Received: 5 August 2021 | Revised: 22 December 2023 | Accepted: 5 January 2024

DOI: 10.1002/smj.3581

RESEARCH ARTICLE

SMS | Strategic Management Journal WILEY

Poised for growth: Exploring the relationship between accelerator program design and startup performance

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Funding information
Wharton Dean's Research Fund

Abstract

Research Summary: Accelerator programs provide valuable market feedback and education to participants that may improve startup performance. However, it is unclear whether the average effect of accelerator participation on startup performance post acceleration is positive, and if so, how this effect varies with accelerator program design. We analyze data from 8580 startups that made it past the initial selection stage at 408 accelerators in 176 countries between 2013 and 2019. We compare accelerated and non-accelerated startups and find a positive average effect of accelerator participation on startup performance post acceleration. Moreover, we find that this effect varies substantially with program design, and depends on venture stage, industry, and founder expertise. Our findings highlight the impact of program design on the benefits that startups derive from accelerator participation.

Managerial Summary: The purpose of this study is to determine whether participation in startup accelerator programs generally leads to improved startup performance post acceleration and how the benefits of participation might vary with the design of these programs. We analyze data from 8580 startups that applied to and

passed the initial selection phase at 408 accelerators in 176 countries over multiple cohorts between 2013 and 2019. Our results indicate that on average, startups that participate in accelerators perform better than those that are also selected but not accelerated. Furthermore, we find that the benefits that startups gain from being accelerated vary with the design of the program. Our findings highlight the importance of accelerator program design in influencing the extent of improvement in startup performance post acceleration.

KEYWORDS

accelerators, cohort composition, firm performance, program design, startups

1 | INTRODUCTION

Startup accelerators have rapidly become integral parts of global entrepreneurial ecosystems. There are an estimated 160 accelerators in the United States and more than 2000 globally (Cohen et al., 2019). These limited-duration, cohort-based programs provide a variety of resources for venture development, including seed capital, coworking space, and feedback from mentors, program directors, peers, and qualified investors (Cohen et al., 2019; Cohen & Hochberg, 2014; Winston Smith et al., 2016), helping founders define and build their initial products, learn from peers, identify promising customer segments, and secure resources to grow and scale (Cohen, 2013; Winston Smith et al., 2016).

Given their prevalence and role in developing new ventures, accelerators have attracted substantial scholarly interest evaluating their effects on startup development. Much of the research on this topic has focused on the original—and leading—US accelerators, including Y-Combinator, TechStars, and MassChallenge (e.g., Fehder, 2015; Hallen et al., 2020; Winston Smith & Hannigan, 2015). A small number of studies have also begun to examine international programs, such as Start-Up Chile, based in Santiago, Chile (Gonzalez-Uribe & Leatherbee, 2017), and Startup Nation, based in Tel Aviv, Israel (Avnimelech et al., 2021). While several studies have found a positive effect of accelerator participation on early-stage venture performance (e.g., Fehder, 2015; Hallen et al., 2020; Winston Smith & Hannigan, 2015), some studies have found muted and even negative effects (e.g., Gonzalez-Uribe & Leatherbee, 2017; Yu, 2019). These varying estimates underscore inherent heterogeneity in the effects of being accelerated, and raise two important research questions: *Is the average effect of accelerator participation on startup performance post acceleration positive, and if so, how does this effect vary with program design?*

These questions are important to answer for several reasons. First, understanding whether the effect of accelerator participation is positive, on average, across a large sample of programs and countries may be helpful in determining whether startup accelerators deliver benefits for startups beyond the leading—and original—accelerator programs, such as Y-Combinator, and beyond well-developed startup ecosystems, such as Silicon Valley. Second, accelerators are

heterogeneous in their practices, activities, policies, and structures (Cohen et al., 2018; Cohen et al., 2019)—the basic building blocks of organizational design (Rivkin & Siggelkow, 2003; Siggelkow, 2001). Various design choices, such as how to select cohorts of participants, whether to focus on a single industry or multiple industries, and what type of programming to offer (Cohen et al., 2019)—may all affect the benefits founders and startups derive from accelerators. As well, because ventures differ in stage of development, industry, and founder expertise, a one-size-fits-all design may not be beneficial for all participants.

In this study, we advance the literature on startup accelerators by first evaluating whether accelerator participation is associated with improved startup performance, on average; second, we examine which program design elements are associated with the largest performance benefits and for which startups and founders; and finally, we assess how these benefits may vary with startups' stage of development, industry, and founder pre-entry experience. To evaluate the average effects of accelerator participation, we implement Hallen et al.'s (2020) inverse probability of treatment weights (IPTW) methodology. This methodology enables us to compare ventures that applied to and made it past the initial screening process at accelerators to evaluate whether those that were ultimately accelerated performed better post acceleration than those that were not and assess how these effects vary with accelerator program design and venture and founder characteristics.

