

Emergent Strategy and Innovation in Entrepreneurship: A Complex Adaptive Systems Perspective

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Abstract: Entrepreneurship research increasingly recognises that opportunities, strategies and innovations develop in settings where technologies, institutions and stakeholder relationships change together. Yet the relevant literatures often locate explanation at different levels: opportunity research privileges entrepreneurial judgement, ecosystem research emphasises interdependence, and strategic entrepreneurship concentrates on the mobilisation of resources. This conceptual paper connects these levels through a complex adaptive systems perspective. It asks how entrepreneurs translate distributed environmental change into coordinated action and innovation without assuming either complete foresight or purely spontaneous adaptation. The framework was developed through a theory-integration approach that compares the causal roles assigned to variation, interaction, feedback and selection across complexity, opportunity and strategic entrepreneurship research. It distinguishes five constructs: environmental complexity and disequilibrium, opportunity emergence, adaptive entrepreneurial capability, adaptive self-organisation, and innovation outcomes. Three propositions specify the mechanism. Environmental disequilibrium makes opportunities more likely to emerge when change creates interpretable gaps in existing arrangements; adaptive entrepreneurial capability strengthens the conversion of those possibilities into self-organised action; and emergent strategy carries the effect of such action into innovation while performance feedback reshapes later interpretation and capability. The contribution is a process model that joins individual judgement to collective reconfiguration and treats innovation as both an outcome and a source of subsequent adaptation. The framework also identifies boundary conditions—resource slack, network accessibility and feedback quality—that can interrupt the proposed sequence. The paper concludes with an empirical agenda using longitudinal, multilevel and process-sensitive designs.

Keywords: Complex Adaptive Systems; Entrepreneurial Opportunity; Adaptive Entrepreneurial Capability; Self-Organisation; Emergent Strategy; Innovation

1. Introduction

Entrepreneurial action rarely unfolds against a stable background. A new platform changes access to customers; a regulatory decision alters the value of existing assets; a supplier failure exposes a neglected capability; or a local network recombines knowledge that was previously separate. These events do more than add uncertainty. They change the relationships through which an entrepreneurial problem is understood. Consequently, the relevant unit of analysis is not only an alert individual or a resource-seeking firm, but an evolving configuration of actors, rules, technologies and feedback. Complex adaptive systems (CAS) theory offers language for this configuration because it explains how local interactions can produce system-level patterns that no participant designed in advance (McKelvey 2004; Roundy, Bradshaw and Brockman 2018).

Existing entrepreneurship theories illuminate important parts of this process but leave their connection under-specified. Opportunity research asks whether opportunities are discovered, created or enacted through judgement (Alvarez and Barney 2007; Davidsson, Recker and von Briel 2020). Effectuation explains how entrepreneurs proceed when prediction is unreliable (Sarasvathy 2001), while bricolage shows how resource constraints can prompt novel recombination (Baker and Nelson 2005). Entrepreneurial ecosystem research shifts attention to interdependent actors and contextual conditions (Stam and van de Ven 2021; Wurth, Stam and Spigel 2022). Strategic entrepreneurship, in turn, links opportunity seeking with advantage seeking (Ireland, Hitt and Sirmon 2003). The conceptual problem is not a shortage of explanations. It is that individual judgement, collective reorganisation and innovation outcomes are often presented as adjacent ideas rather than as stages in a testable causal process.

This gap remains despite earlier efforts to bring complexity science into strategic entrepreneurship. Schindehutte and Morris (2009), for example, use complexity to recast opportunity space, micro-macro interaction and entrepreneurial dynamics, while Spigel and Harrison (2018) explain ecosystems as processes that accumulate and circulate resources over time. Those accounts establish that entrepreneurial outcomes are path dependent and systemically produced. They are less specific, however, about the intervening sequence through which an environmental disturbance becomes an opportunity interpretation, how that interpretation recruits distributed action, and how action is selected into a strategic pattern. The present paper does not claim

that CAS is new to entrepreneurship; its contribution is to tighten that causal chain and make its cross-level transitions empirically examinable.

