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RESEARCH ARTICLE

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Making business model decisions like scientists: Strategic commitment, uncertainty, and economic performance

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Abstract

Research Summary: This study abductively investigates how a firm's degree of business model development—the extent to which strategic choices are crystallized—moderates the impact of a scientific approach to decision-making on performance. We present findings from a field experiment involving 261 entrepreneurs, where treated entrepreneurs learn to apply a scientific approach, while control counterparts receive comparable content without this approach. Results show that the effect of scientific decision making varies with business model development. Treated entrepreneurs with higher degrees of business model development elaborated their theories of value focusing on lower-level choices, achieving superior economic performance compared to controls. Conversely, treated entrepreneurs with lower levels of business model development reevaluated fundamental aspects, resulting in increased epistemic uncertainty and less favorable short-term economic outcomes compared to controls.

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Managerial Abstract: Using a field experiment with 261 entrepreneurs, we explored how the degree of business strategy definition influences the benefits of adopting a scientific approach to decision-making. In the experiment, half of the entrepreneurs were taught to use a scientific approach for making decisions (the treated group), while the others received similar training without the scientific approach (the control group). Results show that treated entrepreneurs with already defined strategies benefited more, experiencing improved performance even in the short term. Conversely, treated entrepreneurs with strategies still under definition experienced more uncertainty and lower short-term economic performance, as the scientific approach prompted them to reassess and adjust their core strategic decisions.

KEYWORDS

business model, entrepreneurial strategy, experimentation, field experiment, uncertainty

1 | INTRODUCTION

Strategy elaboration is fundamentally about making choices (Ghemawat & Levinthal, 2008; Porter, 1986; Van Den Steen, 2018). A crucial question in this area thus concerns whether the decision-making approach that firms use to make these choices impacts performance (Gans et al., 2019). This question is particularly relevant in entrepreneurial settings, where strategy makers face uncertainty in multiple domains, from technology (Folta, 1998; Gans & Stern, 2003; McGrath, 1997) to market preferences (Foss & Klein, 2012; Kirtley & O'Mahony, 2023; Sarasvathy, 2009), and the resolution of uncertainty is often endogenous to action (Agarwal et al., 2007; Moeen et al., 2020; Ott & Eisenhardt, 2020).

Recent research in this context highlights the relevance of a “scientific approach to decision making” (Agarwal, Bacco, et al., 2024; Camuffo et al., 2020; Camuffo, Gambardella, Messinese, et al., 2024; Coali et al., 2024; Spina & Battaglia, 2024; Valentine et al., 2024), which resembles the approach followed by scientists as they develop new knowledge (Zellweger & Zenger, 2022). This approach advances the fundamental insight that entrepreneurs benefit when they develop a “theory of value” for their business and validate it with evidence (Agarwal, Bacco, et al., 2024; Camuffo, Gambardella, & Pignataro, 2024), both in the short term and in the long term (Coali et al., 2024). However, prior research has overlooked a fundamental aspect: whether this approach is effective at all stages of a firm's business model development.

In this article, we address this important gap by exploring the following research question: *Does the degree of business model development of the firm moderate the performance impact of a scientific approach to decision-making?* We define a firm's degree of business model development

as the extent to which an entrepreneur perceives the firm's business model to be already crystallized and that radical change is unlikely. This contrasts with the entrepreneur being still in the process of defining the key strategic elements of the business model, where radical changes remain likely (Gans et al., 2019; Ghemawat & Levinthal, 2008; Leiblein et al., 2018; Siggelkow, 2002; Van Den Steen, 2018). Business models play a key role in allowing an entrepreneur to capture value from new ideas (Teece, 2010) and require the identification of a fit among the various interdependent activities of a firm (Brea-Solis et al., 2015; McGrath, 2010; Zott & Amit, 2010). The concept of degree of business model development relates to the entrepreneur's perception of having completed the business model elaboration process. Prior research has largely overlooked the role of the degree of business model development—and, more in general, the degree strategic commitment already made—in moderating the relationship between decision-making approaches and performance. In fact, empirical evidence predominantly focused on studies involving firms at a stage where their business model and strategy are likely well defined (Bloom & Van Reenen, 2010; Pillai et al., 2020; Yang et al., 2020) or where they have just started elaborating it (Bruhn et al., 2018; Camuffo et al., 2020), thereby limiting the generalizability of prior findings.

This article addresses this gap with a question-driven abductive approach (King et al., 2021; Lipton, 2017; Pillai et al., 2020). To this end, we collected evidence via a 9-month randomized control trial (RCT) with 261 UK entrepreneurial firms attending a strategy training program. Both groups underwent training covering cognitive-based decision-making—involving conceptual frameworks and tools such as the Business Model Canvas—as well as evidence-based decision-making—incorporating various data collection and testing techniques like surveys, qualitative interviews, and A/B testing tailored for different entrepreneurial contexts. The key distinction was that the control group was encouraged to use cognitive- and evidence-based components as they deemed appropriate whereas the treatment group was encouraged to *combine* them within a scientific decision-making approach, which is using them to articulate and validate a “theory of value” (Agarwal, Bacco, et al., 2024; Camuffo, Gambardella, Messinese, et al., 2024; Felin & Zenger, 2017). Specifically, the treatment group was prompted to utilize frameworks for developing theories about problems they encountered, derive hypotheses, and subsequently employ data-gathering and analysis techniques to test them.

The main result—robust to several checks—is that treated firms at a high degree of business model development perform better than control firms but treated firms at a low degree of business model development perform worse than control firms. We conduct an abductive investigation and evaluate three alternative interpretations of this result (King et al., 2021; Lipton, 2017; Pillai et al., 2020), considering that it might be explained by an entrepreneur's (a) confidence, (b) experience, or (c) the level of strategic commitment already made, and the consequent degree of granularity in the choices that remain open. Using a mixed-method research design, we present quantitative and qualitative evidence that contrasts the first two interpretations and supports the latter. A scientific approach to decision-making encourages firms to articulate or interrogate their theory of value. For those at a high degree of business model development, who have already made strategic commitments, it facilitates the articulation and fine-tuning of their theory of value within the boundaries of the choices already made. This translates in a relatively quick positive effect on economic performance while maintaining their current trajectory. Conversely, for those at a low degree of business model development, who have not yet made strategic commitments, it helps gathering insights that could potentially alter the course of their uncrystallized business model more substantially. Although this change might not immediately translate into improved firm performance, it results in an increase in epistemic

uncertainty¹ regarding the firm strategy in the short term. In contrast, firms that do not use a scientific approach do not articulate or scrutinize their theory of value. When they have already made strategic commitments, the lack of systematic scrutiny leads them to pursue business as usual, with limited performance improvements. When they have not yet made significant strategic commitments the lack of systematic scrutiny leads them to quickly pursue unvalidated opportunities as they emerge and—compared to treated (scientific) firms that instead delay action because they “stop to think”—might even lead to positive outcomes in the short term. However, the long-term performance of decisions that are not based on a fully developed theory of value is not guaranteed.

This study makes three main contributions. First, it contributes to strategy research on decision-making by providing evidence of the relationship between the use of a scientific approach to decision-making and firm performance and how this relationship is moderated by the degree of business model development. It advances the important insight that, when firms have yet to make strategic commitments, a scientific approach can translate into higher short-term epistemic uncertainty rather than superior performance. In presenting these results, this study also addresses an important conceptual shortcoming concerning the generalizability of prior empirical work that explored the use of more formal and deliberate decision-making through samples of firms that did not necessarily vary in their degree of business model development (Bloom & Van Reenen, 2010; Bruhn et al., 2018; Camuffo et al., 2020; Yang et al., 2020). In addition, existing research on business models highlights the importance of the learning process entrepreneurs go through to identify successful business models (McGrath, 2010; Snihur & Zott, 2020; Zott & Amit, 2008). However, this research has not explored how different degrees of development of business models affect performance outcomes. By integrating the literature on business models and that on decision-making, this study offers a comprehensive understanding of how decision-making within the context of business model development influences firm performance outcomes.

Second, this research enhances our understanding of the performance implications of theory-based approaches to decision-making within entrepreneurial strategy (Zellweger & Zenger, 2022). While previous studies indicate that theory-guided decision-making positively impacts performance in both the short and long terms (Agarwal, Bacco, et al., 2024; Camuffo, Gambardella, Messinese, et al., 2024; Coali et al., 2024; Spina & Battaglia, 2024), they often overlook the significant role of prior strategic commitments. The extent to which firms have already made strategic commitments when applying the approach substantially affects both the time frame within which performance improvements manifest and the specific performance dimensions impacted. Beyond its academic contribution, this study offers insights to policy makers. Evidence suggests that initiatives that offer training with a view to stimulating entrepreneurial growth and productivity often yield limited results (Lerner, 2009; McKenzie, 2021). Our study highlights that the impact of an intervention can extend beyond economic outcomes to encompass various dimensions. Specifically, the examination of an entrepreneur's theory of value and the consequent redesign of some of the firm's core elements can represent a significant and positive outcome of policy interventions.

¹Epistemic uncertainty reflects “ignorance on knowable information” (Packard & Clark, 2020, p. 767). Uncertainty may apply to both external/environmental dimensions that affect the firm as well as internal/business model attributes (such as the underlying value proposition or value capture mechanism). In this article, we refer predominantly to the latter. For a comprehensive analysis of the exogenous uncertainty that characterizes the evolution trajectory of a sector or industry in entrepreneurial contexts, see Moeen et al. (2020).

2 | THEORETICAL BACKGROUND AND MOTIVATION

2.1 | A scientific approach to decision-making

A scientific approach to decision-making involves four key steps: (1) the development of a theory of value, (2) its articulation into hypotheses that logically flow from it, (3) the collection of evidence that can either support or refute the hypotheses, and (4) the disciplined assessment of the evidence collected. First, entrepreneurs who employ a scientific approach frame the problem they face using a theory of value—a cognitive representation of how their business generates value (Agarwal, Bacco, et al., 2024; Camuffo, Gambardella, & Pignataro, 2024; Ehrig & Schmidt, 2022; Felin & Zenger, 2017). This helps them understand more clearly what the key attribute of the problem are and develop a logic of cause and effect between them (Agarwal, Bacco, et al., 2024; Camuffo et al., 2020; Felin et al., 2024; Felin, Gambardella, et al., 2020). Second, the articulation of their theory of value into clear, falsifiable, predictions (Agarwal, Bacco, et al., 2024; Felin & Zenger, 2016; Spina & Battaglia, 2024) helps entrepreneurs modularize the problem into smaller, and more addressable blocks, which reduces the level of causal ambiguity (Felin, Kauffman, & Zenger, 2020; Leatherbee & Katila, 2020) and fosters the generation of innovative ideas via recombination and modular addition (Ott & Eisenhardt, 2020). Third, gathering inputs through rigorous tests provides valuable feedback that can help entrepreneurs distinguish between businesses with good and bad outcomes (Gans et al., 2019; Gruber et al., 2013; Murray & Tripsas, 2004; Pillai et al., 2020; Ries, 2011; Shepherd & Gruber, 2020; Thomke, 2003). Fourth, the systematic and critical assessment of the evidence gathered helps compare the signals collected against an ideal threshold (Boulding et al., 1997; Keil & Mähning, 2010). This approach resonates with prior research indicating that the combination of cognitive-based components (e.g., Csaszar & Laureiro-Martínez, 2018; Gary & Wood, 2011) and action or evidence-based components (e.g., Bingham & Eisenhardt, 2011; Ghosh et al., 2020; Leatherbee & Katila, 2020; McGrath, 2001; Murray & Tripsas, 2004; Ott et al., 2017) in decision-making can be an effective way to address uncertainty and obtain positive entrepreneurial outcomes (McDonald & Eisenhardt, 2020).

2.2 | A scientific approach for firms at different degrees of business model development

The use of a scientific approach combines the four elements described above in a synergistic way to help tackle the choices faced by entrepreneurs (Agarwal, Camuffo, et al., 2024; Felin et al., 2024; Packard et al., 2017; Zellweger & Zenger, 2022), guiding them toward more informed decisions based on logical reasoning and systematic testing. Prior conceptual and empirical research suggested that this synergistic effect translates into a positive effect on short-term (Camuffo, Coali, Gambardella, et al., 2024; Camuffo, Gambardella, Messinese, et al., 2024; Camuffo, Gambardella, & Pignataro, 2024) and long-term economic performance (Coali et al., 2024) compared to both traditional business support programs (Camuffo, Coali, Gambardella, et al., 2024; Camuffo, Gambardella, Messinese, et al., 2024; Camuffo, Gambardella, & Pignataro, 2024) and compared to strictly evidence-based approaches (Agarwal, Bacco, et al., 2024). These studies reveal that entrepreneurs using a scientific approach combine theory and evidence to make coherent changes to their business model (Agarwal, Bacco, et al., 2024; Valentine et al., 2024). However, research in this domain has implicitly operated under the assumption that firms applying this approach are at comparable stages, whether they are working on rudimentary ideas or have extensively developed

their business model. Understanding whether and how this type of firm heterogeneity affects the effectiveness of a scientific approach is therefore crucial.

