

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Journal of Business Venturing Insights

journal homepage: www.elsevier.com/locate/jbvi

Pivot, persist or perish? Knowledge problems and the extraordinarily tight boundary conditions of entrepreneurs as scientists

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ABSTRACT

The characterization of entrepreneurs as scientists (EaS) has become increasingly popular among management scholars because it fits neatly with existing theories of entrepreneurial action grounded in the assumption that entrepreneurs form and test beliefs in an intendedly rational fashion, under conditions of uncertainty, while continually seeking to obtain and process new information. Recent scholarship breathes new life into the EaS paradigm by proposing a framework that builds upon pragmatism in developing a microfoundational perspective concerning causally inferential action and rationality-based heuristics. Yet, the drift towards EaS is not without controversy. Business venturing is rarely analyzable through the lens of natural laws and orderly structures. Moreover, uncertainty is not the only knowledge problem (KP) that entrepreneurs confront. As such, EaS may be ineffective in bringing resolution to these other challenging KPs – ambiguity, complexity, and equivocality – especially when entrepreneurs are entertaining decisions to pivot or persist. In this sense, our work underscores the importance of EaS while also asserting the need for clear boundary conditions.

“A/B testing is great. But if executed to perfection will turn every website into a porn site. And I don't think that as entrepreneurs, that's what you set out to do.” – Jeff Lawson, Twilio Founder

1. The notion of entrepreneurs as scientists: A step forward, backward, or sideways?

Most entrepreneurs probably don't see themselves functioning as scientists, but should they? Would startups generate better decisions, actions, and outcomes if they engaged in a more scientific approach to business venturing? Like most things in life, the answer is that “it depends.” Certain problems entrepreneurs face are indeed highly conducive to problem-solving through techniques and processes that are inspired by the scientific method. In particular, actions taken under conditions of uncertainty often benefit from a scientific approach because entrepreneurs are groping in the dark for ways to profit from emergent technologies that no one understands very well; as for instance, in the early days of rocketry or nanoscale research. Under such conditions, scientific approaches generate valuable learnings for entrepreneurs and society-at-large.

In actuality, however, these sorts of open-ended, unknowable conditions are very rare. Far more typically – as experienced venture founders will attest – entrepreneurs confront conditions characterized by circumstances that are partially knowable and for which an

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entrepreneur's prior experience and the insights of others are relevant and useful, including: competing priorities, resource constraints, unreliable suppliers, broken promises, pesky customers, employee retention, excessive optimism, unforeseeable and uncontrollable events (like the recent pandemic), ethical dilemmas, financial stress, and perhaps most importantly of all: decisions to pivot, persist, or perish/exit. Would entrepreneurs be better off dealing with these various issues using scientific methods? It seems unlikely. In fact, many entrepreneurs might say that behaving as a scientist in the face of these challenges would quickly undermine their ventures. In this sense, the scholarly view that scientific methods have an enormous overlap with entrepreneurial action – or that science and entrepreneurship *should* have an enormous overlap – reveals a deep misunderstanding of both science and entrepreneurship. While there are certainly ways in which science should be more entrepreneurial and entrepreneurship should be more scientific, it is problematic and unnecessary for scholars to link them so tightly together. As an alternative, we propose that entrepreneurs encounter a multitude of knowledge problems, each of which demands unique tools and capabilities – some perhaps scientific, but most patently unscientific.

2. The temptations and travails of EaS

In the field of entrepreneurship, the creation of “future goods and services” (Venkataraman, 1997) through entrepreneurial action (McMullen and Shepherd, 2006; Sarasvathy, 2001) challenges entrepreneurs to venture into unknown futures (Townsend et al., 2018; Townsend et al., 2024), where the consequences of entrepreneurial action cannot be accurately forecasted or known at the time when action is taken (Knight, 1921). Existing entrepreneurship research has addressed the problem of uncertainty through a variety of tools, frameworks, perspectives, and field-level theories (Gans et al., 2019; McMullen and Shepherd, 2006; Packard and Bylund, 2021; Packard et al., 2017; Sarasvathy, 2001, 2009, 2021; Townsend et al., 2018) that provide the means and processes through which entrepreneurs create and cultivate new ventures through entrepreneurial action (Agrawal et al., 2021; Felin and Zenger, 2009; Felin et al., 2019) even when the outcomes of these actions are *a priori* indeterminable (Ehrig and Foss, 2022; Knight, 1921; McGrath and MacMillan, 2000; Ramoglou, 2021).

