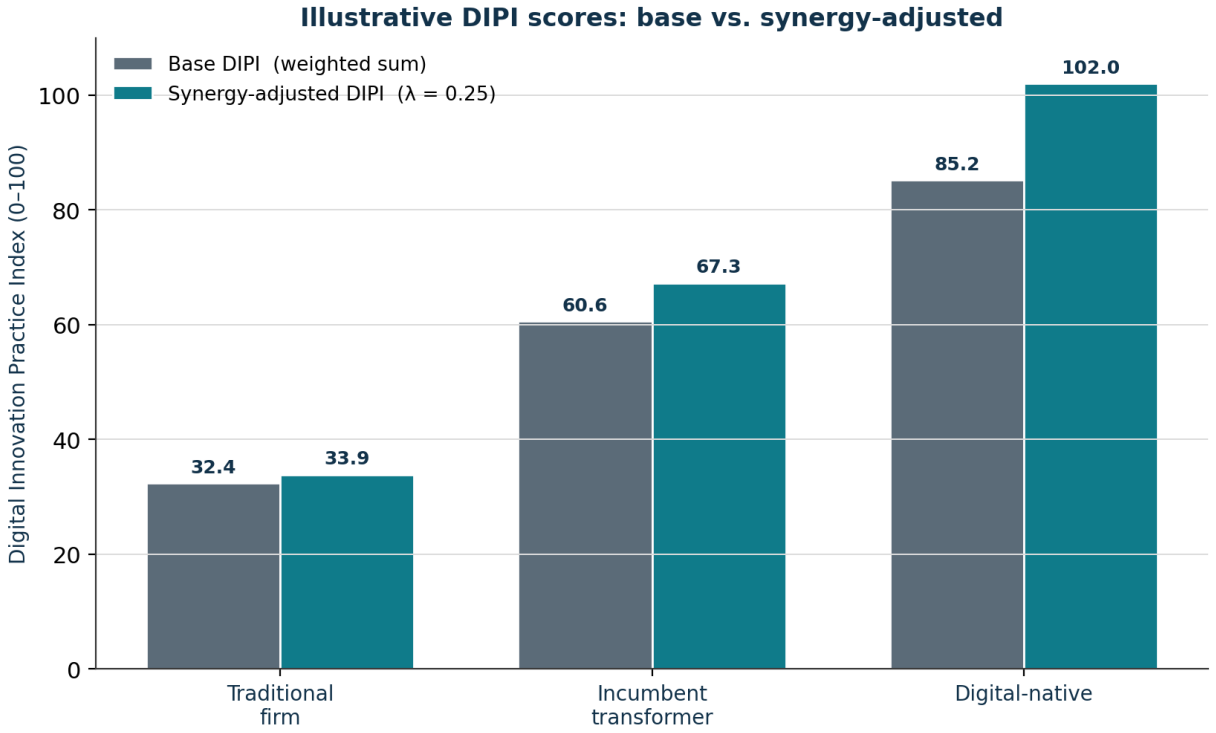

Figure 3. Illustrative base versus synergy-adjusted DIPI across archetypes. The synergy adjustment amplifies the advantage of balanced practice profiles.

5.4 Association with innovation outcomes

A diagnostic is useful only if higher scores plausibly track better outcomes. Figure 4 presents an illustrative simulation in which a synthetic sample of organizations shows a positive association between DIPI and an innovation-outcome index. The pattern is consistent with the theoretical expectation that firms enacting the five practices in a balanced, mutually reinforcing way generate more digital innovation (Nambisan et al., 2017; Warner & Wäger, 2019). The relationship is shown only to communicate the intended logic of the instrument; establishing it empirically is a task for future research (Section 7).