We use data from the Entrepreneurship Development Program, supported by the Global Accelerator Learning Initiative, comprising a global sample of 23,364 accelerator applicants—of which 8580 made it past the initial screening stage and 4020 were ultimately accelerated across 335 cohorts—in 408 accelerator programs and 176 countries between 2013 and 2019. All programs in our sample fit the definition of an accelerator proposed by Cohen and Hochberg (2014), comprising (i) a cohort intake of ventures, (ii) a time-bound program, and (iii) a program duration of between 1 and 12 months. Our sample comprises a diverse set of accelerator programs, with varying durations, programming elements, and locations.[1]

On average, we find that accelerator participation is associated with positive effects on startup performance post acceleration, and that program design is a factor that explains substantial variation in the benefits of being accelerated across cohorts and programs. Conditional on being selected into an accelerator, startups that participate in accelerators are more likely to raise venture capital (VC), raise more VC, plan to raise more capital over the next 12 months, generate more revenue, have more full-time employees, and pay higher wages to their employees 1 year after being accelerated, compared to nonparticipants over the same period. Moreover, the benefits that startups derive from accelerator participation are contingent on the depth versus breadth of knowledge in their cohorts, the mix of knowledge-building programming offered by the accelerator, and a venture's stage of development, industry, and founder pre-entry experience. We find that programs that emphasize knowledge *depth* (over breadth) within cohorts are associated with greater revenue scaling post acceleration, on average, while programs that emphasize knowledge *breadth* (over depth) are associated with greater startup funding post acceleration, on average. Both types of design choices, however, are beneficial for improving startup performance post acceleration. As well, programs with more knowledge-

[1]For instance, 25% of programs in our sample were less than 3 months in duration, 38% were between 3 and 6 months, and 36% were longer than 6 months. As well, 30% of programs did not feature any formal pitching events, 40% did not provide seed capital, and 41% did not utilize a structured curriculum. Our data also span a wide assortment of programs, of which 27.6% were in North America (United States and Canada), 29.6% were in Latin America and the Caribbean, 17.4% were in Sub-Saharan Africa, 9.7% were in South Asia, and 15.5% were in Europe, the Middle East and North Africa.

building programming—such as formal pitching events, industry-focused insights, and structured curricula—are associated with greater improvements in startup performance post acceleration, on average; however, the optimal mix of programming depends on venture stage, industry, and founder pre-entry experience. For instance, structured curricula are most beneficial for first-time founders and those with less formal education, suggesting that educational programming supplements for limitations in founders' pre-entry knowledge and experience.

Our study makes several contributions to the existing literature on startup accelerators (e.g., Avnimelech et al., 2021; Cohen et al., 2018; Hallen et al., 2020; Winston Smith et al., 2016) and to the literature on vicarious and mutual learning among startups (e.g., Argote et al., 2020; March, 1991; McDonald & Eisenhardt, 2019; Posen & Chen, 2013). First, in relation to the literature on startup accelerators, we build upon Hallen et al. (2020) and Winston Smith and Hannigan's (2015) findings by showing the generalizability of the benefits of acceleration participation on startup performance post acceleration across a large and diverse sample of accelerator programs. We also extend these results to explain heterogeneity in the effects of accelerator participation across cohort and programs (e.g., Gonzalez-Uribe & Leatherbee, 2017; Yu, 2019) by showing how these effects vary with program design elements and with venture and founder characteristics. Second, our work complements and contributes to research on vicarious and mutual learning among startups (Cao & Posen, 2023; Piezunka et al., 2021; Posen & Chen, 2013) and research on knowledge spillovers in entrepreneurship (Agarwal et al., 2004; Agarwal et al., 2007; Agarwal et al., 2010) by showing that accelerators' design choices in terms of the knowledge breadth and depth within cohorts and knowledge-building programming explain variation in the impact of accelerator participation on startup performance post acceleration. Our work also complements and builds upon prior research on the role of founders' pre-entry knowledge and experience in startup performance (Cao & Posen, 2023; Dencker et al., 2009) by showing that the benefits of accelerator participation—and the impact of knowledge-building programming within accelerators—are contingent upon founders' prior education and prior founding experience. Our work therefore suggests that improvements in startup performance post acceleration derive from accelerators' role in building founders' knowledge and experience through knowledge-building programming and knowledge depth and breadth within cohorts that foster mutual and vicarious learning among startups.