Indeed, prior research has observed that firms, over time, engage in decision-making across different aspects of their business model such as target market, product features, marketing, procurement, sale channels, and so on (Ghemawat & Levinthal, 2008; Porter, 1986; Zott & Amit, 2010). Typically, these decisions follow a hierarchical pattern, where firms initially address macro elements and subsequently delve into more peripheral elements to achieve fit and consistency (Agarwal, Bacco, et al., 2024; Ghemawat & Levinthal, 2008; Moeen & Agarwal, 2017; Siggelkow, 2002; Snihur & Zott, 2020). For example, Siggelkow (2002) examines how Vanguard started the elaboration of its model with the definition of core elements such as its policy to engage in candid communication with its clients. Over time, they reinforced these core elements through activities such as clear annual reports, shareholder letters clearly forecasting fund performance, and “Plain Talk” educational brochures. Firms’ early choices, those that are more “strategic” or “core,”² tend to have strong interdependencies with subsequent ones, reducing the likelihood of radical changes and organizational plasticity (Gavetti & Rivkin, 2007; Rios, 2021; Van Den Steen, 2018). Once made, these initial decisions represent forms of commitment for the entrepreneur and constrain subsequent actions (Gans et al., 2019; Ghemawat, 1991; Ghemawat & Levinthal, 2008). Such commitment can stem from significant resource allocations associated with earlier choices (Agarwal, Bacco, et al., 2024), cognitive biases that amplify the salience of chosen paths over alternatives (Kahneman & Tversky, 1979; Laureiro-Martinez et al., 2023; Tversky & Kahneman, 1981) or strong beliefs on the firm’s underlying theory of value based on prior experience (Camuffo, Gambardella, & Pignataro, 2024; Valentine et al., 2024). Additionally, positive market feedback received on early choices may encourage persistence in the chosen direction. Importantly, these decisions shape an entrepreneur’s perception of the extent to which the business model is already sufficiently developed versus open to potential changes in its elements.

In this study, we incorporate this important insight from prior literature and ask whether the degree of business model development of the firm moderates the performance impact of a scientific approach to decision-making. We define the degree of business model development as the extent to which an entrepreneur believes that the details of the firm’s business model are already crystallized, so that radical change is unlikely. This contrasts a stage where the entrepreneur believes that the key elements of the business model are still in the process of definition and radical changes are still likely. The degree of business model development ultimately reflects entrepreneurs’ subjective assessment of whether their firm business model is still open to radical changes in direction as opposed to being already crystallized.³ Investigating how this

²What constitutes a core element versus what constitutes a peripheral one varies for different firms: “The same elements are not equally central for all firms” (Siggelkow, 2002, p. 126). However, there is consensus in the literature on the properties of core elements: (1) a high interdependency with other current organizational elements and (2) a large influence on future organizational elements (Siggelkow, 2002). This is also consistent with Van Den Steen’ (2018) definition of strategic choices.

³As a clarifying example, imagine two companies providing fitness coaching for busy individuals. The first company, Coach Guru, is still early in the definition of its business model, with some of its core decisions yet to be finalized, allowing for potentially radical changes. The entrepreneur is unclear whether the service should be offered as a “gym van” driven to the customer’s house or office, via personal trainers visiting the customer’s home, or through small fitness units in neighborhoods with no gym. The second company, Coach Pod, has quite a defined business model. The entrepreneur has made key choices such as that the company will focus on delivering fitness services in small containers located in various residential locations so that individuals can exercise indoors in easy-to-access “portable gyms.” In this article, we ask: What happens when these two companies adopt a scientific approach?



dimension affects the use of a scientific approach to decision making is important. It is reasonable to expect that entrepreneurs taught a scientific approach, perceiving their business model as preliminary and not yet crystallized, would apply the approach holistically across all business model elements. Conversely, entrepreneurs viewing their business model as substantially developed and committed to most choices would employ the approach primarily to fine-tune peripheral aspects still open to change.

Prior research suggests that different decision-making approaches can be more or less suitable for firms at different stages of their journey or operating in different environments (Agarwal, Camuffo, et al., 2024; Ghemawat & Levinthal, 2008). Yet very limited research studies this issue directly. Much of the research in this area tends to focus exclusively on firms that are either large and established and therefore likely to have a high degree of business model development (Bloom & Van Reenen, 2007; Heimeriks et al., 2012; Yang et al., 2020; Zollo & Winter, 2004) or still unestablished (Camuffo et al., 2020) and therefore likely to be still in the process of defining their business model.⁴ This underscores the importance of an abductive exploration that can shed light on the extent to which the degree of business model development moderates the relationship between the use of a scientific approach and performance.

3 | THE EMPIRICAL CONTEXT

3.1 | The RCT: Setting and data-collection process

To investigate how the degree of business model development moderates the impact of a scientific approach to decision-making on firm performance, we conducted an RCT. We embedded the field experiment in a business-support program designed and run by the authors in London, UK, from mid-February 2019 to November 2019. The treatment was administered through a training program, as similar interventions have been shown to affect outcomes for entrepreneurs (Anderson et al., 2018; Camuffo et al., 2020). We targeted entrepreneurial firms with less than 10 employees, as this empirical design required that the subjects receiving the treatment be key decision makers, a condition more accurately met in the context of micro-businesses, where all employees tend to be involved in the management of the firm. We recruited firms with an ad hoc marketing campaign using online media (such as social media, blogs, and online communities) and offline channels (flyers). We did not impose any restrictions in terms of industry; firms admitted to the program operated in a wide range of sectors, from software to retail. This setting enabled the recruitment of firms with different degrees of business model development, a crucial aspect aligning with the research question.

⁴For example, Bloom and Van Reenen (2007) found that the use of standard management practices is associated with higher performance. However, the sample used in that study included firms with an average age of 54 years and 2064 employees. Yang et al. (2020) found an association between the use of highly formalized, rigorous, cognition-based, and deliberate processes and firms' growth in employment. However, their sample consisted of firms that, on average were 50 years old and had 2088 employees. These types of firms are likely to already have a defined business model. Other studies have shown that approaches that rely on structure and codification are associated with superior performance in the context of acquisition integration for large and experienced acquirers such as Boeing, Cisco, Dow, Eastman Chemical, GE, IBM, and Xerox (Heimeriks et al., 2012; Zollo & Winter, 2004). The evidence on firms that might be at a lower degree of business model development is more limited and mixed (Camuffo et al., 2020; Koning et al., 2022).

The program involved an initial formal training period of seven sessions (21 h in total spread over the period between mid-February 2019 and April 2019). These experiential sessions were designed to span several weeks, emphasizing the program's distinctive feature: as part of the program, participants actively applied the tools and techniques taught in class to their projects during the latter part of each session and extended their work beyond the classroom through assignments. Participants were divided into a treatment and a control group. The training in both groups exposed participants to elements of both cognitive-based decision-making, such as strategy frameworks and tools (for instance, the Business Model Canvas or Balance Scorecard), and evidence-based decision-making (such as multiple data collection and testing techniques, including surveys, qualitative interviews, and A/B testing to adapt to different entrepreneurial contexts). However, while the control group was not explicitly encouraged to combine the two approaches, the treatment group was encouraged to do so, employing a scientific approach to decision-making. Specifically, the treatment group was encouraged to use the strategy frameworks presented in class to develop a theory of the problem faced and derive hypotheses from it and was later encouraged to use the data-gathering and analysis techniques to test those hypotheses.

The difference in the two approaches can be seen in how treated and control groups were taught to use the same tools. For instance, one of the training sessions in both treatment and control groups was focused on the "Business Model Canvas." Both sets of entrepreneurs were taught to apply the tool to their business and discuss it with their peers, but only those in the treatment group were explicitly taught to reflect on the extent to which the different elements of the business model connected to each other in a cohesive theory and were subsequently asked to explicitly formulate that theory and break it down into separate hypotheses. Later in the program, entrepreneurs in both groups were taught about the importance of making decisions based on collected evidence and were exposed to multiple evidence-gathering techniques (e.g., surveys, A/B testing, qualitative interviews). Entrepreneurs in the control group were free to apply those techniques based on their intuition, whereas entrepreneurs in the treatment group were explicitly encouraged to use these techniques to test the hypotheses developed in the previous sessions and reflect on how the evidence collected compared to their initial theory. We provide an example of the differences in the training and in-class activities between treatment and control groups in section 2 of the Appendix (Figures A1 and A2). To ensure the program was engaging and experiential, we assigned entrepreneurs in both groups to smaller subgroups that were randomly matched with six experienced instructors who were recruited and trained for this study. The experiment was designed such that each instructor taught entrepreneurs in both the treatment and control groups. All instructors received identical training material from the research team and underwent multiple "train-the-trainer" sessions to ensure they would deliver the content of the program in line with our research design.

Several measures were taken to ensure the internal validity of our results. We addressed contamination by teaching treated and control groups on different days of the week (Wednesday vs. Thursday) or different time slots of the same day (Saturday morning vs. afternoon), preventing them from meeting and discussing key elements of the treatment. We also kept communication about the program separate and discrete for the two groups. We required all applicants to complete an extensive survey and interview to collect baseline information on their business and their approach to decision-making prior to the intervention. We then used this information to randomly assign firms to either the treatment or control group: 139 firms were assigned to the treatment group and 135 firms to the control group.

3.1.1 | Data collection and operationalization

The intervention ran between February and April 2019, but we monitored firms' performance and decision-making until the end of November 2019. Due to funding availability, we could only gather data over this relatively short time window, and we take this aspect into consideration when discussing our results. In addition to the pre-intervention survey and interview, we collected eight data points through telephone interviews that focused on each firm's decision-making, key changes it had made in terms of strategy, and its performance. The first telephone interview post-intervention took place about 8 weeks after the training program had begun. We then collected data once a month until the end of the data-gathering period. In conducting these calls, we created a predefined protocol that included open- and close-ended questions, an approach in line with Bloom and Van Reenen's (2010) and Camuffo et al.'s (2020). We used open-ended questions to monitor entrepreneurs' decision-making process and let key themes emerge from narratives and close-ended questions to elicit self-reported performance information. The open-ended questions substantially reduce concerns that respondents might answer in a way that complies with the research design, particularly since entrepreneurs were not aware their answers were scored against a predefined grid. The performance data provided were self-reported by the entrepreneurs, but we conducted cross-reference checks with external sources for 100 firms (for which we found correspondence between the information provided by the entrepreneurs and public records in 92.5% of the cases, with small discrepancies in other cases) and consistency checks across interview rounds. The final sample included 261 firms, as we excluded four participants who gave inconsistent information about their business and nine participants who were not willing to share data. Table 1 compares the baseline characteristics of the treated and control groups for the final sample of 261 firms.

To check that the treatment produced the intended result, we measured the level of adoption of the scientific approach based on the content of the telephone interviews. *Scientific Intensity* is a time-varying score (ranging from 0 to 5) that captures the level of adoption of the scientific approach. To calculate this score, we followed the data collection method used by Camuffo et al. (2020). A team of research assistants analyzed and coded each interview's content according to a predefined coding scheme and collected measures on the extent to which entrepreneurs used theory (measured with four variables), hypotheses (measured with four variables), tests (measured with four variables), and evaluations (measured with four variables). To adequately capture the multiple dimensions of each component, we identified subcomponents that measured the key aspects that define theory, hypotheses, tests, and evaluation (see Table A1 in the Appendix for more detail). For each subcomponent, research assistants provided a score from 0 to 5, where a low score (say 0 or 1) indicates that the entrepreneur does not employ or employs to a limited extent a specific aspect in his/her decision-making process; a high score (such as 5) reflects that the entrepreneur adopts a specific aspect extensively. We then aggregated variables to compute an overall scientific intensity score (for more detail, see Camuffo, Coali, Gambardella, et al., 2024).

In Table A2, we compare the level of scientific intensity of the treatment and control groups at the time of each interview. Results show that there was no clear difference between the two groups at the baseline. The level of scientific intensity was higher for treated firms in subsequent interviews although it diminished in precision over time.

TABLE 1 Balance checks.

Variable	Elaboration	Treatment		Control		Difference	
		Mean	SD	Mean	SD	<i>b</i>	<i>p</i>
Business age	Age of the business (years)	2.48	3.22	3.28	5.17	0.8	(.14)
Team size	Number of team members	1.8	2.09	1.9	2.21	0.09	(.72)
Gender (female)	Proportion of women in the team	0.42	0.42	0.5	0.44	0.08	(.12)
Age	Age (team average)	35.76	8.43	36.37	9.2	0.61	(.58)
Hours—total weekly	Weekly hours dedicated to the company (team average)	31.51	18.29	29.61	17.12	−1.89	(.39)
Background—Economics	Team members with Economics backgrounds (%)	0.14	0.29	0.15	0.29	0.01	(.85)
Background—STEM	Team members with a STEM (Science Technology Engineering Mathematics) background (%)	0.29	0.39	0.36	0.43	0.07	(.19)
Education	Highest educational level attained by team members (5 = PhD, 4 = MBA, 3 = MSc, 2 = BA, 1 = high school, 0 = other; team average)	2.67	0.8	2.58	0.79	−0.1	(.33)
Confidence	Agreement on a 1–5 scale with the following statements (team average): “We are confident in our entrepreneurial skills”, “We are sure we are deploying the best strategy for our business”, “We are confident in our ability to manage our business,” “We master the competences necessary for our venture,” “We are sure there is no better business model for our idea”	3.41	0.69	3.34	0.76	−0.07	(.44)
Probability pivot idea	Probability of making a radical change to the business (0–100) based on the following question. “Where 0 = extremely unlikely and 100 = extremely likely, please indicate the current probability of: Making a radical change to your business.”	45.78	27.86	42.12	26.99	−3.66	(.28)
Degree of business model development	One minus the probability of making a radical change to the business (0–100)	54.22	27.86	57.88	26.99	3.66	(.28)
Probability pivot problem	Probability of changing the problem and customer segment	38.13	25.86	40.55	26.26	2.43	(.45)
Probability expansion	Probability of expanding the business outside of the current industry or market	68.32	27.09	66.59	28.12	−1.73	(.61)



TABLE 1 (Continued)

Variable	Elaboration	Treatment		Control		Difference	
		Mean	SD	Mean	SD	b	p
Revenue annual	Annual revenue (2018) £	57.14	166.3	83.13	226.26	25.99	(.29)
Revenue monthly	Monthly revenue (January 2019) £	5.81	20.26	7.04	28.29	1.24	(.69)
Hours—% innovation yearly	Working hours dedicated to the design of new products or services in the last year (2018, %)	45.92	32.98	40.02	32.68	−5.9	(.15)
Hours—% innovation monthly	Working hours dedicated to the design of new products or services in the last month (January 2019, %)	39.24	33.8	36.84	34.59	−2.41	(.57)
Idea value—mean	Estimated value of the project (mean, 0–100)	66.83	16.8	66.62	20.22	−0.21	(.93)
Idea value—range	Estimated value of the project (range, 0–100)	39.26	21.7	38	21.94	−1.26	(.64)
Experience—industry	Number of years of experience in industry (team average)	6.66	6.31	7.66	7.51	1	(.25)
Experience—work	Number of years of work experience (team average)	12.99	7.86	13.51	8.53	0.52	(.61)
Experience—entrepreneurial	Number of years of entrepreneurial experience (team average)	3.81	3.41	4.58	5.86	0.78	(.20)
Experience—managerial	Number of years of managerial experience (team average)	5.88	5.12	6.15	6.02	0.27	(.69)
Observations		133		128		261	

3.2 | Methodology and variable operationalization

3.2.1 | Methodology

To explore the *impact of the treatment on firm performance*, we employed a classic *difference-in-difference* specification. We estimated it by fitting the following model:

$$\text{Performance}_{it} = \beta_0 \beta_1 T_i \beta_2 P_i \beta_3 T_i P_i + \beta_4 DBD_i + \varepsilon_{it}.$$

where T_i denotes the treatment and is equal to 1 for firms that were allocated to the treatment group and 0 for firms that were allocated to the control group, and P_i denotes the time-period post training, with $P_i = 0$ before the training program took place and $P_i = 1$ after the training program (at the end of the observation period). DBD_i is a variable that measures the degree of business model development at the baseline. In this model, the difference-in-difference estimand is the coefficient of the interaction term (β_3). It reflects the difference in performance before and after the training for treated vs. control firms.