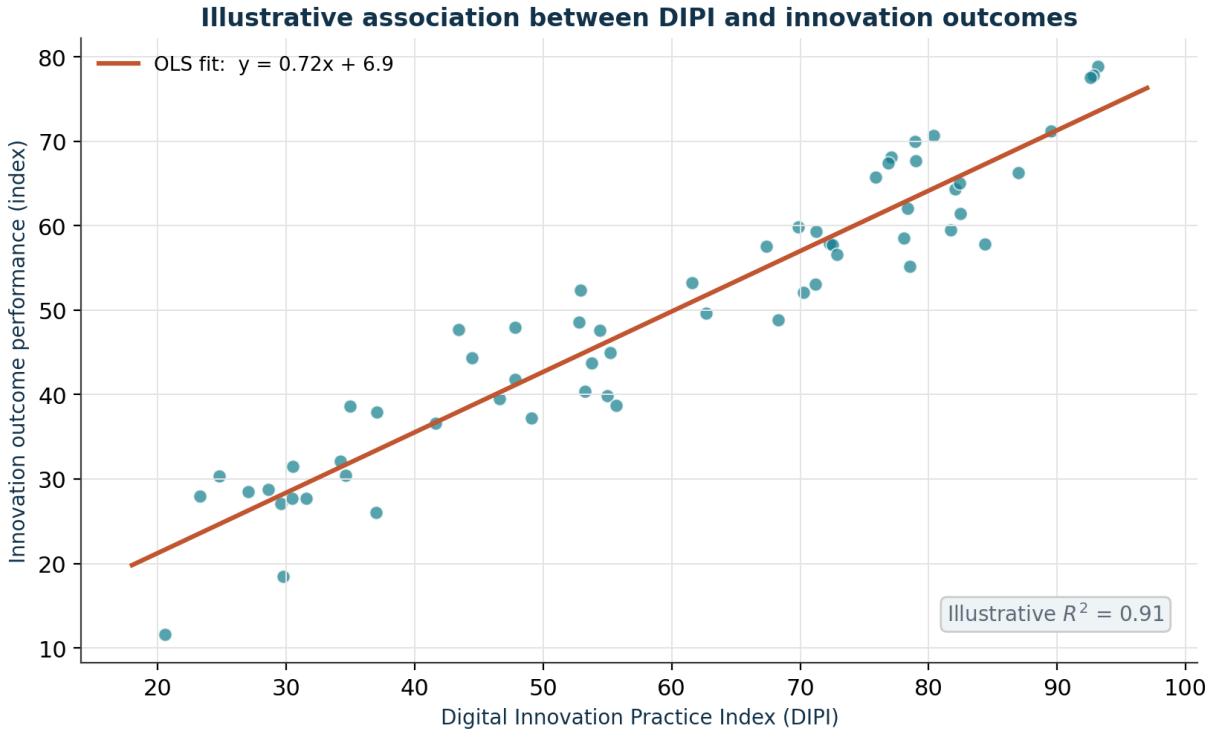

Figure 4. Illustrative association between DIPI and an innovation-outcome index in a simulated sample. Values are simulated and do not represent empirical data.

6. Discussion

6.1 Theoretical implications

The GDIP Framework makes three theoretical contributions. First, it consolidates a fragmented vocabulary: behaviors previously described separately under digital innovation, digital transformation, and digital entrepreneurship are shown to reduce to five recurring practices. This consolidation answers the call by Kohli and Melville (2019) for synthesis across a scattered field. Second, by explicitly layering practices onto enabling strata, the framework connects the micro-level of practice with the meso-level of organizational conditions, addressing the tendency—noted by Hanelt et al. (2021)—for the literature to treat technology impact and organizational adaptation in isolation. Third, the synergy term formalizes the widely asserted but rarely modeled claim that digital innovation practices are complementary (Nambisan et al., 2017), giving that claim a testable operational form.

6.2 Managerial implications

For practitioners, the framework and index offer a structured conversation rather than a prescription. By scoring each practice and computing the DIPI, a management team can see whether its constraint is a missing practice, a weak enabling stratum, or a lack of balance across practices. The maturity bands in Table 2 translate the score into a shared language, and the synergy term directs attention to the value of shoring up the weakest practice rather than over-investing in an already-strong one—an implication that mirrors the competing-concerns balancing act documented at Volvo Cars by Svahn et al. (2017). The Emirates Scholar studies reinforce the point at the level of specific channels: Elkhatibi and Benabdeouahed (2024) show that adoption of a digital innovation such as a conversational agent depends on carefully designed trust and facilitating conditions, while Guelzim and Mdarbi (2024) show that new digital practices such as influencing require deliberate cultivation rather than emerging automatically from technology.

6.3 Policy relevance

At the level of national innovation systems, the framework offers policymakers a way to reason about where public investment most raises the innovative capacity of firms. Because the enabling strata are partly public goods—connectivity, data infrastructure, and digital skills—policy can lift the floor beneath the practices for an entire economy. This is directly relevant to the United Arab Emirates' ambition, articulated in UAE Vision 2071 and pursued by institutions such as the Emirates Scholar Center, to build a diversified, knowledge-based economy. Framing that ambition in terms of measurable innovative practices, rather than technology adoption alone, aligns policy attention with the sources of durable innovative capacity identified by Teece (2007) and Warner and Wäger (2019).

7. Limitations and Future Research

This paper is conceptual, and its limitations follow from that status. First, the five practices, while grounded in the literature, are a parsimonious abstraction; some settings may warrant additional or sub-divided practices, and the boundaries between practices can blur in operation. Second, all quantitative values reported here are illustrative simulations; the DIPI has not been validated against empirical data, and its weights, the synergy sensitivity λ, and the maturity thresholds are provisional defaults. Third, the synergy specification is one of several defensible functional forms; alternatives such as a geometric mean or a variance-penalizing term merit comparison.

These limitations define a research agenda. Priorities include: (i) developing and validating a survey instrument for the five practices, following established measurement-development procedures; (ii) empirically estimating the association between the DIPI and innovation outcomes suggested illustratively in Figure 4; (iii) testing the complementarity assumption by comparing additive and synergy-adjusted specifications on real data; (iv) calibrating sector-specific weights; and (v) conducting longitudinal studies of how organizations move between maturity bands, extending the process perspective of Warner and Wäger (2019) and Vial (2019). Replication within specific digital environments—such as the conversational-agent context studied by Elkhatibi and Benabdeouahed (2024)—would further ground the framework.

8. Conclusion

Innovation in digital environments is not simply faster or cheaper innovation; it is innovation of a different kind, in which the object is malleable, agency is distributed, and outcomes are never quite finished. This paper has argued that the many behaviors described across the digital-innovation, digital-transformation, and digital-entrepreneurship literatures can be consolidated into five innovative practices—combinatorial recombination, distributed co-creation, continuous experimentation, data-driven sensing, and adaptive orchestration—resting

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on three enabling strata and animated by dynamic capabilities. The Generative Digital Innovation Practices (GDIP) Framework assembles these elements into a single architecture, and the Digital Innovation Practice Index (DIPI) renders them measurable, with a synergy adjustment that formalizes the complementarity among practices. Through an illustrative application, the paper has shown how the framework and index expose distinct innovation profiles and maturity gaps across organizational archetypes. Although the quantitative demonstration is simulated rather than empirical, the conceptual contribution stands on its own and, more importantly, defines a concrete agenda for validation. For scholars, the framework offers an integrative vocabulary; for managers and policymakers pursuing knowledge-economy objectives, it offers a practical lens on where innovative capacity is built and where it can be strengthened.

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