Recent work by Zellweger and Zenger (2023; hereafter: “Z&Z”) offers important contributions to this research stream through their expansive theorization of “entrepreneurs-as-scientists” (hereafter: “EaS”) in the business venturing process. By integrating contemporary theories of entrepreneurial action under conditions of uncertainty and foundational approaches to pragmatist theory, Z&Z (2023: 380-81) identify how entrepreneurs utilize “distinct categories of ‘scientific’ action to generate the information necessary for them to transform uncertainty into risk” through a “quasi-scientific” process of belief formation, belief testing, and Bayesian response. Z&Z (2023: 390) advance their model to address one of the central problems highlighted in this stream of research; namely, that “there is abundant evidence that entrepreneurs are hesitant to update their beliefs, even in the face of unsupportive data.” This pivot-reluctance, is rooted in “(the) fear that changing direction will cause resource providers to question their capacity as entrepreneurs (McDonald and Gao, 2019) and withdraw their contributions (Hampel et al., 2020).” To overcome these doubts, Z&Z model the process through which entrepreneurs utilize Bayesian rationality to address the tensions between ‘pivoting or persisting’ under conditions of uncertainty (Shepherd and Gruber, 2021). By explicitly prescribing “startup-specific causal logics” (Felin et al., 2024:1) and the aggressive pursuit of A/B experimentation (Koning et al., 2022), the EaS perspective propounds the benefits of a rational, processual course of action.

Yet, the pragmatism-inspired conceptualization of EaS is not without controversy (Ehrig and Foss, 2022; Sergeeva et al., 2022). In reality, decisional states involving uncertainty are messy and ill-structured (Rapp and Olbrich, 2021, 2023), riddled with incomplete information and unpredictable changes to the environment (Townsend et al., 2024). When uncertainty stems from incomplete, but knowable information, pragmatic applications of EaS through Bayesian updating provide useful tools to guide pivot decisions (e.g., Camuffo et al., 2020; Kapoor and Wilde, 2023; Wuebker et al., 2023). However, when decision environments change in unexpected ways, it is often untenable to address these types of uncertainty through scientific classification and analysis grounded in the discovery of natural laws and orderly social structures (Bort et al., 2023; Hunt and Lerner, 2018; Hunt et al., 2022a,b; Wiklund, 2019). Instead, such conditions require entrepreneurs to use their imagination (Hatchuel, 2023; Kier and McMullen 2018), not Bayesian updating, to draw inferences from sparse informational environments (Ehrig and Foss, 2022).

Moreover, uncertainty is not the only knowledge problem (KP) that entrepreneurs confront, nor even the most common (Townsend et al., 2018). Decision environments are also characterized by *ambiguity*, *complexity*, or *equivocality* – in addition to those involving *a priori* irreducible uncertainty (Knight, 1921; McGrath and Macmillan, 2000). These KPs may be impervious to EaS framing, especially when entrepreneurs are entertaining decisions to pivot or persist. If so, then EaS – regardless of whether it is emblematic of quintessentially pragmatic founders (Z&Z, 2022) – is subject to stringent boundary conditions.

The purpose of our study is three-fold: (i.) explaining why the EaS approach is often applicable in the context of uncertainty to address the problems of incomplete information; (ii.) demonstrating how the search-versus-build tension in business venturing may render EaS inapplicable in decisional contexts characterized by ambiguity, complexity, or equivocality; and (iii.) asserting that the KP framework (e.g., Hunt et al., 2023; Townsend et al., 2018; Mitchell et al., 2020; Zack, 1999) provides a robust, veridical approach to establishing boundary conditions concerning when and why EaS is, or is not, a relevant consideration in entrepreneurship theory and practice. To address these issues, we mirror Z&Z's (2023) approach by investigating the front lines of entrepreneurial decision-making – specifically, the decision to pivot or persist.

