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COMMENTARY

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Unleashing the value of a "scientific approach" to entrepreneurship: Building an empirical research agenda

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Abstract

Research Summary: In this manuscript, we argue that the Entrepreneurs-as-Scientists (E-a-S) research program requires a fundamental shift from predominantly conceptual development toward an empirical agenda to achieve its normative goal: developing a scalable algorithm that improves entrepreneurial learning and value creation. The E-a-S approach prescribes that entrepreneurs learn by articulating causal theories, testing them, updating their beliefs, and revising their theories. We identify three risks of continued emphasis on conceptual development: overlooked complementarities, insufficient attention to boundary conditions, and potential overprescription based on limited evidence. We propose an empirical research agenda, as well as specific topics within it, to ground the E-a-S approach in systematic evidence, advancing a research program that is as

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rigorous in its methods as the entrepreneurial practices it seeks to improve.

Managerial Summary: This manuscript examines a growing approach that encourages entrepreneurs to think and act like scientists—by clearly articulating assumptions, testing them through experiments, updating beliefs, and refining their strategies. The goal is to develop a reliable, scalable method that improves how entrepreneurs learn and create value. However, current insights and ongoing research projects predominantly focus on conceptual work. We highlight three practical risks of such a focus: missing complementarities, overlooking when the learning method works best, and applying it too broadly without sufficient validation. We suggest that entrepreneurs use this approach flexibly since it was not designed to be a fixed formula. Ongoing research will clarify how to adapt it across contexts, helping entrepreneurs make more informed, disciplined, and effective strategic decisions.

KEYWORDS
decision making, entrepreneurial education, entrepreneurial learning, scientific method, uncertainty

1 | INTRODUCTION

Over the recent years, the "Entrepreneur-as-Scientist" (E-a-S) approach has emerged as a distinctive perspective to examine how entrepreneurs can learn and thrive when creating, developing, and transforming their ideas into an entrepreneurial venture (Camuffo et al., 2020; Felin, Gambardella, Novelli, & Zenger, 2024; Felin, Gambardella, & Zenger, 2024; Zellweger & Zenger, 2023). With its roots in an early piece on how entrepreneurs act as "theorists" (Felin & Zenger, 2009), this line of work advances a normative claim: entrepreneurs can benefit by adopting a learning "algorithm" (Minniti & Bygrave, 2001) that resembles the scientific method (Camuffo et al., 2020). Such an algorithm comprises the articulation of theories of value grounded in the observation of reality and causal reasoning, their systematic testing through experimentation, and their refining or discarding before ultimately committing to hard-to-reverse choices. Following a first set of field experiments which provided the early empirical support for the E-a-S approach (Camuffo et al., 2020; Camuffo, Gambardella, Messinese, et al., 2024), a sometimes contentious body of conceptual work has followed and iteratively challenged, updated, and refined its usefulness and foundations (Blank & Eckhardt, 2024; Ehrig & Foss, 2022a, 2022b; Leatherbee & Katila, 2020; Sergeeva et al., 2022; Shepherd & Gruber, 2021; Zellweger & Zenger, 2022a, 2023). Considering that this initial fast-paced and uncoordinated research suggested the E-a-S approach was a valuable line of inquiry within strategic entrepreneurship, we—as researchers deeply invested in developing and furthering the E-a-S approach—believe it is timely to structure the most critical pathways to nurture the E-a-S research program.

Our main argument is that while the first phase of research on the E-a-S approach has concentrated on conceptual questions about the epistemological foundations of the approach and their implications for its usefulness

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(Ehrig & Foss, 2022a, 2022b; Felin, Gambardella, Novelli, & Zenger, 2024; Sergeeva et al., 2022; Zellweger & Zenger, 2022a, 2022b, 2023), refocusing the next phase of the research program on empirical work is critical in order to achieve its primordial *normative* intent. As we understand it, such intent is the creation of a *scalable* algorithm for entrepreneurial learning and decision-making that can increase entrepreneurs' potential to create economic value *relative to a scenario in which entrepreneurs rely only on alternative algorithms for learning and decision-making*.

After a brief overview of the conceptual research which dominated the early-stage debate about the E-a-S approach, we expand on three reasons that drive the need to refocus the E-a-S research program toward empirical research: (1) the risk of missing complementarities that could improve validate or challenge the E-a-S algorithm, (2) the risk of failing to comprehend limitations to its impact at scale, and (3) the risk of overprescription relative to alternative algorithms for entrepreneurial learning and decision-making. Ultimately, as the arguments articulated in this paper target scholars interested in initially engaging with the E-a-S approach, we also highlight emerging research on the E-a-S approach and offer promising areas for empirical inquiry yet to be developed. In so doing, this essay suggests a structure for the program's future scholarly direction while inviting proponents (and critics) of the approach to engage in an evidence-oriented academic debate about its usefulness (or lack thereof).

2 | EARLY-STAGE E-A-S RESEARCH: A CONCEPTUAL QUEST ON USEFULNESS

2.1 | The E-a-S as an algorithm for entrepreneurial learning and decision-making

Tracing its intellectual roots to earlier work that conceptualized entrepreneurs as active theorists about business opportunities and the value of resources (Felin & Zenger, 2009), the E-a-S approach maintains that entrepreneurs can benefit from "behaving as scientists" when developing, evaluating, and making decisions about their early ventures (Camuffo et al., 2020; Zellweger & Zenger, 2022a).[1]