This paper addresses that problem through the question: how does environmental disequilibrium become coordinated entrepreneurial action and, eventually, innovation? The answer developed here is deliberately conditional. Change does not automatically reveal an opportunity, networks do not automatically self-organise, and flexible strategy does not necessarily generate a valuable innovation. Translation between these states depends on an adaptive entrepreneurial capability: the capacity to interpret weak and conflicting signals, mobilise distributed resources, run bounded experiments and revise commitments in response to credible feedback. This formulation treats capability as learned and relational rather than as innate talent.

The proposed framework makes three contributions. First, it positions opportunity emergence between environmental change and action, thereby avoiding the claim that complexity itself is productive. Second, it supplies a micro-to-meso mechanism: entrepreneurial judgement matters because it helps participants coordinate local adaptations without requiring central control. Third, it models innovation outcomes recursively. Market response, technical performance and stakeholder acceptance feed back into later interpretations and routines; an outcome in one episode becomes an input to the next. These contributions refine a CAS account of entrepreneurship and create propositions suitable for multilevel empirical testing.

2. Theoretical Background

A CAS consists of heterogeneous agents whose actions are interdependent, whose interactions are often nonlinear, and whose local adjustments can generate emergent order. Applied to entrepreneurship, the perspective changes the question from how a venture executes a predetermined plan to how entrepreneurial arrangements remain viable while the problem, available resources and relevant partners are themselves moving. McKelvey (2004) describes this terrain as one in which entrepreneurial order develops near the boundary between rigid stability and unstructured turbulence. The practical implication is not that more complexity is always beneficial. Excessive coupling, rapid feedback or opaque dependencies can make learning difficult and amplify failure.

Entrepreneurial ecosystems are a visible meso-level expression of these dynamics. Their actors—entrepreneurs, investors, universities, support organisations, incumbent firms and public agencies—possess different goals and resources, yet their repeated interactions create shared expectations and pathways for resource flow. Ecosystem performance therefore cannot be reduced to a checklist of elements. It depends on how elements combine and whether participants can access them (Stam and van de Ven 2021). A CAS interpretation explains why similar policy inputs can generate different outcomes across places and why small interventions may occasionally trigger disproportionate change (Roundy, Bradshaw and Brockman 2018). Recent ecosystem research likewise calls for closer attention to causal mechanisms and policy processes, not merely descriptive inventories (Hess et al. 2025).

A process view also changes how ecosystem resources are understood. Culture, finance, knowledge and support services have effects through relationships that make them available to particular ventures, not simply through their presence in a region (Spigel 2017). Successful and unsuccessful ventures can themselves replenish or deplete these resources by producing experienced employees, investor knowledge, legitimacy and caution (Spigel and Harrison 2018). Small local actions may consequently be amplified into wider change when they attract complementary responses, as complexity-based research on organisational emergence demonstrates (Plowman et al. 2007). The reverse is equally possible: a promising initiative can stall when complementary actors do not respond or when prior commitments lock the system into an inferior path.

Opportunity emergence is the first translation problem. The discovery view locates opportunities in changes that exist independently of a particular entrepreneur, whereas the creation view emphasises iterative action through which an opportunity takes form (Alvarez and Barney 2007). External-enablement research helps bridge the two by distinguishing an environmental change from the venture outcomes it may enable (Davidsson, Recker and von Briel 2020). From this perspective, disequilibrium supplies variation and unsettles existing arrangements, but an opportunity emerges only when actors connect those changes to a plausible user problem, means of delivery and route to value capture. This is an interpretive and relational accomplishment, not a simple act of detection.

Opportunity interpretation is constrained by cognition as well as context. Entrepreneurs compare the relational structure of a new technology or market with patterns they already understand; evidence from verbal-protocol

research shows that these structural alignments affect which possibilities are recognised (Grégoire, Barr and Shepherd 2010). Prior knowledge can therefore improve interpretation while simultaneously narrowing attention. Moreover, uncertainty changes as action proceeds. What begins as uncertainty about whether demand exists may become uncertainty about stakeholder response, execution or appropriation. Treating judgement as repeated reassessment, rather than a single choice, captures these transitions (Packard, Clark and Klein 2017) and explains why an early opportunity frame should remain provisional.