3. EaS and the pivoting paradox

For both scholars and practitioners, few dimensions of entrepreneurship are more central to the fate of business ventures than the decision to pivot or persist, evidenced by a steadily increasing flow of contributions in the *Journal of Business Venturing* (e.g. Berends

et al., 2021; Fisher et al., 2021; Snihur and Clarysse, 2022) and other prominent outlets (e.g. Grimes, 2018; Hampel et al., 2020; Ries, 2011). Three common themes link these approaches to the pivot, persist, or perish/exit conundrum: (i.) the long shadow of uncertainty; (ii.) the prominent impact of information updating; and (iii.) the presumption of quasi-scientific hypothesis-testing. Z&Z's integrative EaS model coalesces this pragmatic characterization of entrepreneurial action by championing the notion that entrepreneurs create value amidst uncertainty by forming and testing formalized beliefs in "quasi-scientific" fashion. In this decisional landscape, actions related to pivoting or persisting are made manifest by entrepreneurs when they "thoughtfully [craft] a theory amenable to efficient testing and careful feedback interpretation" (Z&Z, 2023: 398).

In the context of *a priori* irreducible uncertainty (Knight, 1921; McGrath and MacMillan, 2000), recent research suggests that business venturing approaches based on Bayesian updating favorably influence learning gains, which consequently lead to superior firm-level outcomes (e.g. Agarwal et al., 2023; Camuffo et al., 2020; Kapoor and Wilde, 2023; Leatherbee and Katila, 2020). Among scholars propounding the EaS perspective, the logic underlying this relationship stems from the manner in which entrepreneurs employ "causally inferential action" by forming and testing beliefs that are continually updated in response to stakeholder feedback, particularly that provided by customers and investors (Z&Z, 2023: 382). Other scholars question the validity and value of Bayesian approaches. Kuechle et al. (2016) present compelling experimental evidence that raises questions about the extent to which entrepreneurs engage in Bayesian updating in response to new information. Ehrig and Foss (2022: 2) push back conceptually on the logic of Bayesian updating, arguing that such processes are limited in the presence of Knightian uncertainty. They go on to argue that "modeling entrepreneurial learning processes using Bayes rule is a highly limited approach, and not the umbrella approach that unifies theory-based learning." Our perspective is that both views raise important insights but that the value of each approach is contingent upon the type of uncertainty – incomplete information or dynamic changes – the entrepreneur confronts in the decision environment. That is, Bayesian updating significantly aids entrepreneurs in addressing the problems of incomplete, but knowable information, but these tools can also lead to failure in the presence of dynamic, unexpected changes.

At the same time, although pragmatic uses of Bayesian updating can lead to failure at the individual level, there can be gains that inexorably emerge at a systemic level. In a fashion analogous to quantum dynamics, surprises and chaos constantly occurring at a micro-level create conditions for value-generating progress at a macro-level (Heracleous, 2013; Overman, 1996). Thus, even in situations where EaS erroneously guides entrepreneurs towards problematic choices, EaS can generate system-wide benefits under uncertain conditions, but the benefits rarely accrue to individual entrepreneurs (Townsend et al., 2018). This, in turn, sets the stage for the "pivot paradox," in which there is a drive to discern causal inferences from sparse information when new, small, resource-constrained firms may have no better than a random chance of choosing correctly (Hunt et al., 2023). Recent work seeking to apply Heisenberg-inspired principles to business decisions (Chen et al., 2022; Shelef et al., 2024), offers an interesting conceptual bridge in this regard, but only if useful boundary conditions can be set concerning EaS.