The E-a-S approach is a normative "algorithm" (Minniti & Bygrave, 2001; Valentine et al., 2025) for entrepreneurial learning and decision-making in which theorizing complements experimentation. Specifically, the E-a-S algorithm relies on four interrelated components—theories of value, beliefs, hypotheses, and experiments—that together drive entrepreneurial learning and decisions. *Theories of value* are forward-looking causal representations that articulate how a venture is expected to create and capture value, specifying how a set of hypothetical actions and conditions are causally related and believed to generate future (desirable or even undesirable) outcomes (Camuffo, Gambardella, & Pignataro, 2024; Ehrig & Schmidt, 2022; Felin & Zenger, 2009, 2017; Sorenson, 2024). These theories provide coherence in decision making by organizing complex and uncertain environments into a structured causal logic.[2] *Beliefs* reflect the entrepreneur's subjective assessment of the plausibility of the possible future outcomes under their theory of value, of its underlying assumptions, and of its causal relationships. Theories of value and beliefs are specific to an entrepreneur, as it is assumed that even in conditions of symmetric information, distinct entrepreneurs may envision different future states of the world, conceptualize different assumptions and causal relationships leading to them, and attribute different likelihoods over any of these components.[3] Furthermore, beliefs are not static; they are provisional assessments which are revised through the disciplined deployment of the E-a-S algorithm. *Hypotheses* translate theories of value and associated beliefs into specific, testable conjectures. They identify which assumptions or causal links are most critical to the theory's validity and therefore merit scrutiny, thus helping entrepreneurs prioritize what to test considering resource scarcity and the expected value of new information. Lastly, *experiments* are the primary mechanism through which evidence is generated to evaluate hypotheses. They encompass a broad set of practices, from formal experiments to structured data collection, designed to produce *novel* information to revise beliefs associated with the entrepreneur's theory of value. By making the process of belief revision explicit—about both the target outcomes and the theory itself—the E-a-S algorithm advances systematic learning via a combination of theorizing and experimentation.

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The E-a-S algorithm guides entrepreneurial learning and decision-making through four iterative steps. First, entrepreneurs compose theories of value—conceptual causal structures—about how their businesses would create or capture value, forming beliefs about them. Second, entrepreneurs design and conduct "experiments" to learn about their predicted outcomes (based on their theories) and about their theories themselves. Experimentation allows them to obtain information about the theorized relationships between actions, conditions, and outcomes. Third, entrepreneurs use the information collected during their experiments to revise their beliefs about both the expected outcomes *and* the plausibility of their theories. Lastly, such revision leads entrepreneurs not only to modify their assessment of their business ideas but also to adjust, completely reimagine, or even discard their theories of value.

2.2 | The early conceptual debate over the "usefulness" to the E-a-S approach

Apart from an early set of experimental studies testing the performance consequences of training entrepreneurs in the E-a-S algorithm (Agarwal et al., 2025; Camuffo et al., 2020; Camuffo, Gambardella, Messinese, et al., 2024; Novelli & Spina, 2024), the initial scholarly engagement with the E-a-S approach was marked by ongoing debates about its epistemological foundations and, relatedly, its "usefulness" in supporting entrepreneurial decision-making.

These debates started with a question about whether the E-a-S approach overreaches by promoting a particular decision-making logic without explaining observed entrepreneurial behavior (Sergeeva et al., 2022). In response, while a positive research agenda about whether entrepreneurs already behave as scientists could have merit (Zellweger & Zenger, 2022a), proponents clarified that E-a-S is explicitly *normative in intent and pragmatic in orientation* (Camuffo, Gambardella, Messinese, et al., 2024; Felin, Gambardella, & Zenger, 2024). It posits that (1) entrepreneurs are individuals who attempt to find solutions to a concrete problem of starting a successful venture in terms of its economic performance, (2) entrepreneurial success depends on the set of practices adopted by the founder and/or the founding team, as well as their knowledge, and (3) scholars are particularly well-placed to propose, study, and validate which practices and knowledge would enable entrepreneurs to solve their problems. Thus, rather than claiming that entrepreneurs naturally behave like scientists, scholars who initially promoted the E-a-S approach asked whether entrepreneurs would benefit from learning and adopting its "algorithm" to improve their economic outcomes (Camuffo et al., 2020; Camuffo, Gambardella, Messinese, et al., 2024; Valentine et al., 2025; Zellweger & Zenger, 2023).

Considering its pragmatic and normative foundation, a natural question that followed was about the usefulness of the approach to entrepreneurs. As the E-a-S approach enables entrepreneurs to learn about endogenously created causal theories tested through experimentation, its usefulness was questioned because entrepreneurs tend to deal with "unknown unknowns" (Ehrig & Foss, 2022a, 2022b), for which any form of disciplined belief revision is hard if not impossible. The contention was that the E-a-S approach would offer only little to no guidance on how entrepreneurs form beliefs in the absence of prior data or when unforeseen contingencies emerge.

This important criticism motivated several conceptual reflections about whether and to what extent the E-a-S approach can be useful in dealing with "unknown unknowns" (Valentine et al., 2025; Zellweger & Zenger, 2022b, 2023). These reflections clarified that the E-a-S approach cannot be reduced to Bayesian learning within a fixed mental representation (Agrawal et al., 2026) just as the scientific method cannot be reduced to the application of Bayes' rule in the process of scientific inquiry and discovery. Rather, the E-a-S approach can be understood as "deep" learning that encourages entrepreneurs to revise not only their beliefs about a target outcome within a given theory, but also to question and reconstruct theories of value (Karni, 2022; Valentine et al., 2025). In this sense, conceptually, the E-a-S approach is compatible with, and complementary to the creative and imaginative process entrepreneurship research maintains as necessary when dealing with unknown unknowns (Patvardhan & Ramachandran, 2020; Rindova & Martins, 2024; Schilling, 2018).

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Furthermore, the E-a-S approach posits that entrepreneurs should recognize that their theories may be mis-specified, incomplete or wrong; it also explicitly maintains that entrepreneurs should remain open to unanticipated events that could reshape their theories (Camuffo, Gambardella, Messinese, et al., 2024).[4] Thus, the algorithm put forth by the E-a-S approach could support entrepreneurs in explicitly acknowledging and deliberately engaging with theory mis-specification, unexpected events and discontinuous learning (Camuffo, Gambardella, & Kazemi, 2025).