To explore *the moderating effect of the degree of business model development*, we employed a *triple difference specification* and analyzed how the difference in performance between treated and control firms is shaped by the *Degree of business model development* at the baseline with the following model:

$$\text{Performance}_{it} = \beta_0\beta_1 T_i\beta_2 DBD_i\beta_3 T_iDBD_i\beta_4 P_i\beta_5 T_iP_i + \beta_6 P_iDBD_i\beta_7 T_iP_iDBD_i + \varepsilon_{it}.$$

The coefficient of interest is β_7 , the coefficient on the triple interaction term (Wooldridge, 2007). In all regressions, we clustered the standard errors at the firm level.

3.2.2 | Variable operationalization

Dependent variable: Performance

This study investigates the impact of a scientific approach to decision-making on performance. We measured performance using *Revenue*, measured as the log of (1+) the cumulative revenue generated from the beginning of the program up until the last period in thousand pounds sterling. To do so, we used data collected by our research assistants during the interviews.

Independent variables

The first independent variable is *Treatment*, a dummy variable equal to 1 for firms in the treatment group and 0 for those in the control group. The second independent variable is *Post*, a dummy variable equal to 0 at the baseline and 1 after the training program and until the end of the observation period. Finally, we included the degree of business model development in the analysis. We asked entrepreneurs to provide us with an estimate of the probability of making a radical change to their business (on a scale from 0% to 100%). For clarity of interpretation, we constructed a variable that we call *Degree of business model development* that we calculated as the difference between 100 and the probability of making a radical change (provided by the entrepreneur). This is a proxy for the extent to which an entrepreneur believes that the details of their firm's business model are already crystallized and feels committed to the strategic choices already made. We expected that entrepreneurs with a more defined business model—who had already committed to a series of key choices—would indicate a higher probability of not making changes to their business. We expected that entrepreneurs with a *lower* degree of business model development, whose firms were still plastic, would report a *lower* probability of *not* changing their business. The measure reflects the continuous nature of the construct and is comparable across firms irrespective of the nature of the context or industry in which they operate. Table 2 displays summary statistics and pairwise correlations.

3.3 | Main results

3.3.1 | Firm performance: Firm revenue

We start by examining the impact of the intervention on firm size in Table 3, where we report the results of the analyses that investigate the impact of the treatment on firm revenue and the moderating role of the *Degree of business model development*. Column 1 reports the results of the difference-in-difference specification. The impact of the intervention on performance can be



TABLE 2 Descriptive statistics and pairwise correlations.

	Obs	Mean	SD	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12
1 Treatment	522	0.5096	0.5004	0.0000	1.0000	1											
2 Revenue (Log 1+, £ 000)	522	1.2738	1.6735	0.0000	7.2904	-0.048	1										
3 Degree of business model development (probability of not making radical changes)	522	56.0115	27.4184	0.0000	100.0000	-0.0667	0.0886	1									
4 Annual revenue at the baseline (in 000 GBP)	522	60.5103	171.2932	0.0000	1500.0000	-0.0657	0.4781	0.1018	1								
5 Confidence	522	3.3778	0.7225	1.2000	5.0000	0.0484	0.0415	0.2518	0.117	1							
6 Prior experience (work)	522	13.2439	8.1736	0.0000	40.0000	-0.0317	0.0859	-0.0915	0.01	-0.1153	1						
7 Prior experience (industry)	522	7.1516	6.9189	0.0000	35.0000	-0.0724	0.0694	-0.1254	0.0487	-0.0481	0.6048	1					
8 Prior experience (managerial)	522	6.0106	5.5664	0.0000	30.0000	-0.0245	-0.0283	-0.1504	-0.0202	-0.033	0.7447	0.517	1				
9 Prior experience (entrepreneurial)	522	4.1898	4.7739	0.0000	30.0000	-0.0813	-0.0092	-0.1492	-0.0399	0.0539	0.5558	0.4634	0.6081	1			
10 Value expectation	223	3.5864	0.2878	0.6931	4.1109	0.0021	0.1374	0.0933	0.0498	0.081	-0.058	-0.0495	-0.0296	-0.0984	1		
11 Certainty	223	0.3342	0.2333	0.0000	0.6931	-0.1392	0.0713	0.0449	-0.0667	-0.0574	0.0191	0.044	-0.0205	-0.0581	0.2403	1	
12 Scientific intensity	522	2.679678	1.147471	0	5	0.0748	0.051	0.0544	-0.0428	0.0216	-0.1931	-0.1751	-0.1323	-0.1409	0.1604	0.0343	1

TABLE 3 Impact of the treatment on performance.

Variables	(1) Log (1+) revenue	(2) Log (1+) revenue
	OLS panel	OLS panel
Treatment × Post (B5)	−0.1197 (0.4596)	−1.1558 (0.0029)
Treatment × Post × Degree of business model development (B7)		0.0184 (0.0020)
Treatment (B1)	−0.0814 (0.5779)	−0.1428 (0.6325)
Post (B4)	1.0572 (0.0000)	1.6783 (0.0000)
Degree of business model development (B2)	0.0052 (0.1145)	0.0052 (0.1799)
Treatment × Degree of business model development (B3)		0.0011 (0.8342)
Post × Degree of business model development (B6)		−0.0107 (0.0221)
Constant (B0)	0.5238 (0.0096)	0.5272 (0.0168)
Observations	522	522
R squared	.0987	.1115
Number of firms	261	261
Clustered errors	Firm	Firm

Note: Robust pval in parentheses.

assessed with the interaction between *Treatment* and *Post*. This interaction shows the average difference in outcomes between treated firms and control firms following the treatment. Results show that, on average, the intervention did not have a clear impact on economic performance as measured by firm revenue ($B = -0.1197$, $p = .4596$). Results from the triple difference specification, reported in Column 2, paint a very interesting picture. They show that the effect of our intervention varies depending on the degree of business model development. For firms whose degree of business model development was equal to 0 when they started the program (firms that at the time of enrolment in our program reported that their probability of making a radical change was 100%), being exposed to our intervention had a negative impact on revenue ($B = -1.1558$, $p = .0029$). However, the coefficient of the triple interaction shows that the impact of the intervention increased with the degree of business model development of the firm at baseline ($B = 0.0184$, $p = .0020$). To comment on the economic significance of this effect, we refer to the mean and the standard deviation of the degree of business model development. Treated firms that were at the average degree of business model development (56.0115) when they started the program experienced revenues that, at the end of the program, were 13% lower compared to those of firms in the control group. However, treated firms that were one standard

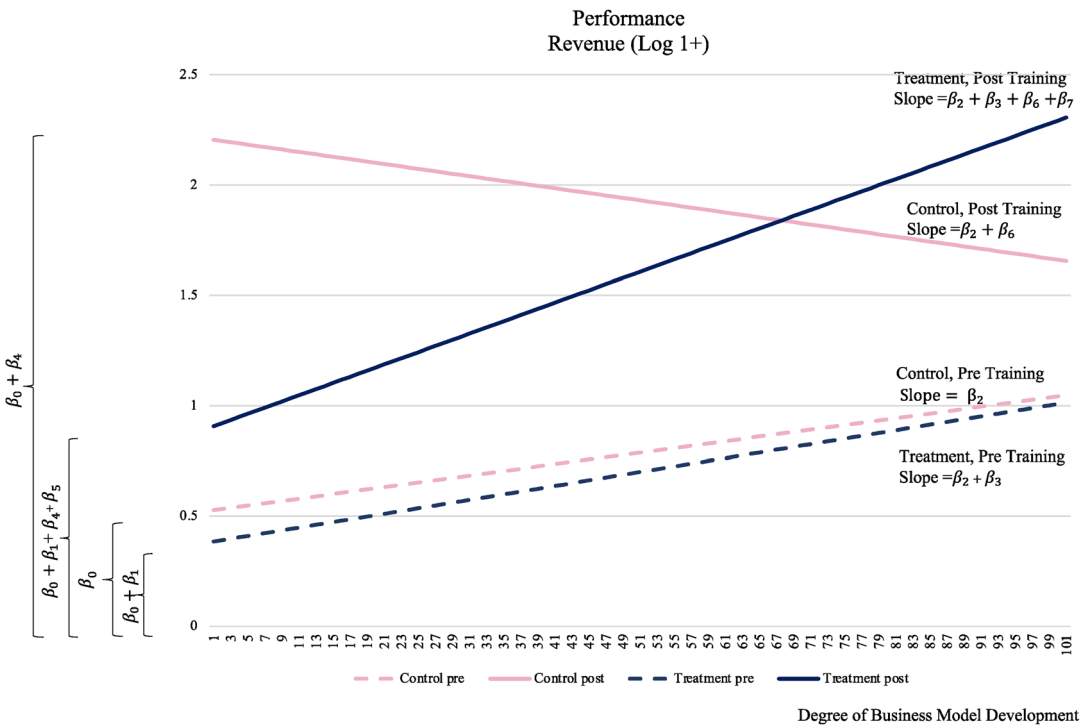


FIGURE 1 Impact of treatment on performance for different degrees of business model development.

deviation (27.4184) above the mean in their degree of business model development at the beginning of the program reported revenues that, at the end of the program, were 38% higher than the control group.

To help clarify the effect, Figure 1 offers a visual representation of how the predicted values of the performance variable (Log 1 + Revenue) across the four groups—(1) Treatment Pre-Training, (2) Control Pre Training, (3) Treatment Post Training, and (4) Control Post Training—as a function of the firm *Degree of business model development* before the training. The coefficients β_0 , β_1 , β_4 , and β_5 all shift the intercept term, estimating the mean of the outcome variable among the four groups: Control Pre-Training (β_0), Treatment Pre Training ($\beta_0 + \beta_1$), Control Post Training ($\beta_0 + \beta_4$), and Treatment Post Training ($\beta_0 + \beta_1 + \beta_4 + \beta_5$). The coefficients β_2 , β_3 , β_6 , and β_7 are all slope shifters, capturing how the *Degree of business model development* differentially affects the four groups. Looking at the coefficients, the impact of the degree of business model development for control firms after the training (vs. before the training) is given by β_6 , the overall impact of the degree of business model development for treated firms after the treatment is $\beta_6 + \beta_7$, and the differential effect of the degree of business model development for treated firms after the training is given by β_7 , which therefore constitutes our focus.

Figure 1 clearly shows that after the treatment, the performance of treated firms is lower than that of the control group for firms at a *lower degree of business model development*.⁵ For

⁵This figure was inspired by Starr et al.'s (2018) graphical representation.

firms at a *higher degree of business model development* the performance of treated firms is higher than that of the control.

3.4 | Robustness checks

We ran a series of checks to test the robustness of this effect.

3.4.1 | Outliers

We checked if the results might have been driven by the presence of outliers in our sample by replicating the analysis after 99% winsorization. We report these results in Table A3 in the Appendix; they are consistent with those reported in Table 3.

3.4.2 | Alternative measure of degree of business model development

We tested the robustness of results by using an alternative proxy for the degree of business model development: the annual revenue of each firm in the year before the program (log of 1 +, in thousands of GBP). This measure was used in prior research on firm evolution as a measure of firm development (Churchill & Lewis, 1983; Davidsson, 2004; Greiner, 1972). Results, aligned with the main ones, are reported in Table A4 in the Appendix.