Z&Z (2023: 383) emphasize that their intention involves advancing "the idea that founders are ideally pragmatists who behave like scientists in search of value." However, as both Ehrig and Foss (2022) and Sergeeva et al. (2022) assert, the applicability of this assumption to theories of entrepreneurial action is subject to numerous caveats. We agree, but for far more broad-based reasons. In our view, the boundary conditions to which EaS is constrained in addressing the question of pivoting or persisting is that it is not entirely clear whether collecting more evidence or information typically resolves the primary epistemic problems faced by the entrepreneurs in the business venturing process (Townsend et al., 2018). As Z&Z (2022 & 2023) highlight in their work, the scientific process should lead to faster, more successful pivoting – when it is warranted – since the entrepreneur's information processing stems from Bayesian learning that should sharpen the accuracy of causal inferences.

The problem with this perspective is that it fundamentally situates entrepreneurial action as seeking a fixed solution to an optimization problem – what Z&Z (2023:384) refer to as the process of "identifying the optimal new resource configuration." This runs the risk of generating both bad science and bad entrepreneurship. As the epigraph from Twilio founder, Jeff Lawson, illustrates, entrepreneurial efforts to strictly follow the evidence gathered through a 'scientific process' may lead entrepreneurs towards a decision path that is undeniably backed by clear information about user preferences, but one that is incompatible with their values and goals. In our view, such pivot concerns reflect a broader array of challenges with stakeholder engagement that entrepreneurs face when confronting other KPs during these early, critical stages in the business venturing process (i.e., ambiguity, complexity, uncertainty, and equivocality – Townsend et al., 2018. Also: Hunt et al., 2023; Mitchell et al., 2020). Accordingly, while Z&Z's theory significantly advances the conversation regarding how entrepreneurs translate uncertainty that is rooted in incomplete information into value,² their exclusive focus on uncertainty limits the veridicality and utility of the scientific approach to entrepreneurship theory and practice.

4. Lean processes and (very) unscientific outcomes

In recent years, entrepreneurship scholars and practitioners – as well as policy makers seeking to promote job growth and economic expansion through business venturing (Gilbert et al., 2004; Smallbone, 2020) – have engaged in a robust and lively debate regarding the relative effectiveness of different frameworks and approaches for equipping entrepreneurs with strategies to navigate uncertain environments (e.g., Eisenhardt and Bingham, 2017; Felin et al., 2019; Gans et al., 2019; McMullen and Shepherd, 2006; Packard et al., 2017; Ries, 2011; Blank and Dorf, 2020; Sarasvathy, 2001, 2009, 2021; Townsend et al., 2018). The EaS characterization is popular because it provides a clear, compelling, and philosophically grounded approach that guides entrepreneurs to formulate and test a series of beliefs in an intendedly rational fashion, under conditions of uncertainty, while continually seeking to obtain

² Practically, we also suspect that many entrepreneurs, such as those highly disposed to impulse-driven action, would certainly benefit at times from attempting to engage the EaS thinking Z&Z propose.

and process new information. The admirable qualities of the EaS approach are also complemented by some empirical evidence that the use of such approaches helps entrepreneurs address the problems of uncertainty. In this sense, EaS corresponds neatly with most prominent theories of entrepreneurial action, including those based on discovery (Kirzner, 1997; Shane and Venkataraman, 2000), creation (Alvarez and Barney, 2007), imagination (Klein, 2008), effectuation (Sarasvathy, 2001), judgment-based decision-making (Foss and Klein, 2012), and design (Berglund et al., 2020; Dimov, 2021) in providing a useful tools for addressing common problems entrepreneurs face in business venturing processes.