Other reflections on the usefulness of the E-a-S approach emerged from comparisons against the "lean startup approach," or from statements about its "oversimplification" of the entrepreneurial process. From the first perspective, although both the lean startup and the E-a-S approach emphasize learning through experimentation, these approaches have fundamental differences in the underlying assumptions about rationality, learning, and the source of entrepreneurial advantage (Felin et al., 2020; Felin, Gambardella, Novelli, & Zenger, 2024; Leatherbee & Katila, 2020). Lean startup is grounded in bounded rationality, portraying entrepreneurs as facing severe cognitive and informational constraints and therefore learning primarily through action, customer engagement, and rapid iteration (Blank & Eckhardt, 2024; Contigiani & Levinthal, 2019). In this view, experimentation is designed to resolve customer information asymmetries by uncovering pre-existing but initially unknown preferences and demand conditions. By contrast, the E-a-S approach is rooted in generative rationality, which emphasizes entrepreneurs' capacity to formulate novel, forward-looking causal theories about how value might be created under uncertainty (Felin & Holweg, 2024). Accordingly, the E-a-S approach centers on causal reasoning and awareness or belief asymmetries rather than information asymmetries: entrepreneurs differ from others in the contrarian beliefs they hold about possible future states of the world. These beliefs motivate problem formulation and the articulation of a theory of value prior to experimentation. Experiments, in turn, do not substitute for theory but are guided by it, serving to discipline, refine, or falsify articulated causal conjectures rather than merely accelerating convergence toward observed customer feedback.

From the second perspective, it has been posited that the E-a-S approach, as an algorithm based on theorizing and testing, would reduce a complex, imaginative, and judgment-laden entrepreneurial process to a procedural routine (Dimov, 2024). However, the E-a-S approach does not constrain imagination or stifle novelty per se. Rather, it effectively relies on heterogeneous, idiosyncratic theories of value as the source of entrepreneurial advantage (Felin & Zenger, 2009, 2017). In this way, the algorithm disciplines and supports how imaginative conjectures are evaluated and acted upon, rather than prescribing their content (Felin et al., 2021).

Beyond clarifying its conceptual distinctiveness, the E-a-S research program has also begun to codify and make available a set of practitioner-oriented tools that translate its prescriptions into concrete decision-making activities. This support is distributed across the components of the E-a-S approach: tools that help entrepreneurs articulate and structure theories of value by identifying key attributes and their causal connections (e.g., the story tree canvas, causal directed acyclic graphs, and the theory map); tools that guide the derivation of focused, falsifiable, and prioritized hypotheses from those theories; and tools that connect hypotheses to appropriate evidence-gathering techniques (Coali, Novelli, et al., 2024). Underlying these instruments is a common set of design principles intended to support the aforementioned steps that define the approach (i.e., theorizing, experimentation, belief updating, and theory revision).

Within this broader toolkit, the "Value Lab" illustrates this orientation particularly well in the theory-development phase (Felin et al., 2021; Felin, Gambardella, Novelli, & Zenger, 2024). In contrast to lean startup frameworks—such as the Business Model Canvas, which emphasizes a "static" business model which can be adapted iteratively via rapid customer engagement and adaptation based on observed feedback (Blank & Eckhardt, 2024)—the Value Lab foregrounds theory as the focal object of learning. It provides some structure to the development and evaluation of theories of value by entrepreneurs, where experimentation is explicitly organized around articulated causal (and potentially contrarian) conjectures, beliefs, and "if-then" statements to be tested. Importantly, this framework presumes that entrepreneurs begin with imaginative, contrarian conjectures about how value might be created and captured, conjectures that cannot be inferred directly from existing market data (Felin, Gambardella, Novelli, & Zenger, 2024).[5]

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As proponents of the approach, we believe that these early conceptual debates were a necessary first phase in the development of the E-a-S research program and in building momentum to advance research on it. However, as we argue next, their primordial focus on the usefulness of the approach and the normative intent of the E-a-S approach leads us to argue that an evidence-oriented refocus of the E-a-S research program is better suited to advance it and resolve unsettled questions.

3 | THE NEED FOR AN EVIDENCE-ORIENTED REFOCUS TO E-A-S RESEARCH

Entrepreneurial success is often attributed to how uniquely able a founder or founding team is at iteratively tailoring solutions to market needs (Leatherbee & Katila, 2020; Shepherd & Gruber, 2021), or at adaptively connecting with and catering to key stakeholders (Sarasvathy, 2001, 2008). Yet individuals possessing exceptional foresight or creative vision are rare, and capabilities for managing distinct stakeholders are costly to build and difficult to scale. This is precisely the dilemma that motivated one of the foundational pieces on the E-a-S approach (Camuffo et al., 2020): could there be a routine or protocol that *systematically* improves the decisions of a *broad population* of entrepreneurs, rather than relying on traits concentrated in a fortunate few? Posed this way, the approach's central promise is inherently empirical—it is a claim about whether a teachable practice raises entrepreneurial performance at scale—and is therefore one that conceptual argument alone cannot settle.

Acting on this premise, we—together with our network of coauthors—have designed multiple field experiments to test the implications of teaching the E-a-S approach to early-stage entrepreneurs (Agarwal et al., 2025; Camuffo et al., 2020; Gambardella, Messinese, et al. 2024; Camuffo, Gambardella, and Pignataro 2024; Camuffo, Gambardella, and Kazemi 2025; Coali, Gambardella, & Novelli, 2024; Gagliardi & Novelli, 2024; Gambardella & Messinese, 2025; Novelli & Spina, 2024; Valentine et al., 2024). These experiments, summarized in Table 1, first sought to establish a main effect of training entrepreneurs in the E-a-S approach and have more recently begun to probe its boundary conditions and its performance relative to alternative learning algorithms.

Despite this start, and viewed from the vantage point of our own empirical work, the program's center of gravity has shifted away from the practical, scalable ambition that first motivated it. The early conceptual debates—an unintended, if intellectually generative, byproduct of that ambition—have come to dominate, while empirical work that engages the E-a-S approach specifically remains the exception. The pattern is visible even within the program's own home territory: in a recent special issue on the theory-based view, only three of 11 pieces were empirical (Csaszar et al., 2024; Ott & Hannah, 2024; Valentine et al., 2024). The gap is not a shortage of evidence on entrepreneurial experimentation as such—a substantial literature examines how young ventures experiment, and a recent integrative review documents that much of it is already systematic and "scientific" in orientation (Corbo et al., 2026). Rather, that literature has developed largely in parallel to the E-a-S program and has rarely tested its *distinctive* prescription: the combination of explicit theory articulation with disciplined experimentation and belief revision. Given the pragmatic and normative intent of the approach, this scarcity is consequential. We see three risks of failing to reorient the E-a-S research program toward empirical research.