That interpretation normally develops over time. Dimov (2007) warns against attributing an opportunity to a single person and moment of insight; ideas acquire coherence through interaction, evaluation and revision. Digital technologies extend this process by making artefacts editable and participation less tightly tied to location, but they also multiply dependencies and accelerate imitation (Autio et al. 2018). Resilience in digitally advanced entrepreneurship therefore rests partly on the capacity to combine technological options with organisational and network adaptation (Audretsch et al. 2024). In CAS terms, opportunity emergence is a provisional pattern that stabilises enough to guide action while remaining open to revision.

Digital settings make this provisionality especially visible. Digital artefacts are editable, distributable and readily combined, so the boundaries of both the venture and its product may continue to shift after market entry (Nambisan 2017). Openness and generativity invite contributions from users, complementors and platform owners, creating agency that spans organisational and geographic boundaries (Nambisan, Wright and Feldman 2019). These affordances widen the opportunity space but also create dependencies: changes to an interface, ranking algorithm or access rule can invalidate a previously viable configuration. Digital complexity is therefore not simply faster environmental change; it is a redistribution of who can alter the entrepreneurial arrangement and who controls consequential feedback.

The second translation problem concerns agency. This paper defines adaptive entrepreneurial capability as a learned capacity distributed across an entrepreneur and collaborators. It contains four connected activities: sense changing relationships; frame a tractable problem; mobilise people and resources across organisational boundaries; and update commitments after experiments. The definition draws on dynamic-capability reasoning, which treats sensing, seizing and reconfiguration as mechanisms for coping with environmental change (Teece 2007), but narrows the focus to entrepreneurial episodes in which both goals and means remain partly indeterminate.

Two established logics clarify how the capability operates. Effectuation limits exposure by beginning with available means and negotiated commitments rather than a forecast treated as fact (Sarasvathy 2001). Bricolage recombines resources that others may regard as inadequate or unrelated (Baker and Nelson 2005). Neither logic is equivalent to improvisation without discipline. Both require selection: actors decide which signals deserve attention, which partners can be trusted and which experiments justify further commitment. Adaptive entrepreneurial capability is therefore visible in the quality and speed of revision, not in constant change for its own sake.

The capability must also balance exploration with exploitation. Exploration preserves variation by testing unfamiliar partners, technologies and problem frames; exploitation stabilises the routines needed to deliver and learn from a selected configuration. March (1991) shows why adaptive systems can over-invest in exploitation: its returns are nearer and easier to attribute than the returns to exploration. For entrepreneurial ventures, the opposite imbalance is also hazardous. Endless experimentation can consume scarce attention without producing commitments that others can rely upon. Adaptive capability therefore concerns the timing of closure as much as openness—the ability to preserve alternatives while evidence is weak and to concentrate resources when a pattern becomes sufficiently credible.

3. Conceptual Development and Framework

The framework was developed through theory integration rather than a claim to systematic review. The analysis began with a focal explanatory problem—the passage from environmental change to innovation—and compared how CAS, opportunity, effectuation, bricolage, dynamic-capability and strategic-entrepreneurship research assign causal roles to four recurring processes: variation, interaction, feedback and selection. Concepts were retained when they identified a distinct state or mechanism in that passage. Overlapping labels were consolidated, and causal order was revised until each link could be expressed as an observable proposition. This procedure does not establish exhaustive coverage of the literature; its purpose is analytical coherence and testable synthesis.

Three criteria governed the integration. Construct distinctiveness required each concept to explain something not captured by the neighbouring construct; level consistency required the framework to identify whether evidence concerned an actor, team, network, venture or environment; and temporal order required a plausible account of what changes before another state can follow. The criteria exposed two problems in a simple complexity-to-innovation argument. It conflates environmental variation with opportunity, and it treats self-organisation as an outcome rather than a mechanism that still requires strategic selection. Separating these roles responds to the call by Schindehutte and Morris (2009) for complexity-based strategic entrepreneurship while avoiding complexity terminology that cannot be operationalised.

The resulting model separates context, emergent state, capability, organising process and outcome. Environmental complexity and disequilibrium describe the initiating conditions. Opportunity emergence is an evolving interpretation of a possible value-creating configuration. Adaptive entrepreneurial capability is the mechanism that helps actors move from interpretation to coordinated experimentation. Adaptive self-organisation captures the relational process through which roles, resources and routines are rearranged. Emergent strategy is the temporary pattern that becomes visible across those actions, rather than a plan fully specified beforehand (Mintzberg and Waters 1985). Innovation outcomes are changes in products, services, processes or business models that users and other stakeholders can evaluate.