These assumptions are mirrored in the practitioner literature by proponents of the lean startup approach, who endorse the perspective that entrepreneurs should engage in a ‘scientific approach’ to creating successful startups through active engagement with customers at the initial stages of new venture creation (Blank and Dorf, 2020; Ries, 2011). At first glance this seems entirely logical. Lean startups combine lean principles, which aim to increase efficiency in production processes, together with customer development, where the central tenets propound the need to reduce waste by eliminating unnecessary research and development (Ries, 2011). As such, lean approaches are heavily reliant upon the outcomes of customer discovery, a process through which entrepreneurs develop testable beliefs concerning profit potential of their respective business models before then seeking to validate (or invalidate) these beliefs through the process of interviewing potential customers (Leatherbee and Katila, 2020). By applying the tools of inductive search, entrepreneurs can swiftly determine whether fit exists between a new venture’s solution and the market’s various needs and desires (Shepherd and Gruber, 2021). Upon receiving disconfirming feedback from would-be customers, lean approaches encourage entrepreneurs to continually pivot until reaching product-market fit, thereby signaling that entrepreneurs are ready to scale their business models in efficacious fashion (Blank and Dorf, 2020).

Though the lean startup framework has enjoyed broad acclamation throughout both the academic and practitioner communities (Leatherbee and Katila, 2020; Shepherd and Gruber, 2021), an increasingly vocal counterpoint poses important questions regarding the viability and effectiveness of lean startup principles and practices under a number of common conditions. This push-back contends that the lean framework does not effectively address key challenges entrepreneurs face in the process of new venture creation (Hampel et al., 2020; Camuffo et al., 2020). For instance, lean production techniques were explicitly developed for incremental improvement of existing processes and products, making this approach a poor match for most entrepreneurs, who are seeking to create value through novel innovations (Felin et al., 2019, 2024). Furthermore, over-reliance on customer feedback actively discourages the formulation of a product vision (Thiel and Masters, 2014; Blank and Eckhardt, 2023), which can lead to short-sightedness and poorly designed trial-and-error feedback loops in product development, causing entrepreneurs to pivot far earlier than necessary (Blank, 2013). Felin and colleagues (2024:1) take an interesting approach to such maladies in arguing for a “scientific method for startups.” The purpose of this, they assert, is to ensure the presence of a more effective “discriminating alignment” between entrepreneurship theories and “the actions they prescribe.” There are important reasons, however, why this is more easily said than done in entrepreneurship. In a speech entitled *The Biggest Mistake I Ever Made*, Jeff Lawson, founder of Twilio, articulates crux of this gap between scholarly theories and the real-world prescriptions that tumble out of them:

“If you go to conferences about technology, about startups, about how to build a business. You learn about all sorts of tools. About being lean, and iterating, and running A/B tests to figure out what your users want. But I think if you solely rely on those tools, and that testing, it won’t necessarily lead you to the right place. A/B testing is great. But if executed to perfection will turn every website into a porn site. And I don’t think that as entrepreneurs, that’s what you set out to do.”

As described by Lawson, it is the very act of designing better experiments (i.e., A/B testing) that is at the root of the problem with scientific methods. Under these conditions, there is a fundamental conflict between values and goals that are motivating the decisions of the entrepreneur and the market evidence being generated through the ‘scientific process.’ In these cases, it is not the knowledge problem of uncertainty that is defining the reluctance of entrepreneurs to pivot towards a porn site. Rather, this reflects the KP of equivocality between the incompatibility of entrepreneur’s vision and the expressed desires of potential customers.

5. Knowledge problems as they actually arise in business venturing

Pivoting reflects a strategic action taken to leverage a new venture’s innovations, which occurs after customer feedback invalidates or violates a business hypothesis, allowing adaptation to new markets and enabling venture survival (Blank, 2013; Hunt, 2013b; Ries, 2011). Despite the central importance of pivoting in the face of disconfirming market feedback, entrepreneurs are often reluctant to update their beliefs, even when faced with insufficient or unsupportive data. Z&Z (2023) highlight several existing arguments that might explain hesitation in pivoting responses, which can be rooted in behavioral biases, the temporal aspects of sensemaking processes, doubts in the quality and sufficiency of evidence that has been accumulated through experimentation and testing of product concepts, or even delayed customer feedback (Chen et al., 2022; Cooper et al., 1988; Kirtley and O’Mahony, 2023). “Composed experiments are,” as Z&Z (2023: 390) note, “often belief-specific and the investments required to build the products and infrastructure necessary to conduct an experiment are lost if the entrepreneur chooses to change course.” Consistent with the foundational rationality assumptions of Z&Z’s model, the next step would ostensibly involve leveraging the scientific process to design and implement better experiments with the goal of improving the quality of evidence that is informing their decisions, thus reducing uncertainty and improving organizational learning (Koning et al., 2022).