3.1 | The risk of missing *complementarities* to improve and (in)validate the E-a-S approach

At the core of the E-a-S approach is the codification of an algorithm to be taught and transferred to entrepreneurs, who would then incorporate it as a "practice" for learning about the value of their early-stage business ideas (Camuffo et al., 2020; Camuffo, Gambardella, Messinese, et al., 2024). Such a practice enables creative founders, who may lack above-normal intuition, to iterate with the market and hone their ideas before making commitments

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TABLE 1 Summary of published papers testing the implications of training entrepreneurs in the E-a-S approach.

Papers	Comparison of interest	Countries and sample	Research design	"E-a-S" treatment	Main finding(s)
Camuffo et al. (2020, MS)	E-a-S versus "absence" of E-a-S (main effect)	Italy (Milan-2016); 116 entrepreneurs	Single two-arm RCT	Training incorporating frameworks to develop and experiment on theories and hypotheses	Treated startups had higher likelihood of termination (+3.5p.p., $p = 0.045$), higher likelihood of "radical" pivots (+1.6p.p., $p = 0.033$), and higher cumulative revenue from the beginning of the training until measurement (+2666 euros winsorized at 99%, $p = 0.008$)
Camuffo, Gambardella, Messinese et al. (2024, SMJ)		Italy (Milan-2016; Milan-2017; Turin-2018), UK (London-2019); 759 entrepreneurs	Four two-arm RCTs		Treated startups had higher likelihood of termination (+9.8p.p., $p = 0.001$), no precise effect on likelihood of "radical" pivots (−5.3p.p., $p = 0.486$), but higher likelihood of pivoting only once (+8.3p.p., $p = 0.003$) or twice (+3.7p.p., $p = 0.001$) relative to not pivoting at all or pivoting three times or more, and higher cumulative revenue from the beginning of the training until measurement (+6999 euros, $p = 0.008$)
Coali, Gambardella, & Novelli (2024, RP)		Italy (Milan-2017; Turin-2018); 382 entrepreneurs	Two two-arm RCTs		Shows that the documented increased likelihood of project termination by "scientific" entrepreneurs is associated with higher accuracy in recognizing project value. "Scientific" entrepreneurs are quicker in adjusting their expectations on project value downward before making the termination decision. It also shows that "scientific" entrepreneurs generate a higher number of new ideas, and a higher proportion of their projects culminate in the launch of a venture
Valentine, Novelli & Agarwal (2024, SS)		UK (London-2019); 261 entrepreneurs	Single two-arm RCT complemented by qualitative data		Treated start-ups report higher levels of theorization and experimentation (based on scores computed from interview transcripts), and these scores were individually negatively correlated with entrepreneurs radically pivoting exactly once (conditioning on having at least one

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TABLE 1 (Continued)

Papers	Comparison of interest	Countries and sample	Research design	"E-a-S" treatment	Main finding(s)
					pivot), whereas their interaction was positively correlated with having exactly one radical pivot
Novelli & Spina (2024, SMJ)	E-a-S effect versus "absence" of E-a-S (moderation assessment)	UK (London-2019); 261 entrepreneurs	Single two-arm RCT		Treated startups did not have higher or lower log-cumulative revenue (+1) from the beginning of the training until measurement (−0.119 log-revenue, $p = 0.459$). However, treated startups with higher (lower) pre-training level of business development had higher (lower) log-cumulative revenue (+1) than their control counterparts. Qualitative interviews suggest that those with higher level of business development used the E-a-S approach to fine-tune their theories of value
Gagliardi & Novelli (2024, Org Sci)		Italy (Milan-2017; Turin-2018), UK (London-2019); 172 female entrepreneurs	Single two-arm RCT		Female entrepreneurs who develop a value proposition targeting female consumers as a case of user entrepreneurs, when treated 'scientifically', pivot more radically their initial ideas and have better performance in launching and sustaining their ventures
Agarwal et al. (2025, Org Sci)	E-a-S versus alternative decision-making algorithm	Tanzania (Morogoro, Pwani, Dar Es Salaam-2021); 151 entrepreneurs	Single three-arm RCT (control group excluded from main analysis)	Training focused on creating a unique theory of value and then on experimentation to test it versus training focused on rapid experimentation	No difference in termination in start-ups across groups, higher cumulative revenues and profits from the beginning of the training until measurement (+1548 dollars in revenue winsorized at 99%, $p = 0.148$; +1494 dollars in profits winsorized at 99%, $p = 0.008$), higher likelihood of introducing core and operational changes (+21p.p., $p = 0.08$) but reduced likelihood of introducing only core changes (−13p.p., $p = 0.07$) and no difference in operational changes only or no changes

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TABLE 1 (Continued)

Papers	Comparison of interest	Countries and sample	Research design	"E-a-S" treatment	Main finding(s)
Camuffo, Gambardella & Jannace (2025, CEPR)		China, Colombia, India, Italy, Netherlands, Spain, Tanzania, UK; 1556 entrepreneurs	Eight three-arm RCTs		The theory component of the scientific approach is comparatively more important than the experimentation component. Theory and experiment-trained entrepreneurs achieve 1.7 times as high cumulative sales growth and employee productivity relative to experiment-only trained entrepreneurs. Instrumental-variable estimates confirm that theory-based causality drives these gains, whereas pure experimentation offers no significant short-term benefits
Gambardella & Messinese (2025, Org Sci)		Italy (online-2020); 308 entrepreneurs	Single three-arm RCT	Training on frameworks to develop and experiment on theories and hypotheses versus training on effectuation frameworks versus general training	Both E-a-S and effectuation reduce the cumulative information obtained by the entrepreneurs relative to the control group (−0.038 and −0.034, respectively, on a self-reported 0–1 scale, both with $p < 0.05$), E-a-S increased the likelihood of termination (+6.4p.p., $p < 0.05$), whereas effectuation decreased it (−5.3p.p., $p < 0.1$) relative to the control group

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that could prove detrimental to the long-run survival of a venture (Coali, Gambardella, & Novelli, 2024; Novelli & Spina, 2024). Understanding the E-a-S approach as a "practice" that entrepreneurs use to learn and support decision-making aligns with the recent stream of research examining the relationship between structured management practices—the array of activities that managers adopt to execute their required tasks—and organizational performance (Bloom et al., 2012; Scur & Wolfolds, 2024). These studies, which are mostly empirical, focus on practices that are implementable and potentially transferrable to organizations (Bloom et al., 2013; McKenzie & Woodruff, 2017) and on how heterogeneity in their adoption explains performance differences across firms (Bloom et al., 2012; Teodorovicz et al., 2023). In its simplest form, following the E-a-S approach is a potentially valuable practice for entrepreneurs when starting their ventures.