Distributed agency is central to the move between these constructs. Technology entrepreneurship frequently advances through the accumulated inputs of users, engineers, investors, regulators and producers rather than through the actions of a heroic founder (Garud and Karnøe 2003). The focal entrepreneur nevertheless remains consequential because framing, convening and commitment decisions influence which distributed inputs become connected. The framework therefore avoids two extremes: it does not reduce innovation to an individual trait, and it does not portray emergence as agency-free. Adaptive entrepreneurial capability is the bridge because it concerns how situated actors make the system's distributed knowledge actionable.

Table 1: Construct definitions and observable evidence

Construct	Definition in the Framework	Illustrative Evidence
Environmental complexity and disequilibrium	Interdependent technological, market or institutional changes that disturb established relationships.	Rule changes, new interfaces, supply disruptions, shifting actor dependencies.
Opportunity emergence	A provisional, shared interpretation that connects environmental change to a feasible configuration for creating and capturing value.	Changing problem frames, stakeholder validation, convergence around a use case.
Adaptive entrepreneurial capability	A learned capacity to sense, frame, mobilise and update under partial knowledge.	Cross-domain scanning, bounded experiments, staged commitments, revision after evidence.
Adaptive self-organisation	Decentralised reconfiguration of roles, resources and routines around a provisional opportunity.	New collaborations, role changes, resource recombination, locally initiated coordination.
Emergent strategy and innovation outcomes	A coherent pattern formed through repeated action and the externally evaluated changes it produces.	Consistent investment direction; adoption, reliability, revenue logic and stakeholder acceptance.

Figure 1 represents a sequence without implying a one-way or deterministic path. Capability is placed beneath the central transition because it operates through interpretation and coordination rather than as another environmental stage. The dashed arrows make feedback explicit: realised outcomes change what actors notice, whom they trust and which routines they repeat.

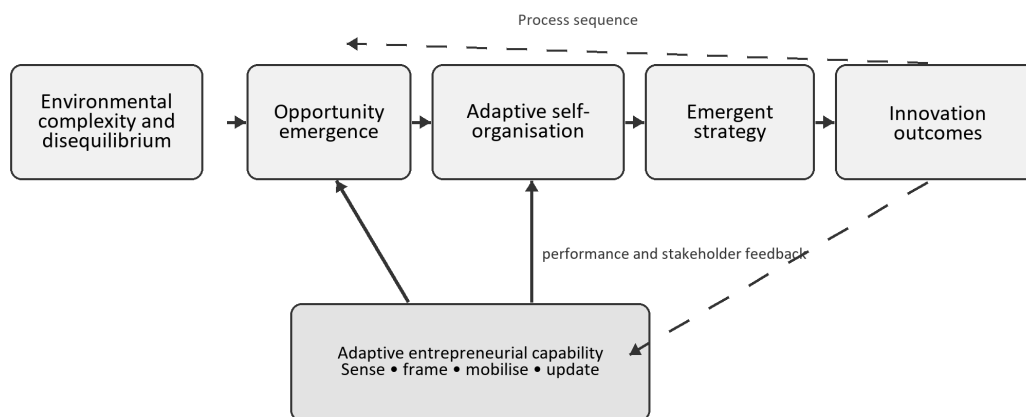


Figure 1: Complex adaptive entrepreneurship as a recursive multilevel process

4. Propositions

Environmental change enlarges the range of possible entrepreneurial responses, but only some variation becomes meaningful. A regulatory discontinuity may open access to a market while simultaneously increasing compliance costs; a digital interface may lower coordination costs but expose a venture to platform dependence. Opportunity emergence thus requires an interpretable gap between existing arrangements and a feasible alternative. Moderate disequilibrium can make such gaps visible by weakening established assumptions. At very high levels, however, rapid and contradictory signals may prevent a stable interpretation. The proposed positive relationship is therefore most plausible where actors have enough time, knowledge diversity and feedback access to distinguish a persistent change from noise.

4.1 Proposition 1

Environmental complexity and disequilibrium increase the likelihood of opportunity emergence when changes create interpretable gaps in existing market, technological or institutional arrangements.