But as Sergeeva and colleagues (2022: 692) assert, entrepreneurs do not confront the “unsurmountable epistemological barrier of unknowability” armed only with science, but also with the capacity to act and exert influence upon circumstances, the environment, and the future in addressing a multitude of KPs (Townsend et al., 2018; Zack 1999) through varied human actions and proclivities (Lerner et al., 2018). Often, this involves unusual, unanticipated twists and turns that are rooted in the agentic novelty of entrepreneurial action (Hunt et al., 2022a,b; Townsend et al., 2024), which Pidduck and Tucker (2022) refer to as “unorthodox phenomena,”

and which [Kuura and Sandoval \(2023\)](#) call “the aesthetic of imperfection.” KPs that exist past the boundaries of scientific processes may instead require “meaningful heterodoxies” ([Pidduck and Tucker, 2022](#)) to aptly engage entrepreneurial decisions, actions, and outcomes. Sometimes entrepreneurs do, intentionally or unintentionally, function as pragmatic scientists, but it is rare that business venturing unfolds solely in the context of incomplete, but knowable information ([Hunt and Lerner, 2018](#); [Townsend et al., 2018](#)). This is not to say that uncertainty does not impact the early stages of the business venturing process, but recent research highlights critical questions about the extent to which core models of entrepreneurial action should be designed solely to address the problem of uncertainty through a quasi-scientific paradigm. For instance, [McDonald and Eisenhardt \(2020\)](#) suggest that new ventures engage in “parallel play,” occasionally observing and ‘borrowing’ good ideas from their peers, but mostly engaging in their own venture building process. In these cases, gathering external evidence from customers and competitors only plays a limited role in the venture creation process ([Hunt et al., 2023](#); [Mitchell et al., 2020](#)). If the sole KP with which entrepreneurs must contend is exclusively related to the problem of incomplete information, why would these ventures not exclusively engage in search activities in early business model design decisions, given that observing and mimicking peer rivals can be extremely effective in enabling them to reduce uncertainty by effectively calibrating their beliefs with the external market?

These concerns reflect the distinct but important epistemic challenges posed by the other KPs: ambiguity, equivocality, complexity, and risk ([Mitchell et al., 2020](#); [Townsend et al., 2018](#); [Zack, 1999](#)). Each reflects a distinct but important form of “unknowingness” that entrepreneurs confront in the earliest stages of new venture creation; each with critical differences in the decision logics and stakeholder engagements required to address the underlying issues ([Hunt et al., 2023](#); [Mitchell et al., 2020](#); [Townsend et al., 2018](#)). Based on the issues described above, our central assertion is that the EaS framework ([Z&Z, 2023](#)) is shaped and bounded by the manner in which entrepreneurs necessarily seek resolution for the full complement of KPs, which – aside from uncertainty – are often ineffectual to EaS logics. Accordingly, we propose that in the early stages of new venture creation, the value of gathering more evidence and information is contingent on the critical knowledge problems with which entrepreneurs must contend. There are, therefore, non-ignorable limits to the benefits of the EaS approach. Given the breadth of scholarly attention to the problem of uncertainty in entrepreneurship research ([Townsend et al., 2018](#)), it is worth considering the nature and substance of ambiguity, complexity, and equivocality in this light.

5.1. Ambiguity

Ambiguity refers to what Weick calls the ‘collapse of sensemaking,’ – i.e., the conditions that emerge when people suddenly feel that the world is no longer constituted as a rational, orderly system ([Weick, 1995](#)) – which can be mitigated through the use of inter-subjective agreement ([Townsend et al., 2018](#)). Consistent with this perspective, some entrepreneurs are found to be reluctant to pivot because externally imposed changes or updates to their ideas can result in the entrepreneur questioning their own identity ([Z&Z, 2023](#)). Other studies highlighted by Z&Z suggest that entrepreneurs are hesitant to pivot in response to disconfirming feedback due to fear that their new ventures will lose the support of investors and other key stakeholders (e.g., [Hampel et al., 2020](#); [McDonald and Gao, 2019](#)). For these reasons, entrepreneurs tend, rather irrationally, to have extremely low sensitivity to negative signals, especially when such signals could indicate imminent roadblocks ([Elfenbein et al., 2017](#)).