The analogy between the E-a-S approach and structured management practices is useful to understand the substantive risk of not empirically refocusing the E-a-S research program. A large body of research in economics and strategy has shown that performance gains rarely arise from isolated practices, but from cohesive systems of complementary practices whose value depends on how they are combined, sequenced, and embedded within organizations (Bloom & Van Reenen, 2007; Milgrom & Roberts, 1995; Porter, 1996). Interpreting the E-a-S approach as a structured practice raises analogous questions that cannot be resolved conceptually alone, such as how entrepreneurs innovate around the algorithm by integrating complementary practices and how such complementarities amplify or attenuate its value as ventures evolve. For instance, entrepreneurs could consider integrating open innovatiion practices (Laursen & Salter, 2006) to contribute to a firm's ability to leverage external knowledge, facilitating a more comprehensive and rapid approach to problem-solving. As the entrepreneurial firm scales, there could also be innovations in terms of the organizational structure adopted in ways to promote knowledge integration and facilitate theory building. Without systematic empirical inquiry, the research program risks underdelivering on its normative promise, leaving unexplored how entrepreneurs might actively design surrounding practices to enhance theory building, testing, and updating.

A second, closely related risk concerns human capital. Management scholarship has shown empirically how human capital is a critical determinant for the adoption of structured management practices (Bloom et al., 2012; Teodorovicz et al., 2023), and entrepreneurship literature has also studied which types of human capital can improve the performance of entrepreneurial firms (Campbell et al., 2017; Gruber et al., 2024). Particularly within the context of entrepreneurial firms, research theorizes (and importantly, empirically tests) which skills entrepreneurs should attempt to develop, why they could benefit from acquiring them, when and how to deploy them, and how to compensate for valuable skills they do not possess (Campbell et al., 2017; Unger et al., 2011). From this perspective, empirical evidence is critical to an effective prescription of the E-a-S approach to entrepreneurs due to its nature as a potential general skill that—once combined with the unique creativity, goals, and complementary skills from entrepreneurs—can create firm-specific value via unique theories of value (Camuffo, Gambardella, & Pignataro, 2024; Felin & Zenger, 2009; Ployhart et al., 2014; Ray et al., 2023). Specifically, knowledge of the E-a-S approach can be conceptualized as a "meta skill" that is broadly applicable across industries—thus representing a form of general human capital (Campbell et al., 2012; Teodorovicz et al., 2024)—and that essentially entails disciplining the use of a series of other complementary skills that an entrepreneur may possess to develop, test, and update theories of value. These complementary skills could entail creativity, causal reasoning, and even data analysis. Absent empirical evidence on skill complementarities and mismatches, there is a danger of misattributing failures of implementation to flaws in the approach itself, rather than to poor alignment between entrepreneurs' human capital portfolios and the demands of disciplined theory-based decision making. Furthermore, this concern is particularly acute from a strategic entrepreneurship perspective because a distinguishing feature of the E-a-S approach is its suggestion that entrepreneurs create *unique* theories of value which may not be shared by other entrepreneurs (Felin, Gambardella, & Zenger, 2024). Thus, a related and primordial empirical question that remains to be addressed is "which are the skills that effectively enable entrepreneurs to obtain *firm-specific advantages* in their new ventures when deploying their general skill of structuring learning via the E-a-S approach?"

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Finally, neglecting an empirical refocus risks freezing E-a-S in an early configuration, despite early empirical evidence that returns to training varying depending on which part of the algorithm is prioritized (Agarwal et al., 2025; Valentine et al., 2024). Thus, promoting continuous improvement to the E-a-S approach depends on empirical research assessing alternative "playbooks" to implement it, and even the impact of new tools associated with it—such as the Value Lab (Felin et al., 2021; Felin, Gambardella, Novelli, & Zenger, 2024). Ultimately, without sustained empirical attention to potential complementarities to it and ways to continuously improve the implementation of the E-a-S approach, the research program risks remaining conceptually persuasive but ultimately unable to guide entrepreneurs systematically toward building unique and high-performing new ventures.

3.2 | The risk of failing to comprehend *Limitations* to its impact at a scale

Another risk of failing to expand the empirical basis of the E-a-S research program is over extrapolating the early-stage research findings. Evidence from completed replications suggests that core findings are robust (Camuffo, Gambardella, Messinese, et al., 2024; Coali, Gambardella, & Novelli, 2024). Moreover, this evidence documents pervasiveness also across industries, as ventures taking part in these studies ranged from agriculture and food services to health, education, urban mobility, and social ventures. Thus, a distinctive strength of the E-a-S agenda has been the early-stage investment in assessing whether the benefits of training entrepreneurs to behave "scientifically" travel across countries (see Table 1).

However, the accumulating early evidence also indicates that the effectiveness of the E-a-S approach is contingent on individual- and firm-level conditions. For example, the likelihood of radical pivots following an E-a-S training varied depending on whether the business value proposition was aligned with entrepreneurs' gender (Gagliardi & Novelli, 2024), the degree of business model maturity (Novelli & Spina, 2024), or the joint engagement in theorizing and experimentation (Valentine et al., 2024). Furthermore, ongoing work also highlights how recency of training, depth of absorption, and entrepreneurs' ability to engage in parsimonious theorizing shape E-a-S training effect on revenue generation (Jannace & Camuffo, 2023). These results suggest that, absent a more systematic engagement with empirical research, there is a substantial risk of overlooking additional firm-level and entrepreneurial-level conditions that limit the efficacy of the E-a-S approach, such as settings characterized by acute time pressure or when entrepreneurs lack complementary skills that allow theory-based reasoning to be effectively translated into coordinated action.