An opportunity interpretation does not coordinate resources by itself. Participants must translate a tentative account of value into roles, experiments and commitments. Adaptive entrepreneurial capability supports that translation by linking sensemaking to mobilisation. Its sensing component compares signals across customers, technologies and institutions; its framing component identifies a problem that can be tested; its mobilisation component recruits complementary knowledge and assets; and its updating component withdraws or deepens commitments as evidence accumulates. These activities create minimum coordination without freezing the configuration too early. The effect should weaken when gatekeepers block network access, resources are indivisible, or power asymmetry prevents partners from revising roles.

4.2 Proposition 2

Adaptive entrepreneurial capability strengthens the conversion of an emergent opportunity into adaptive self-organisation by enabling distributed actors to coordinate experiments, resources and provisional roles.

Self-organisation can generate many local adaptations without producing an innovation. A recognisable strategic pattern is needed to select and connect those adaptations. Emergent strategy performs this mediating role when repeated actions produce a coherent direction that stakeholders can support, even though that direction was not designed completely in advance. The pattern channels investment, makes interdependencies legible and permits unsuccessful variations to be abandoned. Innovation outcomes then provide feedback through adoption, technical reliability, unit economics and stakeholder response. Feedback is useful only when it is timely and difficult to manipulate; delayed or politically filtered measures can reinforce an inferior path. The model is recursive because credible results reshape both subsequent opportunity interpretation and the routines that constitute capability.

4.3 Proposition 3

Emergent strategy mediates the relationship between adaptive self-organisation and innovation outcomes, and feedback from those outcomes subsequently reshapes opportunity interpretation and adaptive entrepreneurial capability.

Table 2: Proposition summary and empirical implications

Proposition	Relationship	Empirical Indicators and Boundary Conditions
P1	Disequilibrium → opportunity emergence	Timing of external changes and problem frames; moderation by knowledge diversity, interpretability and signal velocity.
P2	Opportunity emergence × adaptive capability → self-organisation	Partner recruitment, experiments, role/resource reconfiguration; constraints from gatekeeping, indivisibility and power asymmetry.
P3	Self-organisation → emergent strategy → innovation; recursive outcome feedback	Stable action patterns, adoption and technical/economic results; moderation by timeliness, credibility and openness of feedback.

5. Discussion and Theoretical Contributions

The framework clarifies what a complexity account adds to entrepreneurship research. CAS is sometimes used as a broad metaphor for turbulence. Here it performs a narrower explanatory task: it connects dispersed variation and local interaction to an emergent pattern, while specifying the selection mechanisms that keep emergence from becoming an all-purpose label. Opportunity emergence selects a provisional interpretation from environmental variation; adaptive capability selects and coordinates experiments; emergent strategy selects a pattern from repeated action; and stakeholder feedback selects which innovations persist.

This sequence joins levels of analysis that are usually separated. Environmental complexity is a system condition, interpretation and judgement are individual or team activities, self-organisation occurs in a network, and innovation is evaluated at venture and market levels. Treating these as a process prevents a common category error: inferring an individual capability directly from a successful ecosystem, or attributing an ecosystem outcome to one entrepreneur. The proposed capability is a microfoundation, but its exercise depends on accessible relationships and institutional permission.

The framework also qualifies strategic entrepreneurship. Opportunity seeking and advantage seeking need not occur as separate managerial tasks. Under disequilibrium, they can be coupled through experiments that simultaneously reveal demand and assemble difficult-to-copy relationships. This extends the integration proposed by Ireland, Hitt and Sirmon (2003) by showing how a strategic pattern can emerge before reliable forecasts or stable resource positions exist. It also complements effectuation and bricolage: those logics describe action under constraint, whereas the present model specifies how their repeated use can become collective organisation and an observable strategy.

A further contribution concerns the relationship between local adaptation and strategic coherence. Complexity accounts rightly show that small deviations can accumulate into radical change (Plowman et al. 2007), but accumulation alone does not explain why a pattern becomes economically or socially valuable. The concept of emergent strategy supplies that missing selection layer. It allows strategy to be recognised retrospectively in a stream of commitments while retaining a forward-looking role for entrepreneurial judgement. This is particularly important in distributed settings, where participants may coordinate around a direction before they agree on a complete plan.