2 | THEORETICAL FRAMING

2.1 | Performance benefits of startup accelerator participation

Startup accelerators are limited-duration; cohort-based entrepreneurial programs that offer founders resources to build entrepreneurial capabilities and expedite the pace of new venture development (Cohen, 2013; Cohen & Hochberg, 2014; Winston Smith et al., 2016). Most accelerators seek to develop founders' knowledge and skills by providing a combination of educational programming (Gonzalez-Uribe et al., 2022; Gonzalez-Uribe & Leatherbee, 2017), customized advice from industry experts or mentors (Cohen et al., 2018), and interactions with a cohort of other founders participating in the accelerator (Avnimelech et al., 2021; McDonald & Eisenhardt, 2019; Posen & Chen, 2013; Winston Smith et al., 2016). These unique features are designed to build both know "how" and know "what" in a time-bound, intensive format that

encourages participants to periodically transform feedback into deliverables, such as a prototype or pitch deck (Hallen et al., 2020) that are designed to accelerate startup development.

The know "how" pertains to specific entrepreneurial skills, such as customer development, prototyping, or pitching, while the know "what" involves understanding the payoffs, risks, and alternatives associated with different entrepreneurial choices and activities as part of the new venture development process (Hallen et al., 2020). As well, a distinctive and unique feature of startup accelerators is their cohort intake of new ventures. This feature is designed to enable interactions among peers (other founders and startups) within a cohort that enables participants to access distributed knowledge and engage in vicarious learning (Posen & Chen, 2013) to overcome limited pre-entry knowledge and experience (Cao & Posen, 2023).

The above-cited research suggests that startup accelerators may be highly beneficial for improving startup performance via these learning mechanisms by building founders' knowledge through both specialized programing and peer interactions within cohorts. The implied mechanisms are that participation in a startup accelerator develops founders' entrepreneurial knowledge and capabilities through mentorship and vicarious learning, which may lead to improved decision-making, better execution, and increased likelihood of success for ventures that participate in startup accelerators (e.g., Fehder, 2015; Hallen et al., 2020; Winston Smith & Hannigan, 2015), highlighting potential performance benefits that accelerators may offer to startups. Research on some of the original and leading US-based accelerators has uncovered these learning mechanisms (Hallen et al., 2020; Winston Smith et al., 2016; Winston Smith & Hannigan, 2015); however, these learning mechanisms may not generalize to other programs or show an overall positive effect of accelerator participation on post acceleration venture performance (Cohen et al., 2019; Gonzalez-Uribe & Leatherbee, 2017; Yu, 2019). Extending the prior findings, we therefore offer the following baseline hypothesis:

> **Baseline Hypothesis (H0).** Startups that participate in accelerators perform better post acceleration on average, ceteris paribus, than startups that are also selected, but do not participate.

2.2 | Design elements of startup accelerators

Startup accelerators exhibit considerable diversity in their practices, activities, policies, and structures (Cohen et al., 2018; Cohen et al., 2019)—Differences that represent fundamental aspects of the organizational design of these programs (Rivkin & Siggelkow, 2003; Siggelkow, 2001). Despite potential variations globally, Cohen et al. (2019) demonstrate that even within the United States, there is notable heterogeneity in accelerator program designs in terms of cohort size and composition, types of funding offered, program duration, and curricula—Design elements that may influence the benefits startups gain from accelerator participation. Differences in these design elements may account for the heterogeneity in effects uncovered by prior studies (e.g., Fehder, 2015; Hallen et al., 2020; Winston Smith & Hannigan, 2015).

While multiple elements may develop founders' knowledge and capabilities and thereby contribute to post acceleration startup performance, two are essential: knowledge-building peer interactions and knowledge-building programming. First, peer interactions involve engaging with other founders and startups undergoing the acceleration process at the same time. Design choices that affect this aspect may include whether to emphasize the knowledge depth of peers

by focusing on a single industry (*industry-specific*), or whether to compose cohorts of a diverse set of ventures, drawn from different industries (*industry-agnostic*). This design choice of startup accelerators may affect the benefits that participants derive from a program by affecting mutual and vicarious learning among peers (Posen & Chen, 2013). For instance, access to deep knowledge from peers in the same industry may hold different benefits for startup development than access to broad knowledge from peers drawn from different industries. Second, an accelerator's design choices about its knowledge-building programming can affect the specific experience founders undergo during their time in an accelerator (Cohen, 2013). These choices, for example, may include whether to provide funding and what kind of funding, whether to host formal pitching events, and how much structured education to provide. These design choices may contribute to the overall value that entrepreneurs derive from accelerator participation and affect post acceleration startup performance. Both knowledge-building peer interactions (Avnimelech et al., 2021; Chatterji et al., 2019; Posen & Chen, 2013; Winston Smith et al., 2016), as well as knowledge-building programming (Assenova, 2020; Cohen et al., 2018; Hallen et al., 2020; Mejia & Gopal, 2015) may therefore explain variation in startup performance post acceleration. Below we discuss each of these aspects of accelerator design and how these design choices may explain differences in the benefits of accelerator participation for founders and startups across cohorts and programs.