In the earliest stages of new venture creation, high levels of ambiguity make it extremely difficult to link ideas to performance in a way that can be measured and documented – or scientifically tested. A hypothesis formed at this stage could be incomplete due to this ambiguity, rendering it nearly impossible to deduce clear implications from a scientific approach based on the accumulation of evidence. Goal ambiguity and questions concerning just how much the identity of the entrepreneur or concerns about the extent to which external stakeholders continue to provide social and material support to a new venture do not solely implicate the KP of uncertainty. The entrepreneur may not have a clear or set goal when starting the process of building a venture, but through the process of stakeholder engagement and enrollment, the entrepreneur and stakeholders can reduce goal ambiguity and co-create common goals and objectives through mutual engagement ([Dew et al., 2008](#)). This process of co-constructing new ventures by building social support differs in important ways than gathering evidence through a ‘scientific process’ to address problems of uncertainty ([Saravathy, 2021](#)) and highlights an alternative pathway through which entrepreneurs can address the KP of ambiguity in the venture creation process.

5.2. Complexity

Complexity refers to environmental conditions in which there exists a vast array of decisional factors, intersecting one another in complicated ways that influence potential outcomes. Thus, even under conditions in which the relevant variables might be known, the effects of their various interactions cannot be assessed, which drives unknowingness ([Kauffman, 1993](#)). KPs grounded in complexity emanate from a combination of both detail complexity, which is the multiplicity of variables involved in a problem, and dynamic complexity, which is the multiplicity of the interactions that occur between these variables over time ([Simon, 1972](#); [Townsend et al., 2018](#)). Entrepreneurs who are reluctant to pivot in the face of complexity often choose to adjust temporal commitments by extending timelines, which is viewed as less disruptive than recalibrating relational commitments through pivoting ([Berends et al., 2021](#)).

High levels of complexity exist throughout new venture creation because of the multiple dimensions and interdependencies of the strategic configurations that shape a new venture ([Siggelkow and Rivkin, 2005](#)). Stable environments give a natural advantage to deductive reasoning because business hypotheses can be more clearly disputed or approved in the face of customer feedback. As complexity increases, however, deduction comes under fire due to conflicting external signals or feedback, which eventually break down in the face of bounded rationality ([Agrawal et al., 2021](#)). But competing information and conflicting feedback require synthesis, not hypothesis generation. Complexity is about the identification and/or creation of tools to leverage available resources towards a system-building, organization-enhancing resolution of inter-related dimensions that are spinning out of control ([Townsend et al., 2018](#)).

For example, the early stages of nanoscale technologies in the 1980s and 1990s generated a massive array of design artifacts, for which the relationships between these artifacts were poorly understood (Loveridge et al., 2008). Over the course of a quarter century, tools were developed to better ascertain the relevance and applicability of business models to the emergent technologies stemming from nanoscale properties and phenomena (Cameron and Mitchell, 2007). Start-up performance hinges upon the apt categorization and prioritization the evolving relationships that constitute complex environments (Kirtley and O'Mahony, 2023). For this reason, strategic partnerships can be an effective way for new ventures to remain flexible and responsive to complexity (Larson, 1991) – a strategic response that would have little meaning in facing uncertainty (Hunt et al., 2023).