Moreover, if the research program does not continue to broaden empirically to incorporate the context where entrepreneurship takes place, this growing body of evidence risks being overinterpreted and the impact at scale of the E-a-S approach may be overestimated. A large literature in strategy and entrepreneurship demonstrates that entrepreneurial behavior and performance are deeply shaped by formal institutions (e.g., regulation, property rights, bankruptcy regimes) and informal institutions (e.g., norms, beliefs, cultural attitudes toward risk and failure) (Armanios et al., 2017; Eesley et al., 2018; Kleinhempel et al., 2023). Differences in institutional environments could shape not only the costs of failure (Eberhart et al., 2017), but also the extent to which skills building is rewarded relative to stakeholder engagement (Armanios et al., 2017). Cultural heterogeneity further compounds these effects, as durable and intergenerationally transmitted cultural dispositions may shape tolerance for uncertainty and even willingness to revise prior commitments (Kleinhempel et al., 2023), both elements which are critical for deploying the E-a-S approach. In institutional settings misaligned with the principles of disciplined theorizing and testing, the E-a-S approach may fail to translate into performance advantages not because it is flawed per se, but because the surrounding institutional environment undermines its use.

Even beyond these macro-level institutional and cultural forces, a complementary source of boundary conditions that needs to be examined empirically lies in the ecosystem of supporting entrepreneurial organizations that shape entrepreneurs' skill backgrounds prior to and during venture creation. Universities, training programs, accelerators, incubators, and other intermediaries are critical in providing skills for entrepreneurs to thrive (Armanios et al., 2017;

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Chang & Assenova, 2026; Eesley & Lee, 2021). As discussed earlier in the commentary, skills may play a central role in shaping entrepreneurs' human capital and condition the value of deploying the E-a-S approach. In ecosystems that reward (or where training emphasizes) action without reflection or commitment without systematic experimentation, entrepreneurs may not possess the required skills or incentives to deploy the E-a-S approach effectively.

Finally, there is a meta-level risk in the current trajectory of the early-stage empirical work on the E-a-S research program. Much of the existing empirical evidence on the E-a-S approach has emerged from a relatively concentrated group of scholars—including some of the authors. Although this work has deliberately pursued geographic breadth, intellectual concentration may constrain the range of boundary conditions considered. Broadening the empirical turn to include a wider set of researchers, institutional settings, and training ecosystems would not merely increase replication; it would expand the research program's capacity to identify novel contingencies, alternative complementarities, and limits to applicability. Without such diversification, the E-a-S research program risks overstating its scalability or misattributing failures of implementation to the approach itself, thereby constraining its potential to inform entrepreneurial practice and policy at scale.

3.3 | The risk of *Overprescription* relative to alternative entrepreneurial learning algorithms

The final risk we see in failing to broaden the empirical research program on the E-a-S approach is a potential tendency to overprescribe it relative to alternative entrepreneurial learning algorithms. As the E-a-S framework has gained visibility, it risks being interpreted by researchers studying it as a generally dominant model of entrepreneurial learning. Such an interpretation would be at odds with distinct approaches that embody fundamentally different epistemological tasks and ontological premises, and are therefore suited to different learning problems rather than interchangeable substitutes.

From a learning perspective, entrepreneurial approaches can be understood as calibrated algorithms that structure how entrepreneurs address gaps in knowledge under uncertainty. Recent syntheses highlight at least four such algorithms beyond the E-a-S approach: Effectuation, Simple Rules, Lean Startup, and the Entrepreneurial Strategy Compass (Corbo et al., 2026; Leatherbee & Katila, 2020; Valentine et al., 2025). These approaches vary systematically in whether learning is an ex-ante intent or an ex-post byproduct, in the relative emphasis placed on cognition versus action, and in the nature of the reality they presume entrepreneurs are confronting. Importantly, these differences imply not only distinct strengths, but also distinct limitations. The E-a-S approach, with its emphasis on theory construction, hypothesis testing, and disciplined belief updating, is particularly well suited to contexts in which entrepreneurs face generative knowledge problems, that is, situations where the relevant causal structure is not yet known and must be conjectured, articulated, and progressively refined. Yet other approaches may be more effective than the E-a-S when the dominant task is instead the acquisition of existing knowledge or the construction of shared meanings and commitments among stakeholders, as in Table 2—adapted from Valentine et al. (2025) and Leatherbee and Katila (2020).

Without systematic empirical work that compares these approaches across contexts, there is a danger that the normative appeal of E-a-S leads to its application beyond the conditions under which it creates the most value. For example, in environments where reliable external signals already exist and the central challenge is efficient discovery of customer preferences or business model parameters, Lean Startup-style experimentation may dominate the returns to more theory-intensive inquiry. Similarly, in highly turbulent or socially constructed settings where goals, partners, and categories are co-evolving, effectual logics that emphasize commitment, control, and stakeholder co-creation may be more effective than disciplined hypothesis testing. In mature industries characterized by rugged but well-mapped landscapes, simple rules or strategy compass approaches may allow faster and more scalable learning than repeated theory revision. Absent comparative evidence, failures of fit risk being misinterpreted as failures of execution rather than mismatches between the learning algorithm and the underlying knowledge problem.

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This concern motivates the need for explicit comparative frameworks that articulate the relative advantages and disadvantages of alternative entrepreneurial learning algorithms vis-à-vis the E-a-S approach. Accordingly, the next table summarizes the core learning task addressed by each approach, its epistemological and ontological orientation, and the conditions under which it is likely to outperform or underperform E-a-S. The table is not intended to rank approaches hierarchically, but to make explicit the tradeoffs involved in selecting one learning algorithm over another. In doing so, it reinforces a central implication of this commentary: progress in the E-a-S research program depends not on establishing the approach as universally superior, but on empirically clarifying when theory-based, scientific reasoning dominates alternative learning algorithms.

Taken together, the three risks advanced in this essay underscore that the future contribution of the E-a-S research program hinges on a deeper engagement with empirical research. In the following section, we therefore outline directions for relevant areas for empirical research on the E-a-S approach.