3.4.3 | Attrition

Not all the firms in our sample continued to participate in the interviews for the full duration of the study (see Table A5 for the distribution of attrition over time). Notoriously, attrition is more the norm than the exception in field experiments (Gerber & Green, 2012). To address this issue, we designed the program so that the training was followed by monthly events focused on relevant themes for entrepreneurs delivered in the same way for treated and control firms but on separate days. Participation in these events was conditional on firms' continued engagement with the program and data collection. Nevertheless, some firms dropped out before the last interview round. Entrepreneurs that were not available for interviews indicated that their incentive to participate in interviews was lower after the training was over. To verify that attrition did not affect the results, we followed the best practice outlined by Gerber and Green (2012). First, we checked that there was no clear difference between treated and control groups in terms of early withdrawal from the program. In Table A6 in the Appendix, we estimate early withdrawal from the program as a function of the intervention, which we show has no relevant impact. Second, we addressed attrition by inputting the missing values of those who left the study. We followed Gerber and Green (2012) and used different case scenarios. The main analyses presented in Table 3 made the conservative assumption that the performance of firms that left the program remained the same as when they left the program. This assumption is consistent with previous studies that have used similar data (Camuffo et al., 2020; Camuffo,



Gambardella, Messinese, et al., 2024). We then replicated the analyses by assuming that the performance of firms who left the program grew at the average rate of growth for firms in the sample. We present these analyses in Table A7 in the Appendix, Column (1). Finally, we replicated these analyses using an unbalanced panel and retaining firms in the sample only up until the time at which they left the program. We included interview dummies to control for firms leaving the program at different points in time. Results are reported in Column (2) and are consistent with the main ones.

4 | INTERPRETING THE RESULTS

Analyses in Table 3 suggest that the *Degree of business model development* moderates the relationship between a scientific approach to decision-making and performance. We found that treated firms perform worse than control firms when they are at a lower degree of business model development, whereas they perform better than control firms when they are at a high level of business model development. To understand the underlying reasons, we follow an abductive approach.

4.1 | Alternative interpretations: Confidence, experience, or strategic commitment

We identify three possible explanations drawing from different streams of research. First, drawing from psychological and cognitive studies that examine decision making (Bandura, 1977; Bennett & Chatterji, 2023; Chen et al., 2024; Fuchs et al., 2019; Hayward et al., 2010), we considered the possibility that the main results might be driven by the confidence of the entrepreneur in their project amplifying the effect of the intervention for entrepreneurs at a higher degree of business model development. Second, drawing on human capital literature that has extensively emphasized the importance of prior experience for firm survival (Agarwal & Shah, 2014; Klepper & Sleeper, 2005) and performance (Agarwal et al., 2016; Azoulay et al., 2020; Gruber et al., 2013; Shah et al., 2019), we considered the possibility that higher entrepreneurial experience might make the intervention more effective for entrepreneurs at a higher degree of business model development. Third, we consider research on strategic commitment and search (Agarwal, Bacco, et al., 2024; Chavda et al., 2024; Gans et al., 2019; Ghemawat & Levinthal, 2008; Packard & Clark, 2020; Rosenberg, 1994), a stream that suggests that search activities and consequent learning can decrease uncertainty for entrepreneurs who have already made strategic commitments and are fine-tuning their strategy (Alexy et al., 2021). This reduces the need for further exploration and improves performance. However, the opposite may be true for entrepreneurs who have yet to commit to key strategic choices (Gans et al., 2019), such as those with lower degrees of business model development. We consider the possibility that the intervention led this latter group to pursue further exploration (Felin et al., 2024; Felin, Gambardella, et al., 2020), resulting in increased uncertainty and lower short-term economic results during the search process. Table 4 provides a conceptual schema of the main results, elaborates on the three alternative explanations, and provides an overview of the evidence in support of each interpretation.

4.2 | Testing alternative interpretations: Quantitative analysis

To investigate the validity of the first two alternative interpretations (*higher confidence* and *higher experience*), we conducted two triple differences analyses that we report in Table 5, where we studied performance as a function of the interactions between the intervention and (a) the level of confidence of the entrepreneur at the baseline ([measured as their agreement on a 1–5 scale with statements related to confidence, as displayed in Table 1], reported in Column 1 and (b) prior work experience of the team at baseline [measured as the average number of years of work experience in any role of all individuals working in the firm], reported in Column 2). Results show that these alternative interpretations do not account for the results in the main analyses: The interaction terms do not show any clear impact of confidence nor of experience in driving the results.

To investigate the validity of the third alternative explanation (*higher strategic commitment*), we conducted the following quantitative analysis. During the observation period of the study, we asked entrepreneurs about the likelihood that their revenue would increase or decrease by certain amounts over the subsequent 3 months.⁶ We used these data to measure two aspects, at the end of the period: (1) the entrepreneurs' estimation of the value of their business, which we measured by taking the (log transformed) net likelihood of revenue increase (i.e., the difference between aggregate likelihood of revenue increase and aggregate likelihood of revenue decrease), and (2) the entrepreneurs' certainty about the value distribution of their business proposition (log transformed), which we measured by calculating the Herfindahl index of the distribution of the likelihood estimates expressed by entrepreneurs across the different options (decrease GBP0–30,000; decrease GBP30,000–100,000; decrease more than GBP100,000; increase GBP0–30,000; increase GBP30,000–100,000; increase more than GBP100,000). The intuition behind the use of the Herfindahl index is that a more concentrated likelihood reflects a higher degree of certainty about the prospects of the business.

Results, reported in Table 6, show that the treatment does not affect the value of entrepreneurial expectations, but it affects the level of certainty about the value distribution. Specifically, the effect of the treatment on certainty was negative for firms whose degree of business model development was 0 ($B = -0.0648$, $p = .0388$), but its impact on certainty increased alongside the degree of business model development ($B = 0.0023$, $p = .0439$). Figure 2a,b visually illustrates this result, which is consistent with the third abductive interpretation discussed in Table 4: Uncertainty increased for treated entrepreneurs with a low degree of business model development.

4.3 | Testing alternative interpretations: Qualitative analysis

To further validate this interpretation, we present qualitative illustrative evidence. Among all the audio interviews conducted by research assistants with entrepreneurs, we selected a sample of baseline interviews, final interviews, and interviews where the entrepreneurs mentioned an important change to the business model. We used the variables *Treatment* and the median of the *Degree of business model development* to identify four groups: (1) Treatment—Low Degree

⁶Precisely, our survey asked: “Looking at the next 3 months, how likely is it that your turnover will increase (decrease) by GBP 0–GBP 30,000 (GBP 30,000–100,000; more than GBP 100,000), where 0 is extremely unlikely, 5 is neither likely nor unlikely and 10 is extremely likely.”



TABLE 4 Conceptual schema of the main results and evidence in support of the abductive interpretations.

Research question: Does the degree of business model development of the firm moderate the performance impact of a scientific approach to decision-making?	
Main result: Pattern of evidence <ul style="list-style-type: none">Section 4: Table 3 and Figure 1: Treated firms at a higher degree of business model development achieve higher economic performance than control firms; treated firms at a lower degree of business model development achieve lower economic performance than control firms	
Testing the robustness of the main result <ul style="list-style-type: none">Outliers: Appendix, Table A3Alternative measures of degree of business model development: Appendix, Table A4Attrition: Appendix, Tables A5, A6, and A7	
Alternative interpretations	
# Stream of literature and main argument	Evidence
1 Entrepreneurial confidence (Bandura, 1977; Bennett & Chatterji, 2023; Chen et al., 2024; Fuchs et al., 2019; Hayward et al., 2010). When entrepreneurs have strong convictions in their own effectiveness, they are more inclined to engage in tasks that they perceive as challenging (Bandura, 1977) and highly confident entrepreneurs are better positioned to start and succeed with a business (Hayward et al., 2010). Entrepreneurs who have already defined the core aspects of their business model could be more confident about it (Bennett & Chatterji, 2023), and have tighter confidence intervals around beliefs about the profitability of their idea (Chen et al., 2024). Taken together, these studies suggest that entrepreneurs with more developed businesses could be more confident and therefore perform better when treated because their confidence might amplify the effectiveness of the intervention, explaining this study's main results.	The entrepreneur's level of confidence does not explain the main result: <ul style="list-style-type: none">Section 5, Table 5
2 Entrepreneurial human capital and experience (Agarwal et al., 2016; Agarwal & Shah, 2014; Azoulay et al., 2020; Gruber et al., 2013; Klepper & Sleeper, 2005; Shah et al., 2019). More experienced entrepreneurs have acquired informational advantages (Agarwal & Shah, 2014) and can leverage knowledge from their prior experience (Klepper & Sleeper, 2005) to start new ventures, which translates in positive performance (Agarwal et al., 2016; Azoulay et al., 2020; Gruber et al., 2013; Shah et al., 2019). Entrepreneurs with firms at a higher degree of business model development might be more experienced, and their higher level of experience might amplify the effectiveness of the intervention, explaining this study's main results.	The entrepreneur's experience does not explain the main results: <ul style="list-style-type: none">Section 5, Table 5

TABLE 4 (Continued)

<p>3 Strategic commitment and search (Agarwal, Bacco, et al., 2024; Chavda et al., 2024; Gans et al., 2019; Ghemawat & Levinthal, 2008). A scientific approach to decision-making encourages both firms at a higher and lower degree of business model development to articulate or interrogate their theory of value (Agarwal, Bacco, et al., 2024). Firms with a higher degree of business model development have already made a strategic commitment on the core choices whereas peripheral or operational aspects are still open. They therefore do not question their core choices and rather apply the approach to refine their theory of value within the boundaries of the choices already made. This results in reduction of the epistemic uncertainty that concerns operational choices and an overall performance improvement compared to the control group. Firms with a lower degree of business model development, instead, have not yet made a strategic commitment on the core dimensions of their business model. The scientific approach encourages them to articulate a fully-fledged theory of value, prompting entrepreneurs toward a broader search across all dimensions of the business model (Felin et al., 2024; Felin, Gambardella, et al., 2020; Gans et al., 2019). Consequently, all choices—both core and peripheral—are questioned and, compared to the control group, epistemic uncertainty increases while short-term economic performance is halted.</p>	<p>The impact of the treatment on entrepreneurs' uncertainty varies at different degrees of business model development:</p> <ul style="list-style-type: none">• Quantitative evidence: section 5, Table 6• Qualitative illustrative evidence: section 5, Table 7
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of business model development; (2) Treatment—High Degree of business model development; (3) Control—High Degree of business model development; and (4) Control—Low Degree of business model development. We then went through the interviews in each of these categories, focusing on the qualitative questions where the focal entrepreneur was talking about their business proposition and decision-making process to abstract from the narratives key themes regarding (1) how entrepreneurs made decisions and (2) the outcome of those decisions. From this analysis, we identified 5 illustrative cases in each category, totaling 20 illustrative cases that corroborate the interpretation outlined above, presented in Table 7.

4.3.1 | Control—Low degree of business model development: Key themes

Entrepreneurs in this category joined the program with business models at a low degree of development. The cases reported in Table 7 show that the entrepreneurs did not articulate their theory of value and did not engage in rigorous conceptual analysis or testing. As a result, by the end of the data collection period, entrepreneurs in this category were largely either (a) pursuing the same opportunities they entered the program with or (b) pursuing new opportunities

**TABLE 5** Alternative interpretations #1 and #2: Confidence and experience.

Variables	(1) Log (1+) revenue (in £ 000)	(2) Log (1+) revenue (in £ 000)
	OLS panel	OLS panel
Treatment × Post	−0.4123 (.5777)	0.1090 (.7152)
Treatment × Post × Confidence	0.0865 (.6889)	
Treatment × Post × Work Experience		−0.0166 (.4032)
Treatment	0.1016 (.8853)	−0.2634 (.3072)
Confidence	0.1290 (.3908)	
Treatment × Confidence	−0.0619 (.7684)	
Post	1.1809 (.0328)	0.7079 (.0016)
Post × Confidence	−0.0370 (.8151)	
Work experience		0.0023 (.8319)
Treatment × Work Experience		0.0126 (.4383)
Post × Work Experience		0.0259 (.0930)
Constant	0.3959 (.4329)	0.7954 (.0000)
Observations	522	522
R-squared	.0934	.1010
Number of firms	261	261
Clustered errors	Firm	Firm

Note: Robust pval in parentheses. As alternative measures of experience we used the average number of years of industry, managerial and entrepreneurial experience. Results, reported in Table A8 in the Appendix, are consistent with the above.

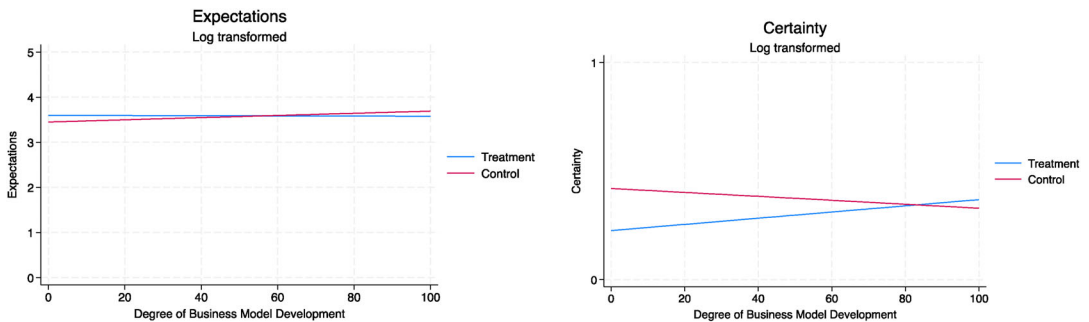
quickly as they emerged with little hesitation. For instance, within category (a), these entrepreneurs often validated their idea based on generic information (not directly linked to their value proposition), or on generic feedback from existing customers:

“Well we’ve been good at selling it so there’s really a market” (Case 2, Interview, 8)

TABLE 6 Alternative interpretation #3: Choice commitment, value expectations, and certainty about value distribution.

Variables	(1) Log (1+) value expectations	(2) Log (1+) value expectations	(1) Log (1+) certainty	(2) Log (1+) certainty
	OLS panel	OLS panel	OLS panel	OLS panel
Treatment	0.0018 (.9651)	0.1457 (.2828)	−0.0648 (.0388)	−0.1941 (.0042)
Treatment × Degree of Business model development		−0.0026 (.1649)		0.0023 (.0439)
Degree of Business model development	0.0010 (.2702)	0.0024 (.1714)	0.0004 (.5307)	−0.0009 (.2891)
Constant	3.5316 (.0000)	3.4525 (.0000)	0.3491 (.0000)	0.4202 (.0000)
Observations	223	223	223	223
R-squared	.009	.024	.021	.040

Note: Robust pval in parentheses. The number of observations is lower than in the full sample because some entrepreneurs did not answer this question.