5.3. Equivocality

Equivocality refers to KPs stemming from the existence of multiple meanings or interpretations (Daft and Macintosh, 1981). Equivocality is a condition for which individuals and firms do not suffer for want of more information, because no amount of new information has the capacity to resolve equivocality, thereby radically differentiating it from uncertainty, for which there is an unquenchable pursuit for clarifying information in the greatest achievable quantity (Townsend et al., 2018). As equivocality increases, additional information gathered through the scientific process is likely to exacerbate, not resolve, the epistemic problem by adding confusing. Furthermore, ethical questions regarding the equivocality of competing values that might inform an entrepreneur's strategic choices could be antecedent or exogenous to the model of scientific entrepreneurship.

In many respects, equivocality poses the most formidable obstacle to the EaS perspective because it involves the contestation to define reality. Often, this involves battles to define science itself, as illustrated by the centuries-long Ptolemaic versus Copernican conceptions of the solar system (Gingerich, 1993); the battle between the Tobacco Institute and U.S. Government concerning the dangers of second-hand smoke (Ong and Glantz, 2000); the political-tinged disputes concerning wearing masks during the recent pandemic (Stephens et al., 2020); and competing technologies in the early stages of cloud computing (Hunt, 2013a). In each of these cases, and countless others, equivocality generates conditions under which no party is more or less convinced by new information. Instead: stasis prevails and then persists for extended periods. Equivocality underscores the extent to which solution sets, dominant designs, business models, and supra-ordinary profits are a function of hegemonic power, not scientific inquiry (Townsend et al., 2018).

In sum, the EaS approach is indeed well-suited to entrepreneurial efforts addressing the problems of incomplete information that are, in turn, endemic to the problem of uncertainty. However, uncertainty is not the KP that entrepreneurs are often confronting. When ambiguity, complexity or equivocality predominates, EaS logics have bounded applicability and must be augmented by alternatives to a strict hypothesis-testing regime.

6. Conclusion: Science, but only in small, targeted doses

Our central premise is that the value and veridicality of the scientific approach to entrepreneurship faces extraordinarily tight boundary conditions. While the process of gathering more information through a scientifically structured process may allow entrepreneurs to address select facets of uncertainty and, at times, complexity, it is less clear whether such approaches can be effectively utilized to address other KPs with which entrepreneurs routinely contend. Ultimately, the “ecological rationality” of any given approach utilized by entrepreneurs must be calibrated to the specific nature of the KPs being confronted (Hunt et al., 2023). In many instances, science is utterly ineffectual to entrepreneurial circumstances. This is likely to become an even bigger challenge in the years to come. Further exploration is essential for the field to provide clarity regarding the effective range and impact of different systematic approaches to entrepreneurial action, especially in light of dynamic changes to the decisional landscape through the escalating presence and impact of artificial intelligence (Shepherd and Majchrzak, 2022; Townsend and Hunt, 2019; Townsend et al., 2024).

To be clear, we applaud Z&Z (2023) for work that takes material steps towards bridging persistent gaps between scholarship, practice, and policy by formulating a pragmatic process of entrepreneurial action. We learned much from their careful and deliberate approach and see substantial benefits in the broader effort to build and enhance systematic models of entrepreneurial action. At the same time, we believe such efforts are significantly constrained and at least partially undermined by approaches that do not account for the full array of KPs confronting entrepreneurs. EaS is a seductive notion to some scholars because it attempts to return entrepreneurial action theory to the doorstep of omnibus strategic management frameworks, but it is unwise to eschew the past twenty-five years of entrepreneurship research in doing so. For us, the task at hand is clear: build upon the important work of Z&Z and others to explore how entrepreneurs can utilize and engage in systematic processes to address all the various KPs throughout the business venturing process. In small, targeted doses, EaS will be a relevant and effective facet of the entrepreneurial toolbox.

CRedit authorship contribution statement

Richard A. Hunt: Writing – review & editing, Writing – original draft, Project administration, Conceptualization. **David M. Townsend:** Writing – review & editing, Writing – original draft, Conceptualization. **Daniel A. Lerner:** Writing – review & editing, Writing – original draft. **Katrina M. Brownell:** Writing – review & editing, Writing – original draft.

Declaration of competing interest

Individually and collectively, the authors have no conflicts to declare concerning any facet of this manuscript.

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