4 | DIRECTIONS FOR THE EMPIRICAL PROGRAM ON THE E-A-S APPROACH

Considering the intent to advance an empirical research program and motivate scholars interested in pursuing areas to contribute to the E-a-S research program, we use this section to suggest four emerging research areas for empirical research that, if addressed, have the potential to elevate even further the value created by the E-a-S approach.

4.1 | Unveiling effective methods to foster scientific behavior by entrepreneurs

The E-a-S approach can be conceived as combining otherwise distinct perspectives on entrepreneurial learning which had previously emphasized aspects associated with "thinking" like a scientist (e.g., formulating a theory about how an action will unfold) (Eisenhardt & Bingham, 2017; Walsh, 1995) and of "analyzing" like a scientist (e.g., systematically collecting evidence, conducting experiments) (Kerr et al., 2014). While the E-a-S approach advances the value of combining these elements into a learning and decision making algorithm, there is a substantial potential in examining empirically the relative performance of existing (or even novel) frameworks for theorizing, as well as tools and skills to facilitate the collection, analysis, and use of data to disprove or validate theories of value.

Without referring explicitly to the E-a-S approach, some earlier studies have begun to address this challenge. For instance, researchers have examined the benefits (and limitations) of running A/B tests (Berman & Van Den Bulte, 2022; Koning et al., 2022), whereas the study of distinct methods to create theories remains underexplored empirically. Indeed, while a large empirical literature examines entrepreneurial experimentation more broadly—recently synthesized into problem-solving and causal-inference streams (Corbo et al., 2026)—empirical research successfully showing the benefits of the theory-articulation practices that distinguish the E-a-S approach remains scarce (with few exceptions, as highlighted in Table 1). As a result, not only is there space for examining how distinct approaches to experimentation may create value for entrepreneurs, but a critical gap that needs to be addressed by empirical research is that of the relative performance of distinct frameworks to support entrepreneurs in developing theories of value—such as the Value Lab (Felin et al., 2021) or novel frameworks. For instance, advances in causal inference techniques via the use of machine learning and artificial intelligence may provide new ways for individuals (and firms) to create and test theory (Charness et al., 2023; Csaszar et al., 2024). Furthermore, distinct theoretical pieces argue for how the size, complexity, and elaboration of theories may affect their usefulness (Sorenson, 2024), how the repeatability and need for joint action may impact the potential benefits from theorizing exercises (Adner & Levinthal, 2024), how strategists may focus on testing the weakest assumptions when testing and refining their

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TABLE 2 The E-a-S relative to alternative algorithms for entrepreneurial learning and decision-making under uncertainty.

Algorithm	Learning as intent vs. byproduct	Cognition vs. action	Nature of reality	Core strengths	Key limitations	Conditions favoring the approach
Entrepreneurs-as-Scientists (E-a-S/ Theory-Based View)	Predominantly ex ante intent	Cognition-led, followed by disciplined action	Structured but uncertain; causal relations exist but are unknown	Coherent belief updating; coordination across interdependent choices; reduced noise in learning	High cognitive demands; slower initial action; risk of over-theorizing	High-stakes, interdependent decisions; regularities
Effectuation	Primarily ex post byproduct	Action-led; cognition emerges retrospectively	Endogenous and co-created through commitments	Robust under Knightian uncertainty; adaptability	Limited belief integration; weak scalability; underutilizes existing regularities	Nascent ventures; extreme uncertainty; strong stakeholder co-creation
Simple Rules	Largely ex post byproduct	Action-oriented with lightweight cognition	Complex but patterned environments	Speed; flexibility; low cognitive burden	Coarse learning; limited causal articulation; rule rigidity	Time-pressured settings; repeated decisions; moderately turbulent markets
Lean Startup	Hybrid, closer to ex ante intent	Action- and experiment-led	Discoverable through feedback from users	Rapid iteration; low-cost experimentation; customer-centric learning	Fragmented learning; weak integration across assumptions; local optimization	Short feedback cycles; decomposable problems; consumer-facing markets
Entrepreneurial Strategy Compass	Predominantly ex ante intent	Cognition-led, action follows diagnosis	Strategically structured with distinct unknowns	Strategic clarity; alignment of learning with competitive logic	Limited guidance on belief updating; weaker experimentation microfoundations	Entry, scaling, and positioning decisions; competitive uncertainty

Source: Adapted from Valentine et al. (2025) and Leatherbee and Katila (2020).

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theories (Ehrig & Schmidt, 2022), or even compete based on theories (Ehrig & Zenger, 2024). A thorough validation of when and why these methods and characteristics of distinct forms of theorizing lead to superior entrepreneurial performance is a crucial step for empirical research.

4.2 | Documenting micro-level mechanisms

A second empirical opportunity to advance the E-a-S research program is to examine the precise mechanisms through which the E-a-S approach affects not only generic entrepreneurial outcomes (e.g., survival, revenue), but also firm-specific outcomes such as their competitive advantage. While most theoretical research focuses on E-a-S as a process to validate theories of value via iterative testing and reassessment of theory, it remains less clear what the E-a-S approach implies for the broader entrepreneurial process. For instance, when behaving like scientists, entrepreneurs act as if they were more cautious (Novelli & Spina, 2024). However, it is unclear if this means entrepreneurs are killing off bad ideas or projects for which data was simply harder to obtain. Is the E-a-S approach providing tools to reshape risk preferences? On which outcomes does the E-a-S approach focus the entrepreneur's attention (e.g., on survival or value creation)? When would entrepreneurs trade precision in how they test their theory for speed to take potentially highly valuable theories to market with less precise testing? Is there an innovativeness-risk trade-off by implementing E-a-S tools in the real world? These are only some of the questions that require attention by scholars engaged in the E-a-S approach. Furthermore, these questions are hard to address in a single paper. Thus, they call for sequential replication studies— which challenge common practice in management research—not only to establish the approach's validity but also to assess boundary conditions and expand understanding of the mechanisms through which the E-a-S approach affects entrepreneurial processes.