**FIGURE 2** (a, b) Effect of the treatment on expectations and certainty about value distribution.

“The things that I’ve learnt by re-looking at the data is that in the UK people spend up to £4,000 per year, which is more than 10% of the UK survey, eating out. So we think this is... will be quite great” (Case 3, Interview 8).

“Didn’t do any AB testing unfortunately, didn’t have the time. (...) So what we ended up doing was actually (...) after the experience, asking them how they feel. So that’s the feedback we took on” (Case 5, Interview 3).

Regarding category (b), quotes from these entrepreneurs reveal that, when they stumbled upon feedback, they did not reflect on whether the opportunity was worth pursuing or not, but rather went straight into refocusing projects in that direction:



TABLE 7 Qualitative illustrative evidence of the impact of a scientific approach at a low versus high degree of business model development.

Category	Case	
Control, low degree of business model development: Entrepreneurs in this category joined the program with business models at a lower stage of development. Instead of interrogating their theory of value, and using this process to guide their tests, they tended to either (a) pursue the same opportunities they entered the program with or (b) pursue new opportunities quickly as they emerged with little hesitation. This made entrepreneurs in this category quicker to implement solutions, which generated some revenue in the short term. But these solutions were not necessarily “thought through,” so long term performance is not guaranteed.		
Control, Low degree of business model development	1	The entrepreneur joins the business support program with a general idea of a B2B business model that offers training to entrepreneurs looking to start a blockchain-based business. They then decide to offer consulting-based services that provide tailored advice on block-chain based businesses. The change does not originate from a rigorous, theory-guided test of ideas, but rather from direct observation of potential customers as well as other competitors at a large conference: <i>“So we went to the conference and we saw that there were many types of clients to which you can address. The type of client that we are interested in, so entrepreneurs or companies that want to enter the blockchain world, they were interested in a conference that offered this kind of solution, coding and consulting. So basically we spotted the solution from the existing competitors, understanding that the existing competitors are all shifting towards offering consulting and development of blockchain solutions. So it means that at the moment this is what was the market and this is where we should go”</i> (Interview 3). The entrepreneur does not explore if this opportunity is worth pursuing or not, but rather goes straight into hiring developers and refocuses the project in this direction: <i>“[The change] It’s big because we have to change the idea of the kind of team that we are building because we need a programmer, so that would be the first change, and yes, the image of the project also changes, and as you said, we’re looking for different kinds of clients. We already hired a developer”</i> (Interview 3).
Control, low degree of business model development	2	The entrepreneur joins the business support program with a two-sided model business that connected cybersecurity consultants with small businesses. Prior to joining the program, the entrepreneur has already read articles on the subject and talked to small businesses, conducting open-ended and unstructured interviews; they are unable to mention how many people they spoke to. After starting the program, they quickly focus on execution and avoid further exploration, starting to sell immediately. They see their initial sales as validation for their idea. They note the positive feedback obtained in customer conversations, but they do not conduct any systematic testing: <i>“No change to the value proposition, no. It’s a constant redefining of the nuances of the value proposition and no real change. Well we’ve been good at selling it so there’s really a market”</i> (Interview 8).

TABLE 7 (Continued)

Category	Case	
Control, low degree of business model development	3	The entrepreneur joins the program with a business model focused on offering an application that enables pre-ordering of artisan meals from restaurants and cafés at a discounted price. The entrepreneur collects feedback without a theory underlying the strategy, immediately reacting to feedback as it emerges. General patterns, despite not being specific to the value proposition, are considered encouraging: <i>“The only business that I have (...) is the restaurant which I’m going to demo. Other than that, what I want to do is talk with a number of restaurants, so which is why I’m trying to launch this project with (the program). (...) The restaurant owner, she had a quick look, she has two restaurants, she said that this kind of app is more suited for her secondary restaurant which is more near the train station and it’s serving the working community. So she’s quite interested there. Yes, so that is one of the people who are giving me requirements as well. (...) I was really looking at the data that I had gathered. So whilst the things that I’ve learnt by re-looking at the data is that in the UK people spend up to £4000 per year, which is more than 10% of the UK survey, eating out. So we think this is... will be quite great”</i> (Interview 8).
Control, Low degree of business model development	4	The entrepreneur joins the business support program with a business model idea about selling clothing online. They conduct a few surveys applying the content taught in the sessions, with the goal of better understanding customers’ preferences. The entrepreneur does not have clear predictions or assumptions to test, nor do they conduct the survey following scientific principles. Instead, they use suggestions from their existing customers to tweak the existing offering quickly, particularly with regards to the delivery options available: <i>“I think the main conclusion was that (...) most of the people who answering that they were willing to spend up to £100. So we might think of changing a little bit the prices, doing a slightly even lower rate on the prices, we’re going to see that now. We’re reviewing this. We have two weeks, to three weeks until the website is on again, to review again the prices. And so the survey, it was clearly seen that we need to do speedy delivery and we will pay for it. So I think that we have an extra cost for the delivery options”</i> (Interview 8).
Control, Low degree of business model development	5	The entrepreneur joins the program with a business idea at a low level of development and the goal of alleviating depression in patients with dementia using virtual reality techniques that can take them to visit happy places. During the course, the entrepreneur runs a small proof-of-concept with 10 patients based on basic questions (whether they liked the product and what they would like to see) before developing the app. Based on this limited feedback the entrepreneur promptly goes ahead and develops the app: <i>“I want to raise our seed funding to build the app that I envision, like the ideal one because right now it’s very restricted. (...) Didn’t do any AB testing unfortunately, didn’t have the time. (...) Yes, I know, I don’t have time to do that—So what we ended up doing was actually asking direct questions, so after the experience, asking them how they feel. So that’s the feedback we took on”</i> (Interview 3).



TABLE 7 (Continued)

Category	Case
Treatment, low degree of business development: In sharp contrast to the previous group, interviews with entrepreneurs from this category show that the intervention encouraged them to articulate and interrogate their theory of value, reconsidering their approach to business decisions. These entrepreneurs highlighted that participation in the program prompted a significant shift in their original understanding of the issues at hand. This shift led to major modifications of their initial ideas in the short term, with the aim of achieving beneficial outcomes in the long run. Altering the initial framework of the idea introduced greater uncertainty about the next steps to take. In response to this uncertainty, entrepreneurs adopted a more long-term perspective. They recognized the necessity of further exploration and accepted that the adjustments made during the program might take time to manifest results, aiming to position themselves on a more favorable path.	
Treatment, low degree of business model development	6 The entrepreneur joins the business support program with a business model idea of a service similar to Spotify, which enables customers to choose what they listen to in public or shared spaces (i.e., cafes, parties, etc.). Before joining the program, the entrepreneur was ready to develop a proof-of-concept. The business support program encourages them to articulate and interrogate the theory of value: <i>“Our primary goal would be to validate our current value and growth hypothesis (...) the reason why we think people find value and how things will grow”</i> (Interview 1). This leads them to understand that they are still uncertain about their customers’ pain points. This induces them to pause and engage in further search before advancing the idea: <i>“So before coming into the (program), we had a very clear vision of which problem we were solving. But as we’ve gone through and sort of, you know, rigorously tested our hypothesis and our ideas, we’re a little bit less clear on which points, which pain we’re sort of reducing for our users. So that’s the thing we’re trying to ensure and struggling a little bit to get clarity on”</i> (Interview 1).
Treatment, low degree of business model development	7 The entrepreneur joins the program with a business model about offering venue styling services targeting an audience of parties, weddings, and similar events. Before joining the program, they perceive marketing as the main priority: <i>“So one of the things that I would love to do is to try and find out how I can use what I already have to try and get more awareness out there”</i> (Baseline Interview). The training program, coupled with the emphasis on theory development, hypothesis formulation, and testing, prompts the entrepreneur to recognize the substantial uncertainty surrounding some fundamental aspects of the business model idea such as the target audience. The entrepreneur recognizes that addressing uncertainty about this core area of the business model is fundamental before proceeding further, but it will require time that the entrepreneur will devote to conduct additional search, pausing exploitation activities: <i>“I just need to work better on my target audience and who my clients and values proposition are. (...) So that’s why we just had to redefine everything. (...) I think right now we’re just sort of everywhere. So, it’s really finding out exactly who the main target audience will be. So, we’ve sort of stepped back, it is needed to improve ourselves and then to</i>

TABLE 7 (Continued)

Category	Case
Treatment, low degree of business model development	<p>come out better. So, for the next one year we are not going to do anything, so I just need to reforecast, re-plan, and get my new target audience and just work out on my marketing strategies. We (...) just realized that there was quite a little bit that I actually needed to improve on in understanding the market properly" (Interview 8).</p> <p>8 The entrepreneur joins the program with a business idea about offering an online business that enables its customers to swap clothes. The initial target is university students, and before joining the program the entrepreneur identifies the promotion of the business and the identification of ways to make it cost-effective as key priorities: "Well I think the main problem is working out how to promote it and how to make sure that we can make it cost-effective for ourselves" (Baseline interview). After being exposed to the intervention and being, therefore, induced to articulate and interrogate their theory of value, the entrepreneur realizes that trust in an exchange-based market and long-term customer loyalty are fundamental, but they are uncertain about all the intricacies associated with matching clothes to swap and how they will reflect on their core choices. This brings them back to the drawing board and leads them to engage in another round of search: "Originally our plan was purely to do a swapping thing. So, the idea was that you went along, and you had a pink sparkly top and this girl had a silver sparkly top and then you'd swap and it would all be really easy. What we realized is that it's obviously more complicated than that mainly because of finding people who have something, who may not want to swap. (...) We're starting to look beyond the boundaries of what was effectively sort of a very narrow project which we realize we, whilst it may work, we're now looking longer term and thinking how can we actually turn that into a more viable business more quickly by creating a trust with people on a longer term basis" (Interview 5). "So we thought that we just needed the app, but as I said (...) the app's proved to be a bit of a disaster, so we're going back to the drawing board"(Interview 8).</p>
Treatment, low degree of business model development	<p>9 The entrepreneur joins with a business focused on creating online education for women of color to learn how to code and about cybersecurity. The content includes workshops, e-books, and online sessions and aimed to foster an online community. After joining the program and interrogating their theory of value they realize that the ultimate goal of their customers is to gain employment in the IT sector. This revelation prompts them to recognize the need for establishing corporate connections and integrating a new dimension into their business model, a task that demands substantial time and effort: "We're changing our deliverables. So we're doing events and we do webinars, but we're changing ourselves to employ instructors that do online courses. Because I saw that there was a need for our customers to have it more structured, because the events and lectures are on specific topics in cybersecurity, and from our feedback that we're getting from the events and webinars we're doing, a lot of our members say</p>



TABLE 7 (Continued)

Category	Case
	<i>that they would like a course format. So the idea was if I was to put the video, would people buy it? I thought that that should work, but more people bought the video rather than becoming members, so I realized that people prefer the kind of pay when I want to subscription model. So based on that, I'm thinking next year when we're actually going about our courses to change it to be more of a people pay for courses rather than people becoming members. The job board was a new concept I never thought about, because I spent so much time focusing on how do I get people interested in the service (...) that didn't think about (...) approaching corporate as another, I guess, key client or key target market”(Interview 8).</i>
Treatment, low degree of business model development	10 The entrepreneur joins the program with a business at a low level of development, where the entrepreneur aims to bring medical equipment that had been made redundant in the UK (but was still in good and usable condition) to support research and hospitals in emerging economies. This is based on a direct business model where the entrepreneur acquires the equipment and sells it to the new customers. Following exposure to the intervention and the subsequent invitation to articulate and scrutinize their theory, the entrepreneur comes to a significant realization. They acknowledge that the solution they initially conceived lacks scalability and recognizes that their business's potential to create value lies in adopting a platform business model instead. However, implementing this shift requires considerable time, particularly because the entrepreneur must first navigate the uncertainty surrounding the operation of a platform business model. “To be honest, it wasn't until I came to the (program) that I understood, and I am a scientist, so I know about testing and I know about research. (...) But I never ever thought about using it in a business model, and that's what really attracted me to it. (...) Due to the impact of the (program), what we were thinking before was different to now. The way I'm thinking is different now and I have to, what you call it, cascade that to them so that they can understand what we're doing. (...) But when I got into (the program), I realized that actually a platform, having a platform may work, because a platform would be a place where the supplier and the users can come together and on that platform” (Interview 1). “We are not functioning yet, we are not functioning yet, because we've come back and what we are now is actually doing up our processes, so we're trying to draw up our processes based on using a platform model. We never had a platform before, it was getting the equipment from the supplier, supplier will come to me, I will email (...) but this new process is actually what is taking our time now to look at how we design it, what are the features that we want on the platform” (Interview 8).