Finally, the feedback loop distinguishes adaptation from flexibility. A venture that changes frequently may be reacting to noise, managerial fashion or the preferences of its most powerful partner. Adaptation requires a correspondence between revision and informative feedback. This distinction introduces an evaluative criterion into CAS-based entrepreneurship: the capacity to preserve useful variation while discontinuing arrangements that no longer support stakeholder value.

6. Practical Implications and Future Research

For entrepreneurs, the model recommends managing a portfolio of bounded experiments rather than treating adaptability as continuous strategic reversal. Each experiment should identify the assumption being tested, the actors whose commitment is needed, the affordable exposure and the evidence that would justify continuation. A short opportunity log can record how regulatory, customer and technological signals alter the working interpretation. Network maps can reveal where access to knowledge or assets depends on a single gatekeeper. These practices make feedback traceable and reduce retrospective stories that portray every change as intentional.

Support organisations and policymakers should pay similar attention to connections rather than counts. Adding incubators, funds or training programmes will have limited effect if entrepreneurs cannot reach specialised knowledge, early customers or complementary infrastructure. Interventions can instead shorten feedback cycles through regulatory sandboxes, shared testbeds, procurement trials and brokerage across otherwise disconnected groups. Because CAS responses are path dependent, programmes should be evaluated for who gains access, what new interactions occur and whether unsuccessful arrangements can be revised without excessive loss.

Empirical work should test the sequence rather than correlate broad perceptions of turbulence with innovation. Longitudinal case studies can use event histories to trace an external change, competing opportunity interpretations, partner commitments, strategic pivots and subsequent feedback. Comparative cases would reveal boundary conditions such as slack, network closure and institutional rigidity. A second stage could develop measures of adaptive entrepreneurial capability around sensing, framing, mobilisation and updating, then test cross-level mediation with repeated surveys and archival indicators. Digital trace data—version histories, platform interactions or experiment logs—may capture self-organisation more accurately than single-respondent retrospective scales.

Three cautions should guide that programme. First, opportunity emergence and recognition should not be measured as the same event; the former is an evolving relational pattern. Second, innovation quality needs external indicators such as adoption, reliability or willingness to pay, not novelty alone. Third, researchers should test rival explanations. Prior experience, market power or resource slack may account for both apparently adaptive behaviour and superior outcomes. Designs using process tracing, lagged measures and matched comparisons can help separate these effects.

The framework has limits that future work should preserve rather than assume away. It is designed for episodes marked by interdependence and consequential feedback; it may add little where tasks are separable, outcomes are immediately observable or a dominant actor can specify the entire arrangement. It also does not predict that decentralisation is always efficient. Self-organisation can reproduce exclusion, diffuse accountability or amplify misinformation, particularly in platform-mediated settings. Finally, the propositions describe a recurrent process, not a universal life-cycle sequence. Ventures may enter at different points, revisit earlier interpretations or terminate after any failed transition. Comparative tests across digital, place-based and regulated contexts would establish where the framework travels and where more centralised explanations are superior.

7. Conclusion

Complexity matters to entrepreneurship because it changes relationships, not simply because it raises uncertainty. The framework developed in this paper explains how those changes can move through opportunity emergence, adaptive entrepreneurial capability, self-organisation and emergent strategy to innovation outcomes. Its central claim is modest but consequential: environmental variation becomes productive only through mechanisms that interpret, coordinate and select.

By distinguishing these mechanisms, the paper replaces a direct complexity-to-innovation claim with a multilevel, recursive process. It also identifies conditions under which the process may fail, including inaccessible networks, indivisible resources, power asymmetry and poor feedback. The next step is empirical: follow entrepreneurial episodes through time and examine whether specific patterns of sensing, mobilisation and revision explain why some interdependent actors create a viable innovation while others remain active but uncoordinated.

Ethics Declaration

This conceptual study did not involve human participants, personal data, animals or primary data collection. Ethical approval and informed consent were therefore not applicable. The author declares no conflict of interest.

AI Declaration

Generative AI-assisted tools were used for language editing, structural refinement and document formatting. The author reviewed and takes responsibility for the argument, interpretation, citations and final text.

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