4.3 | Assessing contextual, organizational, and individual determinants/constraints to the absolute and relative performance of using the E-a-S approach

The third line of inquiry we would like to highlight is the need to understand better how characteristics of the location where entrepreneurs act, of the organizational contexts in which they are embedded, and of individuals themselves would drive the effectiveness of tools that use the E-a-S approach—both in absolute terms and relative to the several entrepreneurial algorithms highlighted in Table 2. The literature thus far has neglected the role that institutions specific to certain locations—such as access to credit, ease of interaction with key stakeholders, and even regulatory instability—could enhance or circumvent the role of theory development and testing during the entrepreneurial process. Moreover, even features of the organizational context—such as the concentration of decision rights in a sole founder versus the division of tasks across teams of founders (e.g., conceptualization of a theory versus empirical testing of the theory) could change the relative value of attempts to implement the scientific approach. Such team-based questions could also become crucial to understanding the importance of "behaving as a scientist" as organizations grow. An important direction for future research concerns how entrepreneurs deploy theories of value under resource constraints. While some may emphasize the need to formulate multiple alternative theories prior to commitment (Camuffo, Gambardella, & Pignataro, 2024), resource scarcity may lead entrepreneurs to favor advancing and iteratively revising one theory of value at a time. Which strategy is more effective is likely to depend on contextual factors such as experimentation costs, time pressure, and the nature of uncertainty. Future empirical research could examine these contingencies to clarify when multiple-theory exploration versus focused theory refinement is more effective. Finally, there is limited knowledge on whether individual psychological characteristics (e.g., extroversion/introversion, risk-taking propensity) affect the extent to which entrepreneurs can naturally behave scientifically and whether some entrepreneurs require more training in theory creation and testing.

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4.4 | Monitoring E-a-S behavior, learning, and performance

Finally, the limited set of existing empirical work on the E-a-S approach also has limitations that create challenges for the normative agenda to thrive. For instance, studies either implement hard-to-replicate and hard-to-scale methods to assess scientific decision-making (e.g., lengthy interviews) (Camuffo et al., 2020; Camuffo, Gambardella, Messinese, et al., 2024; Valentine et al., 2024) or are qualitative in nature (Ott & Hannah, 2024). As a result, not only are research findings less comparable across studies, but the use of the same dataset and measure by multiple researchers is also undermined. Furthermore, because empirical studies have measured either "scientific" practices in isolation or bundled as a single package, the absence of a standard measure to assess adherence to the E-a-S approach prevents the study of when and how the different elements of scientific decision-making can potentially complement one another. To meet this challenge, normative-minded scholars may learn from existing work that has focused on building reliable measures of the adoption of practices and processes at scale (Bloom et al., 2012; Bloom & Van Reenen, 2007).

5 | CONCLUDING REMARKS

The E-a-S research program has reached a pivotal moment. Early conceptual work debated its theoretical foundations and clarified its normative goals, but attaining the program's central promise, that is, providing practical, scalable guidance that improves entrepreneurial outcomes, requires empirical validation. The stakes are high: without robust empirical research, we risk promoting an incomplete algorithm, overestimating where it applies, and recommending it in contexts where other approaches would better serve entrepreneurs. Moving forward, the research community must embrace the same disciplined approach we advocate for entrepreneurs: developing clear hypotheses about when, how, and for whom the E-a-S approach creates value, rigorously testing these predictions, and revising our understanding based on what we learn. This empirical turn is not a step back from the program's ambitions. It is rather essential to achieving them. By grounding the E-a-S approach in systematic evidence, we can build a research program that is as rigorous in its methods as the entrepreneurial practices it aims to improve. The question is no longer only whether entrepreneurs should behave as scientists, but whether we, as scholars, will do the same in advancing the E-a-S approach.

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ENDNOTES

[1] The E-a-S approach is deeply related to the Theory-Based View of strategic management (Felin, Gambardella, & Zenger, 2024) to entrepreneurship, whereby economic actors (in the E-a-S approach, entrepreneurs) rely on forward-looking causal reasoning and disciplined testing to learn about an uncertain environment in which they operate, particularly when making strategic decisions that are impactful, hard to reverse, and characterized by deep uncertainty (Camuffo, Gambardella, & Pignataro, 2024).

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[2] While theories of value play a central role in the E-a-S perspective, there could be different descriptions of what a "theory" is. Recent research has increasingly converged on the notion that theorizing itself, i.e., how entrepreneurs construct, elaborate, and revise "theories of value," is the central feature of the E-a-S, combined with purposed and disciplined experimentation (Adner & Levinthal, 2024; Agarwal et al., 2025; Camuffo, Gambardella, & Pignataro, 2024; Ehrig & Zenger, 2024; Felin et al., 2021; Felin & Holweg, 2024).

[3] Ehrig and Zenger (2024) provide useful terminology here. They state that even in conditions of symmetric information, cross-entrepreneur differences in their theories of value and beliefs over future states of the world, assumptions, and causal relationships reflect differences in their "awareness." Such heterogeneity in awareness could explain differences in the economic rents accrued by entrepreneurs and in their early-on capacity to attract resources. Theories of value thus mirror why and when an entrepreneur would be persuaded that their business idea might be successful even if other entrepreneurs may not share this impression.

[4] Recent studies on the E-a-S approach highlight how 'methodic doubt' is a critical tenet of the E-a-S approach (Camuffo, Gambardella & Messinese, 2025). Methodic doubt refers to a disciplined epistemic stance in which entrepreneurs explicitly recognize that their theories of value may be incomplete, imprecise, or incorrect (Cerreia-Vioglio et al., 2026). Within the E-a-S approach, methodic doubt arises from disciplining entrepreneurs to distance themselves from their causal theories and assumptions, taking a stance of attempting to "disprove" rather than "confirm" their theories. Such stance heightens entrepreneurs' awareness of alternative opportunities to create value, omitted contingencies, and unforeseen future states of the world, thereby raising their threshold for acting. Intuitively, methodic doubt mirrors scientific fallibilism: theories are treated as provisional conjectures that must survive demanding tests, leading entrepreneurs to selectively commit only when evidence is sufficiently compelling and to terminate or pivot when it is not.

[5] For concision, we recommend readers to see Felin et al. (2021) for a deeper description of the Value Lab tool.

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