TABLE 7 (Continued)

Category		Case
<p>Control, high degree of business development: Entrepreneurs within this group enter the program with more refined business models, primarily aiming at enhancing the more minor elements, if at all. Similar to control entrepreneurs exhibiting a low level of business development, these individuals showed no significant reservations about the merit of their ideas, sidestepping in-depth conceptual or empirical scrutiny. Instead, they typically offered a broad rationale for pursuing their idea and the informal, non-rigorous process through which it was identified. This absence of a process of interrogation of their theory of value led these entrepreneurs to largely maintain their business model unchanged from before their participation in the program.</p>		
Control, high degree of business model development	11	<p>The entrepreneur joins the program with a developed business model focused around offering financial training, in particular, on cryptocurrencies. They go through the program without interrogating their theory of value: “<i>(The idea was about) the number of people who had heard about Bitcoin, who wanted to understand themselves what all the fuss was about but they were not computer educated so they needed someone who understood the way the computer educated side came from, that wanted to understand it in a more conversational point of view. (...) I was already in close contact with these people anyway because that was my previous business was in financial markets</i>” (Interview 7). Asked about whether they gathered any evidence to verify that their understanding of the problem was correct, and their value proposition valuable, they respond: “<i>No, because we already knew what the product was</i>” (Interview 7).</p>
Control, high degree of business development	12	<p>The entrepreneur joins the program with the idea of providing optical apprenticeships to opticians. The business proposition is already quite developed, based on the entrepreneur's previous work in the area. The entrepreneur does not articulate interrogate the theory of value, which remains high-level: “<i>I was working with apprenticeships and the likes so it's certainly something that I'm aware of but it's really trying to put that out in the market to make it move forward. (...) My main focus is usually to work on the apprenticeships with a caveat of trying to provide training with them (...)the apprenticeship is working well, the program is in place, but there are also the issues with other staff members would I be happy to assist etc. That would be something I would look at</i>” (Interview 6).</p>
Control, high degree of business model development	13	<p>The entrepreneur joins the program with a developed business model based on developing market intelligence (forecast models and reports) for the renewable energy sector. The entrepreneur does not articulate, question, or validate the theory of value, which remains a high-level conceptualization: “<i>The problem that (clients) have (...) is to structure the business. So I mentor them and I help them developing their business. (...) It helps them by giving the know-how and giving some advice that they lack because they might not have all the knowledge about the different parts of the business</i>” (Interview 5). When asked about how they gathered evidence, the entrepreneur indicates that evidence is collected in an unstructured way: “<i>On a weekly basis, I talk with them and I</i></p>



TABLE 7 (Continued)

Category	Case
	<i>mentor. So that is the best source of information, because they are directly (...) my target, and they tell me, 'Uh, yes. I need to do this, I need to learn this, I have this problem.' So I learn directly from them through the different opportunities that I have to talk with them and meet with them. Yeah. (...) Because the nature of what I do (...) mentoring (...) is based on talking with them. But, I mean, without talking to them, I couldn't do mentoring, so (...) it's like eating, you know, going to the restaurant, eating (...) yeah, you go to the restaurant to eat. That is the core experience. So talking with them is a core part of my services"</i> (Interview 5). When asked how they would assess whether their ideas are supported or not through conversations with people, their response is: <i>"Well, there is a huge demand for mentoring, and the feedback is quite straightforward, to say, 'Oh, you know, I need this, can you help?' So there's not a lot of science there. They tell you directly. So you have a very straightforward feedback. It's not difficult. Yeah. (...) I don't do testing as such. But I keep talking and networking."</i> (Interview 5).
Control, high degree of business model development	14 The entrepreneur joins the program with a developed business proposition, centered around personal coaching for women entrepreneurs. The theory of value is never explicitly articulated, and the use of tests is vague and generic: <i>"I also did a bit more hand-holding, mentoring or one-to-one, something like that. I think for people who are just starting off, it's a bit scary. I did do a test with a lady, we'll be busy doing the test in the next couple of weeks because I'm going to do some LinkedIn as well with details of my course, or rather the workshop, so they are happy to help me, so I think that will probably also... And the plan is when they come for the workshop because it's three events, we will be asking them questions like what they want. (...) I have a list of pain points, what they want, like their sleepless nights, freedom of time, because success is not just money in the bank, being able to go to your child's show or something like that. (...) Those are the questions I think they need, but it might be very different from what actually they need, so that would be just in the test, I think"</i> (Interview 2).
Control, high degree of business model development	15 The entrepreneur joins the program with a developed business model centered around offering property services. The theory of value is not explicitly articulated: <i>"Yeah, OK. The value proposition is offering quality accommodation and making it fair, firm and sustainable. (...). Although profitability seems to be the main focus, obviously (...), ultimately you need to be profitable (...), it's highly competitive out there. (...) I know it's going to be better than last year, the results, but still it's below the ... I think it will be still below the 50,000, 50 K threshold, but sort of progressing. And consolidating, in these current times, is already a good thing, with all the things that've been happening, and lots of businesses have been closed down. So, I could be more ambitious, but for the moment, I'm just happy with the state"</i> (Interview 8).

TABLE 7 (Continued)

Category	Case
<p>Treatment, high degree of business development: Entrepreneurs in this group, similar to their counterparts in the previous one, entered the program with more clearly defined business models. The program effectively encouraged them to elaborate and test their theories. Like the control entrepreneurs at the same degree of development, their focus was on particular elements of their strategy rather than its broader aspects, employing targeted tests to evaluate these specific areas. Upon analyzing their results, these entrepreneurs gained a precise and definitive understanding of the validity of their hypotheses concerning the specific elements under examination. This clear understanding, derived from the test results, reduced uncertainty and yielded precise insights that were actionable, soon resulting in noticeable improvements in performance outcomes.</p>	
Treatment, high degree of business model development	<p>16 The entrepreneur joins the program with a developed business model based on the idea of providing—coaching and business training to minority women to support them in establishing international businesses. The training encourages them to articulate and interrogate their theory of value: “<i>We hope that will confirm whether our understanding of the problem is correct... basically, we’ve defined the problem is to retain the talent, and second, to re-skill their people within the organization, but now we have to double confirm whether our solutions would be perceived by the end consumer as something that can actually help them feel future proof</i>” (Interview 5). The entrepreneur applies the scientific approach in a targeted way to fine tune the business model. The macro characteristics of the service are not questioned, and the entrepreneur rather focuses on specific dimensions such as its promotion and the entry strategy: “<i>Through the program, I changed much the strategy of promotion of the company, not as much the service itself. So my biggest testing and one thing that came out of the program was I tested whether if I promoted the same service to the same people but using my achievements to promote the service people would be more willing to buy it. That has proven right, and this was a big take away</i>” (Interview 2). “<i>We were targeting always a number of different locations, and after each of the (tests), we were sort of narrowing down the number of locations. So, now we have finally proved that our product offering would be best launched in East Africa, so that was another outcome of the testing for the last couple of months, that I think is very important</i>” (Interview 5).</p>
Treatment, High degree of business model development	<p>17 The entrepreneur joins the program with a developed business based on the idea of a virtual reality tech platform that connects children with curriculum and culture, featuring interactive cultural content inspired by museums and cultural institutions. The entrepreneur uses the scientific approach in a very focused manner, testing specific assumptions the business theory relied upon. Because the key components of the strategy are already crystallized and the scope of the tests is narrow, results from the test can be quickly implemented with positive results on performance: “<i>So we had the children go through the different levels and then we asked them at different points throughout what was easy, difficult (...), and then afterwards we asked them to go through the pack and then got their feedback on that (...)</i> So we</p>



TABLE 7 (Continued)

Category	Case
	<i>found that kids really like to take what they learned in the digital and apply it in the physical and they like to use their hands. Anything to kind of add a tactile component is really good. (...) It was an assumption and that just kind of confirmed it. (...) I think that it helped us to implement more tactile activities in our learning pack. (...) We gained about 30 (new customers)” (Interview 7).</i>
Treatment, High degree of business model development	18 <p>The entrepreneur joins the program with a business model related to an online marketplace facilitating transactions across the exhibition ecosystem. The platform is pretty much defined, but during the program the entrepreneur is encouraged to articulate and interrogate their theory of value, which leads to identifying a new way of using the platform: <i>“It’s complementing what we’re doing with our platform, with an offline service, which essentially fulfills the same goal, but just for the share of the market that is not as familiar with using a (platform), we would be able to still use (the platform) internally, but have an account manager use that on their behalf, and intend to deliver a service enabled by the technology platform, but that is pitched and sold to the client as a service rather than as a subscription to a software that they can use”</i> (Interview 7). The idea is based on a defined theory: <i>“There is a whole side of the market which is not quite tech-savvy, and has an interest in our value proposition, but doesn’t feel comfortable using the product, whereas would be much more comfortable using us if we were to provide the same, or address the same issue by offering a service rather than a product that they would need to use independently from us.” (...)</i> “We did do market research and testing, and we started rolling out the service, which will now be advertised as per next week on our website.” The entrepreneur’s testing focuses on some specific aspects of the service: <i>“it’s been based on research that we’ve done, but we are starting to roll out the actual service (...) “everything needs to be tested, go-to-market strategy, pricing, level of satisfaction with the service as it is provided at the moment, costs to the business to provide that service”</i> (Interview 7)</p>
Treatment, high degree of business model development	19 <p>The entrepreneur joins the program with a developed business model centered around selling electronic products that match customers’ needs. Their theory of value is already defined: <i>“not all customers are technologically savvy but that they need solving the problems, and we took that misunderstanding in how technology works away, and we made things very simple and that’s exactly why we are on top of our competitors. Our competition is currently selling very specific and technically a lot of details in technical specifications, and what we sell is basically a solution to solve your problem, we don’t overload you with specifications, we just make sure that it works for you.”</i> The program helps them finetuning their strategy: <i>“Yes, we have analyzed the customer journey in much more detail. We identified some bottlenecks and we have also introduced more rigorous testing methods into decision-making and</i></p>

TABLE 7 (Continued)

Category	Case
	<p>releasing products and services” (Interview 1). The entrepreneur explicitly talks about the benefits of a theory-based scientific approach to decision-making as opposed to just conducting tests and how this helps them reduce uncertainty: “We collected tons metrics because my background is social engineering and big data is my bread and butter (...) but (the scientific approach) places the whole project in hypothesis and theory and (...) it helped us understand. (...) It showed (how) to eliminate your gut feeling and occasionally instead of trying to estimate what feels right, those kinds of things were tested (...), it gives a perspective into the direction that we’re going is correct. (...) We were testing it before but now we find that this is the basic of all our decisions. We collect the data and we have to make predictions, we need a set of different metrics data in order to validate whether our decision is correct. (...) We kind of introduced the scientific method in all the decisions, into which categories, which products do we go? (...) We were testing it before but now we find that this is the basic of all our decisions” (Interview 1) The entrepreneur uses the scientific approach to refine the specific way in which they sell a product, developing a theory of what product description would convert more customers: “We started advertising our products as a solution, some memory solutions for those specific devices.” They then test the theory developed “once we had these different listings (...) we find out this is the best method (...) right now memory cards is a third of our business, and we are selling 5000 a month.” (Interview 1)</p>
Treatment, high degree of business model development	<p>20 The entrepreneur joins the program with a developed business model related to automation tools and products for high-volume beverage-consuming venues. They use the scientific approach taught in the program to change a specific aspect of the business, i.e., the revenue model: “It was a hypothesis back when we initially started and now it’s definitely become very much proven concept and we’re working towards finalizing on what parameters we are going to enter into a revenue share model. (...) What I’ve discovered is it is the venue owners and management are not interested in in putting a lot of capital in it to acquire a piece of hardware. So they are more interested in using the machine rather than buying the machine or owning the machine. (...) We are discussing a completely new business model which will work on the revenue share model where we would place the machine at a minimal cost or no cost at all, and we would enter into a revenue share contract with the venue wherein whatever the total sales from the machine are, there’s a certain percentage that comes directly to us. So that really helps them by minimizing there one-off heavy cost, while experiencing the improvement and efficiency and the increasing sales, but it helps us because we get a constant flow of cash flow through the revenue share, and also we maintain the ownership of the machine which maybe after a year I could move that’s a machine from one venue to another venue depending on what the needs are”(Interview 3).</p>



“So basically we spotted the solution from the existing competitors, understanding that the existing competitors are all shifting towards offering consulting and development of blockchain solutions. So it means that at the moment this is what was the market and this is where we should go (...) we need a programmer, so that would be the first change, and yes, the image of the project also changes, and (...) we’re looking for different kinds of clients. We already hired a developer” (Case 1, Interview 3)

“most of the people were answering that they were willing to spend up to £100. (...). We have two weeks, to three weeks until the website is on again, to review again the prices. (...) it was clearly seen that we need to do speedy delivery and we will pay for it.” (Case 4, Interview 8)

The lack of a theory of value made entrepreneurs in this category quicker to implement solutions. This might explain the generation of some revenue in the short term. But because these solutions were not necessarily “thought through” long run performance is not guaranteed.

4.3.2 | Treatment—Low degree of business model development: Key themes

In stark contrast with the previous category, the interviews with treated entrepreneurs in this category reveal that the treatment prompted them to revisit how they were thinking about their original ideas, articulating their theory of value (“*why we think people find value and how things will grow*”) and exploring its “*boundaries*”:

“To be honest, it wasn’t until I came to the (program) that I understood, and I am a scientist, so I know about testing and I know about research. (...) But I never ever thought about using it in a business model, and that’s what really attracted me to it. (...) Due to the impact of the (program), what we were thinking before was different to now. The way I’m thinking is different now” (Case 10, Interview 8)

“Our primary goal would be to validate our current value and growth hypothesis (...) the reason why we think people find value and how things will grow” (Case 6, Interview 1).

“We’re starting to look beyond the boundaries of what was effectively sort of a very narrow project which we realize we, whilst it may work, we’re now looking longer term and thinking how we can actually turn that into a more viable business” (Case 8, Interview 8)

Entrepreneurs within this category emphasize that participating in the program sparked an evolution in their original thinking of the problem at hand. This evolution led to substantial changes to the original ideas in the short term, with the hope of achieving long-term outcomes:

“we just had to redefine everything. (...) I think right now we’re just sort of everywhere. So, we’ve sort of stepped back, it is needed to improve ourselves and then to

come out better. (...) We (...) realized that there were quite a little bit that I actually needed to improve on in understanding the market properly” (Case 7, Interview 8).

“We are not functioning yet, because we’ve come back and what we are now is actually doing up our processes, so we’re trying to draw up our processes based on using a platform model. (...) this new process is actually what is taking our time now to look at how we design it, what are the features that we want on the platform” (Case 10, Interview 8).

The interviews echo the insights from the quantitative analysis, indicating that this group of entrepreneurs experienced an increase in epistemic uncertainty. In the interviews, entrepreneurs directly link this increase in uncertainty to the use of the scientific approach and the subsequent realization of the lack of validity of some earlier choices:

“So before coming into the (program), we had a very clear vision of which problem we were solving. But as we’ve gone through and sort of (...) rigorously tested our hypothesis and our ideas, we’re a little bit less clear on which points, which pain we’re sort of reducing for our users. So that’s the thing we’re trying to ensure and struggling a little bit to get clarity on” (Case 6, Interview 1).

“What we realized is that it’s obviously more complicated than that” (Case 8, Interview 5). “So we thought that we just needed the app, but as I said (...) the app’s proved to be a bit of a disaster, so we’re going back to the drawing board” (Case 8, Interview 8).

Recognizing the need for additional search, these entrepreneurs took a longer-term view, acknowledging that the changes initiated during the program may require time to yield results but were intended to set the entrepreneur on a better trajectory:

“So, for the next one year we are not going to do anything, so I just need to reforecast, re-plan, and get my new target audience and just work out on my marketing strategies.” (Case 7, Interview 8).

This perspective aligns with and helps explain the lower performance and higher uncertainty observed quantitatively (in Tables 3 and 6, respectively) among these entrepreneurs during the study period.

4.3.3 | Control—High degree of business model development: Key themes

Similarly to the case of control entrepreneurs with low degree of business model development, these entrepreneurs did not manifest significant doubts about the value of their ideas. They refrained from articulating a theory of value or conducting thorough empirical analysis. Instead, they typically expressed—in a general manner—why they found their idea worthwhile and described the informal process through which it was identified, lacking rigor in their approach:



“people who had heard about Bitcoin (...) but they were not computer educated so they needed someone who understood the way the computer educated side came from, (...) I was already in close contact with these people anyway because that was my previous business was in financial markets (...) we already knew what the product was” (Case 11, Interview 7).

“Well, there is a huge demand for mentoring, and the feedback is quite straightforward, to say, ‘Oh, you know, I need this, can you help?’ So there’s not a lot of science there. (...) I don’t do testing as such. But I keep talking and networking. (...) So it’s an informal chat” (Case 13, Interview 5).

Since they did not scrutinize their strategies, these entrepreneurs mostly continued conducting business as before the program, without any revision to the macro aspects of their business model.

“The value proposition is offering quality accommodation and making it fair, firm and sustainable. (...) (...) I know it’s going to be better than last year, (...) but sort of progressing. And consolidating, in these current times, is already a good thing, with all the things that’ve been happening, and lots of businesses have been closed down. So, I could be more ambitious, but for the moment, I’m just happy with the state” (Case 15, Interview 8)

4.3.4 | Treatment—High degree of business model development: Key themes

Like entrepreneurs in the previous one, those in this category also joined the program with business models that tended to be more developed. The treatment proved effective in encouraging them to articulate and validate their theories of value:

“But (the scientific approach) places the whole project in hypothesis and theory and (...) it helped us understand. (...) It showed (how) to eliminate your gut feeling (...) instead of trying to estimate what feels right, those kinds of things were tested (...) We collect the data and we have to make predictions, we need a set of different metrics data in order to validate whether our decision is correct. (...) We kind of introduced the scientific method in all the decisions, into which categories, which products do we go? (...) We were testing it before but now we find that this is the basic of all our decisions” (Case 19, Interview 1)

In line with their high degree of business model development, these entrepreneurs focused on fine tuning more granular aspects of their strategy rather than its macro aspects. Consistently, their analysis involved tests that directly targeted these particular aspects:

“Basically, we’ve defined (that) the problem is to retain the talent, and second, to re-skill (...) people within the organization, but now we have to double confirm whether our solutions would be perceived by the end consumer as something that can actually help them feel future proof” (Case 15, Interview 5)

“So we had the children go through the different levels and then we asked them at different points throughout what was easy, difficult (...), and then afterwards we asked them to go through the pack and then got their feedback on that” (Case 17, Interview 7)

“Through the program, I changed much the strategy of promotion of the company, not as much the service itself. So my biggest testing and one thing that came out of the program was I tested whether if I promoted the same service to the same people, but using my achievements to promote the service, people would be more willing to buy it.” (Case 16, Interview 2)

After testing their theories and evaluating results, entrepreneurs in this category had a clear and specific understanding of whether their predictions about the specific aspects they aimed to test were supported:

“So we found that kids really like to take what they learned in the digital and apply it in the physical and they like to use their hands. Anything to kind of add a tactile component is really good. (...) It was an assumption and that just kind of confirmed it. (...) I think that it helped us to implement more tactile activities in our learning pack.” (Case 17, Interview 7)

“What I’ve discovered is (that) the venue owners and management are not interested in putting a lot of capital in it to acquire a piece of hardware. So they are more interested in using the machine rather than buying the machine or owning the machine.” (Case 20, Interview 3)

“So, now we have finally proved that our product offering would be best launched in East Africa.” (Case 16, Interview 5)

The clarity provided by the test results contributed to a reduction in epistemic uncertainty, facilitating precise insights and fast implementation, which quickly translated in positive performance outcomes:

“That has proven right, and this was a big take away” (Case 16, Interview 2)

“I think that it helped us to implement more tactile activities in our learning pack. (...) We gained about 30 (new customers)” (Case 17, Interview 7)

“Once we had these different listings (...) we find out this is the best method (...) right now memory cards is a third of our business, and we are selling 5,000 a month.” (Case 19, Interview 1)

This observation aligns with the quantitative analysis in Table 6, showing certainty does not decrease for entrepreneurs in this category, and Table 3, indicating their superior performance outcomes.



5 | DISCUSSION AND CONCLUSIONS

This study investigates whether the degree of business model development of the firm moderates the performance impact of a scientific approach to decision-making. Using a question-driven approach with a RCT involving 261 entrepreneurial firms in the United Kingdom, we assessed the influence of a scientific approach on performance and its varying effects on firms with various degrees of business model development. The main result is that treated firms with a high degree of business model development have higher performance compared to control firms, while treated firms with a low degree of business model development show lower performance than their control counterparts. To interpret these outcomes, we identify and explore alternative interpretations. We systematically ruled out the possibility that the entrepreneur confidence or experience might explain the results. Instead, we presented quantitative and qualitative evidence supporting the interpretation that these differences are linked to the level of strategic commitment to key business model choices already made by entrepreneurs when they are exposed to the approach and the consequent locus of epistemic uncertainty, as the latter permeated the choices the entrepreneurs have not yet committed to. The scientific approach induced treated firms with both lower and higher degrees of business model development to articulate and interrogate their theory of value, but with different effects. Entrepreneurs with highly developed business models had already settled on their core strategic decisions and primarily dealt with uncertainty related to more peripheral or operational aspects. As a result, they did not reassess their fundamental choices but rather used the approach to fine-tune their theory of value within the framework of these established decisions. This led to reduced uncertainty surrounding operational decisions and an improvement in overall performance compared to a control group. Conversely, entrepreneurs with less developed business models had not yet solidified the core elements of their strategy. The scientific approach prompted these entrepreneurs to develop a comprehensive theory of value, leading them to explore more extensively all facets of the business model (Agarwal, Bacco, et al., 2024; Felin, Gambardella, et al., 2020; Gans et al., 2019). This resulted in a reassessment of all decisions—both central and peripheral—and compared to the control group, increased epistemic uncertainty and stalled short-term economic performance. Control group firms, instead, irrespective of their development stage, tended to avoid articulating their theory of value. Those at a lower degree pursued unvetted ideas quickly as they emerged, while those at a higher degree continued “business as usual” with limited improvement.

This study makes several contributions to research in strategy and entrepreneurship. First, these results provide insight on the performance implications of the use of a scientific approach. Research in this area has theorized and empirically shown a positive effect of a scientific approach on performance across institutional settings and both in the short as well as long term (Agarwal, Bacco, et al., 2024; Camuffo, Coali, Gambardella, et al., 2024; Camuffo, Gambardella, Messinese, et al., 2024; Camuffo, Gambardella, & Pignataro, 2024; Coali et al., 2024; Felin & Zenger, 2017; Zellweger & Zenger, 2022). Despite the relevance of this insights, these studies often overlook the crucial importance of firm heterogeneity in influencing the impact of a scientific approach to decision making. By exploiting a context characterized by firms at different degrees of business model development, this study highlights that contingencies matter in shaping the performance implications of a scientific approach. This aligns with the theoretical insight that the effectiveness of decision-making approaches depends heavily on the specific circumstances confronting each firm (Agarwal, Camuffo, et al., 2024).

Second, this study posits that the most relevant dimension of performance for entrepreneurial ventures is “contextual.” Many RCTs, including those studying the scientific approach, implicitly assume treatment effectiveness should be measured by economic performance outcomes. This study suggests this assumption may need reevaluation as economic performance improvements may be appropriate for established firms but not for those in early stages of business model development, as the treatment prompts a reevaluation of foundational strategies. This reevaluation could temporarily increase epistemic uncertainty and hinder economic performance gains, yet it represents a positive interim outcome previously overlooked. Therefore, in early stages, the value of the scientific approach may not be immediately evident in performance but rather in developing a theory of value itself. Conversely, for firms further along in developing their theory of value, the scientific approach helps refine details and achieve faster performance improvements along the existing trajectory. This study highlights the critical importance of understanding what works in ventures that have vs. have not yet identified a preliminary set of stable business model decisions, an area where research is notably scarce but highly needed (Spina & Hasan, 2024). More research focusing on the factors influencing success in these various phases, such as the scientific approach, would greatly benefit our understanding of how entrepreneurs can leverage business models to drive growth and create value (Snihur & Zott, 2020; Zott & Amit, 2008).

Third, this article provides the intriguing insight that the strategic commitments entrepreneurs have already made significantly influence the decision-making process and how their theory of value is ultimately shaped. A key question arises regarding the origins of these strategic commitments. A preliminary response is provided by Valentine et al. (2024), who show that strategic commitments can emerge from multiple sources: they might result from the entrepreneur's previous experiences or from resources already allocated to the business idea, or from the early articulation of a theory of value. Understanding how these different paths affect entrepreneurial outcomes and prospects is important.

This study also contributes to the strategy literature on search (Gavetti & Levinthal, 2000; Gavetti & Rivkin, 2007; Levinthal, 2017). We advance that the use of a scientific approach supports a search process that combines cognitive and experiential search: it begins with a process of theory and hypothesis development, which facilitates the creation of a map of action-outcome linkages and the assessment of options “off-line.” Subsequently, it involves the collection of evidence and its disciplined assessment, which resonates with the idea of experiential search (Levitt & March, 1988; Lippman & McCall, 1976). Research on search has highlighted synergies between cognitive and experiential approaches, with the theory seeding the search process in promising regions of the landscape and preventing it from taking root in less attractive ones (Gavetti & Levinthal, 2000; Gavetti & Rivkin, 2007; Levinthal, 2017). The quantitative and qualitative findings shed light on how a search process that combines cognitive and experiential search applies in an entrepreneurial setting and how it leads to different search paths for firms with different degrees of business model development, with important consequences in terms of uncertainty resolution. Relatedly, prior research in this area has advanced a relevant tension between organization rationality and plasticity (Gavetti et al., 2005; Rios, 2021), suggesting that firms tend to naturally shift to more rational, less experiential search mechanisms later in their evolution, when they often lack the plasticity necessary to fully benefit from rationality (Gavetti et al., 2005). These findings suggest an intriguing possibility—to be tested by future research—that guiding firms to adopt a scientific approach may serve as a mechanism to encourage earlier adoption of more rational search processes, particularly during their more plastic and absorptive early stages.



A final contribution is to offer insights to policymakers and educators. Encouraging entrepreneurship has been a major means to spur economic growth (Bennett & Chatterji, 2023; Decker et al., 2014; Lerner, 2009; McKenzie, 2021). Bennett and Chatterji's (2023) nationally representative survey of the pre-entry activities conducted by potential entrepreneurs in the United States found that fewer than half of those who consider starting a business take the lowest-cost steps, such as searching the Internet for potential competitors or speaking with a friend, and attribute this phenomenon to the psychological costs associated with learning the true promise of an idea. These results show that an intervention intended to encourage systematic experimentation to support decision-making does indeed result in an increase in search and uncertainty for entrepreneurs at the early stage of their business model definition but suggest the possibility of better outcomes later on. In addition, our results provide guidance for educators. Entrepreneurs in the control group were presented cognitive and evidence-based tools individually, as is typical in many Master's or MBA programs, either as part of the same module or as part of multiple modules. Treated entrepreneurs, instead, were taught how to use these tools in combination, using cognitive frameworks to develop a theory and hypotheses and using evidence-gathering techniques to test and evaluate their theory and hypotheses. The substantial difference in outcomes between the treatment and control groups underscores that it is not *merely the tools* provided to entrepreneurs but also the *manner* in which they are taught to utilize these tools that plays a crucial role.

In line with our abductive approach, we assembled a set of analyses that explored the phenomenon, identified a "promising explanatory conjecture," and put together plausible evidence in line with those explanations. In keeping with an abductive approach, readers are encouraged to form their own interpretation of this phenomenon. Other scholars can build on this work to develop theory, pre-register hypotheses, and test them to build a cumulative knowledge base. We delineate some of the promising avenues for future research that this study's results suggest. First, they suggest the possibility that additional search undertaken by entrepreneurs at low degrees of business model development is a beneficial outcome because, despite delaying the achievement of immediate performance outcomes, it puts entrepreneurs on a better trajectory. Our findings indicate that the longer-term performance effects could be greater for firms at a lower degree of business model development, as a scientific approach allows them to fix errors and make strategic investments for long-term success, even if not immediately visible.⁷ The words of a treated entrepreneur who took part in the program highlight this concept clearly: "*we've sort of stepped back, it is needed to improve ourselves and then to come out better*" (Case 2, Interview 8). Replicating these analyses over a longer period would help confirm that firms with less developed business models can also experience positive revenue impact in the long run.

One of the advantages of this study is that it focused on firms with fewer than 10 employees, to ensure that the treatment was administered to those directly involved in the firm's decision-making. A very promising path for future research would be the exploration of the impact of the treatment with larger firms. The intervention's effect on entrepreneurial decision-making was short-lived, lasting only a few months before treated and control firms' processes became comparable. We also note that as firms mature, their decision-making naturally becomes more systematic. Future research should explore how to design interventions that shape entrepreneurs' long-term decision-making. Fourth, the exploration of the full range of contingencies that might contribute—in conjunction with a scientific approach to decision-making—to better

⁷We are grateful to one of the reviewers for making this valuable suggestion.

performance would be an important avenue for scholars. For instance, resources might play an important role in shaping performance outcomes and might afford entrepreneurs with more opportunities to experiment scientifically (Wuebker et al., 2023).

Overall, this study highlights a crucial dichotomy in entrepreneurial strategy formulation. While initial “blissful blindness” may yield short-term performance advantages, embracing a scientific approach—which prompts entrepreneurs to stop and reflect—may prove disadvantageous in the short term but more advantageous in the longer term. Over time, this approach can continue to enhance performance by guiding entrepreneurs to refine and crystallize their value proposition. By systematically analyzing and iterating upon their strategies, entrepreneurs can navigate uncertainties more effectively, ultimately achieving sustained positive performance. Thus, while immediate gains may be tempting, the disciplined pursuit of a scientific approach can lay the foundation for positive outcomes in the later phases of the entrepreneurial journey.

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DATA AVAILABILITY STATEMENT

Data available on request from the authors.

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APPENDIX

SECTION 1

TABLE A1 Scientific intensity components.

Component	Subcomponent	Definition	Score
Theory	Clarity of theory	The extent to which the theory is understandable	0 (no theory) or from 1 (not clear) to 5 (extremely clear)
Theory	Articulation of theory	The extent to which the theory is detailed	0 (no theory) or from (not detailed) to 5 (extremely detailed)
Theory	Consideration of alternatives	The extent to which the theory includes alternative possible options	0 (no theory) or from 1 (no consideration of alternatives) to 5 (careful consideration of many alternatives)
Theory	Theory based on evidence	The extent to which the theory is based on objective evidence	0 (no theory) or from 1 (theory not based on objective evidence) to 5 (extremely based on objective evidence)
Hypotheses	Explicitness of hypotheses	The extent to which the respondent can articulate the fundamental assumptions that make his/her business viable	0 (no hypotheses) or from 1 (not explicit hypotheses) to 5 (extremely explicit)
Hypotheses	Coherence of hypotheses	The extent to which hypotheses are coherent with the theory	0 (no hypotheses) or from 1 (not coherent) to 5 (extremely coherent)
Hypotheses	Level of details of hypotheses	The extent to which hypotheses clearly indicate the details of what the entrepreneur wishes to learn and how to measure it	0 (no hypotheses) of from 1 (not detailed) to 5 (extremely detailed)
Hypotheses	Falsifiability of hypotheses	The extent to which it is possible to clearly determine (after tests) whether the hypotheses are supported or not	0 (no hypotheses) or from 1 (not falsifiable) to 5 (extremely falsifiable)
Tests	Coherence of tests	The extent to which the test is coherent with the hypotheses	0 (no tests) or from 1 (not coherent) to 5 (extremely coherent)
Tests	Validity of tests	The extent to which the test has been conducted in a context similar to which the business operates	0 (no hypotheses) or from 1 (not valid) to 5 (extremely valid)
Tests	Representativeness of tests	The extent to which the test has been conducted with a sample that is representative of the broad group the firm targets	0 (no hypotheses) or from 1 (not representative) to 5 (extremely representative)
Tests	Rigorousness of tests	The extent to which the appropriate test and procedure for	

TABLE A1 (Continued)

Component	Subcomponent	Definition	Score
		that type of test have been chosen for hypotheses-testing	0 (no hypotheses) or from 1 (not rigorous) to 5 (extremely rigorous)
Evaluation	Data-based assessment	The extent to which the evaluation is based on data	0 (no hypotheses) or from 1 (not based on data) to 5 (extremely based on data)
Evaluation	Coherence of measures	The extent to which the measure used are consistent with the learning objective the entrepreneur has in mind	0 (no hypotheses) or from 1 (not coherent) to 5 (extremely coherent)
Evaluation	Systematic evaluation	The extent to which the evaluation is based on systematically collected and analyzed data	0 (no hypotheses) or from 1 (not systematic) to 5 (extremely systematic)
Evaluation	Explanatory power of evaluation	The extent to which the evaluation results in clarity on the main findings from the test and their implications for the business	0 (no hypotheses) or from 1 (not explanatory) to 5 (extremely explanatory)

TABLE A2 Scientific intensity.

Scientific intensity	Treatment		Control		Difference	
	Mean	SD	Mean	SD	<i>b</i>	<i>p</i>
Interview 0	2.56	1.23	2.35	1.29	−0.2	(.20)
Interview 1	2.34	1.38	1.91	1.43	−0.43	(.01)
Interview 2	2.47	1.36	2.06	1.39	−0.4	(.02)
Interview 3	2.57	1.33	2.12	1.39	−0.45	(.01)
Interview 4	2.54	1.28	2.1	1.39	−0.44	(.01)
Interview 5	2.53	1.29	2.15	1.41	−0.38	(.02)
Interview 6	2.55	1.27	2.18	1.4	−0.37	(.03)
Interview 7	2.57	1.28	2.21	1.41	−0.36	(.03)
Interview 8	2.58	1.29	2.26	1.42	−0.32	(.06)
Observations	133		128		261	



TABLE A3 Impact of the treatment on performance: Winsorized.

Variables	(1) Log (1+) revenue	(2) Log (1+) revenue
	OLS panel	OLS panel
Treatment × Post	−0.1360 (.3984)	−1.1431 (.0031)
Treatment × Post × Degree of Business Model Development		0.0179 (.0026)
Treatment	−0.0819 (.5754)	−0.1428 (.6325)
Post	1.0566 (.0000)	1.6763 (.0000)
Degree of Business Model Development	0.0051 (.1207)	0.0052 (.1799)
Treatment × Degree of Business Model Development		0.0011 (.8342)
Post × Degree of Business Model Development		−0.0107 (.0221)
Constant	0.5313 (.0082)	0.5272 (.0168)
Observations	522	522
R-squared	.0988	.1112
Number of id	261	261
Clustered errors	Firm	Firm

Note: Robust pval in parentheses.

TABLE A4 Impact of the treatment on performance, alternative measure of degree of business model development: Annual revenue at the baseline.

Variables	(1) Log (1+) revenue	(2) Log (1+) revenue
	OLS panel	OLS panel
Treatment × End of observation window	−0.0629 (.6473)	−0.3540 (.0165)
Treatment × End of observation window × Degree of Business Model Development		0.1637 (.0264)
Treatment	0.1061 (.2965)	−0.1436 (.1461)
End of observation window	0.4420 (.0006)	0.6205 (.0000)
Degree of Business Model Development	0.4166 (.0000)	0.3525 (.0000)
Treatment × Degree of Business Model Development		0.1436 (.0181)
End of observation window × Degree of Business Model Development		−0.0929 (.0775)
End of training	0.3285 (.0000)	0.3285 (.0000)
Constant	−0.0089 (.9217)	0.1144 (.1576)
Observations		
R-squared	.3779	.4017
Number of id	783	783
Clustered errors	Firm	Firm

Note: Robust pval in parentheses. Degree of business model Development is measured as the annual revenue of each firm in the year before it started the program (log of 1 +, in thousands of GBP). The dependent variable here is considered for three separate observations: (1) at the baseline, (2) after the training program is over, (3) at the end of the observation period. The different time windows that relate to the dependent and independent variable reduce concerns regarding endogeneity.



TABLE A5 Attrition.

Interview number	In	Withdrawn	Withdrawn %
0	261	0	
1	223	38	15%
2	212	11	4%
3	207	5	2%
4	193	14	5%
5	185	8	3%
6	173	12	5%
7	163	10	4%
8	147	16	6%

TABLE A6 Attrition: Probability of withdrawing from the program.

Variables	(1) Early withdraw OLS cross section
Treatment	−0.0167 (.7862)
Constant	0.4453 (.0000)
Observations	261
R-squared	.0003
Clustered errors	Firm

TABLE A7 Attrition: Alternative specifications.

Variables	(1) Log (1+) revenue	(2) Log (1+) revenue
	OLS panel	OLS panel
Treatment × Post	−1.4584 (.0048)	−0.5733 (.0169)
Treatment × Post × Degree of Business Model Development	0.0236 (.0050)	0.0075 (.0588)
Treatment	−0.1428 (.6325)	−0.7648 (.0655)
Post	2.1711 (.0000)	1.5491 (.0000)
Degree of Business Model Development	0.0052 (.1799)	0.0006 (.9132)
Treatment × Degree of Business Model Development	0.0011 (.8342)	0.0101 (.1534)
Post × Degree of Business Model Development	−0.0102* (.0826)	−0.0031 (.2855)
Constant	0.5272 (.0168)	0.8560 (.0050)
Observations	522	1764
R-squared	.1476	.0761
Number of id	261	261
Interview effects	-	Yes
Clustered errors	Firm	Firm

Note: Robust pval in parentheses.



TABLE A8 Alternative measures of experience.

Variables	(1) Log (1+) revenue (in £ 000)	(2) Log (1+) revenue (in £ 000)	(3) Log (1+) revenue (in £ 000)
	OLS panel	OLS panel	OLS panel
Treatment × Post	−0.1343 (.5494)	−0.0751 (.7496)	−0.0054 (.9809)
Treatment × Post × Industry Experience	0.0040 (.8699)		
Treatment × Post × Managerial Experience		−0.0073 (.8084)	
Treatment × Post × Entrepreneurial Experience			−0.0245 (.5329)
Treatment	−0.1797 (.3480)	−0.0985 (.6375)	−0.1543 (.4395)
Industry Experience	0.0039 (.7298)		
Managerial Experience		−0.0099 (.5009)	
Entrepreneurial Experience			−0.0176 (.1751)
Treatment × Industry Experience	0.0125 (.4948)		
Treatment × Managerial Experience		−0.0008 (.9692)	
Treatment × Entrepreneurial Experience			0.0105 (.7156)
Post	0.9648 (.0000)	1.0213 (.0000)	0.9341 (.0000)
Post × Industry Experience	0.0121 (.4996)		
Post × Managerial Experience		0.0058 (.7865)	
Post × Entrepreneurial Experience			0.0269 (.2701)
Constant	0.7973 (.0000)	0.8877 (.0000)	0.9076 (.0000)

TABLE A8 (Continued)

Variables	(1) Log (1+) revenue (in £ 000)	(2) Log (1+) revenue (in £ 000)	(3) Log (1+) revenue (in £ 000)
	OLS panel	OLS panel	OLS panel
R-squared	.0974	.0924	.0926
Observations	522	522	522
Number of id	261	261	261
Clustered errors	Firm	Firm	Firm

Note: Robust pval in parentheses.

SECTION 2

Examples of differences in slides and in-class activities between treatment and control

In Training Session 2, both groups learned about the customer journey map as a tool to systematically examine what their potential customers were currently doing and where they might experience bottlenecks. As shown in Figure A1, where we reproduce some of the slides used during the training program, both groups learned about the key building blocks of the customer journey and were exposed to the same example (IKEA). Entrepreneurs in the treatment group were explicitly shown how the customer journey map could be used by IKEA to develop, test, and evaluate theory and hypotheses. The control group, instead, devoted more time to learning about the content that was common to both groups. We highlight in green the part that was different for the treatment group.

After this portion of the lecture, both groups conducted an in-class activity, during which they were invited to complete a customer journey map for their business. The in-class activity was followed by a debrief guided by the instructor, where entrepreneurs received feedback on their customer journey maps. These activities were helpful in getting entrepreneurs to apply the content of the class to their business right away, as well in allowing instructors to clarify any doubts entrepreneurs might have. Instructions provided to the two groups are reproduced in Figure A2. For the treatment group, part of the exercise involved the application of the scientific approach, while the control group worked on an alternative question. Since Training Session 2 was one of the earlier sessions, the focus of the lecture for the treatment group was on developing theory and hypotheses. In later sessions, the focus broadened to include how to test the hypotheses and evaluate results.



FIGURE A1 Extract from Session 2 slides: Treatment versus control group.

TREATMENT GROUP

CUSTOMER JOURNEY

Please draw a customer journey map using the template provided and share it with the person sitting next to you.



HOW TO ELABORATE HYPOTHESES

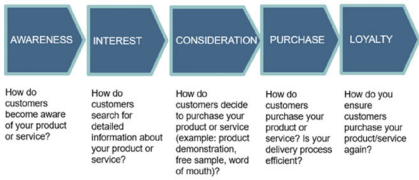
HYPOTHESES	IMPACT (1-10)
The problem [target users] face is [explain problem]	
This problem is more relevant for [this type of users] than [this type of users]	

IMPACT: The impact this hypothesis has on your business

CONTROL GROUP

CUSTOMER JOURNEY

Please draw a customer journey map using the template provided and share it with the person sitting next to you.



CUSTOMER JOURNEY: BOTTLENECKS

Identify what stage might be more difficult for customers to deal with and where they might experience more bottlenecks or issues.



FIGURE A2 In-class activities from Session 2 slides: Treatment versus control group.