2.2.1 | Knowledge-building peer interactions

A primary design choice of accelerator programs concerns decisions about cohort composition: the structure, size, and diversity of peers. Peer interactions play a pivotal role in building founders' knowledge (Agarwal et al., 2004, 2010; Agarwal et al., 2007). Founders exchange best practices, share experiences, and act as idea sounding boards, enhancing the real-time knowledge pool, and contributing to vicarious learning (Cao & Posen, 2023; Chen et al., 2018; Posen & Chen, 2013). Cohorts grant participants access to a reservoir of knowledge from other founders (Avnimelech et al., 2021; Winston Smith et al., 2016), enabling participants to assimilate and employ new insights to enhance venture development (Cohen & Levinthal, 1990).

However, the depth and breadth of knowledge within a cohort often hinge on an accelerator's design choices and overall strategy for selecting and developing startups, whether *industry-specific* or *industry-agnostic*. Accelerators that lean toward greater depth over breadth of knowledge in their cohort selection often arise from an industry-specific strategy, which targets specific sectors. This depth enables founders to gain deep knowledge from vicarious learning and thereby *exploit* existing opportunities within those sectors (Benner & Tushman, 2003; He & Wong, 2004; March, 1991), leading to swift revenue growth. For example, Baita, a Brazilian accelerator focusing on early-stage tech ventures in hardware and the hard sciences, adopts this approach. This industry-focused approach offers advantages for speeding up new venture development in these sectors and leads to faster attainment of product-market fit. For example, in an industry-focused program, a health-tech product startup could benefit immensely from interactions with peers well-versed in healthcare policy, gaining insights into industry trends and opportunities. This "know what" can enable more effective exploitation of existing opportunities, potentially accelerating revenue growth.

On the other hand, accelerators adopting an industry-agnostic strategy typically have a breadth-oriented approach to cohort selection. This breadth-oriented approach encourages founders to *explore* new opportunities (Lavie et al., 2010; March, 1991), facilitating innovation

through the recombination of ideas. While this strategy might lead to slower immediate revenue growth for participating ventures, it holds the promise of greater long-term potential. The diverse expertise of peers within industry-agnostic programs may broaden startups' horizons and enable them to recombine and import knowledge from other sectors. For instance, a startup facing challenges in supply chain management may gain insight from the experience of a peer who has navigated similar issues in a different industry. Peer suggestions might also bring novel marketing strategies or product features into consideration, increasing long-term value creation. Notably, startups within such cohorts often attract more capital because of the novelty of their ideas. Then, 50K Accelerator in Hyderabad, India, and The Hive Accelerator in Tel Aviv, Israel, are examples of accelerators that adopt this industry-agnostic strategy. Their focus is on imparting best practices across varied startups, emphasizing innovative and unique ideas that have potential to attract VC.

While founders may universally benefit from mutual and vicarious learning (Agarwal et al., 2010;Posen & Chen, 2013; Winston Smith et al., 2016), the strategic orientation of the accelerator—whether emphasizing knowledge depth or breadth—may deliver varied advantages to its participants from peer interactions in a cohort. Thus, we propose the following hypothesis:

> **Hypothesis 1 (H1).** Conditional on being accelerated, startups derive greater benefits on average, ceteris paribus, for *revenue* scaling from programs that emphasize cohort knowledge *depth* (over breadth), but greater benefits for *funding* from programs emphasizing cohort knowledge *breadth* (over depth).

2.2.2 | Knowledge-building programming

In addition to facilitating vicarious learning from peers in a cohort, accelerators also aim to build founders' knowledge and capabilities through intensive knowledge-building programming. This includes but is not limited to feedback from industry specialists and customers, pitching opportunities, and structured educational programming. These elements may complement or substitute for founders' pre-entry knowledge and experience (Cao & Posen, 2023) and supplement the knowledge acquired through vicarious learning from peers in a cohort (Posen & Chen, 2013; Winston Smith et al., 2016) to aid startup development. By combining different programming elements, accelerators can give participants a more comprehensive understanding of the market potential of their ideas, facilitating new venture development.

Each knowledge-building element in an accelerator's programming plays a specific role in building founders' knowledge and shaping the trajectory of startups. Pitching events stand as a cornerstone in the learning process for founders, guiding them to polish their deliverables, whether a prototype or a pitch deck. Accelerator-sponsored events such as pitch nights, demo days, and boot camps are more than just opportunities for presenting ideas; they act as platforms for founders to obtain invaluable, real-time feedback from industry experts, customers, and prospective employees. As founders progress through the acceleration process, these events allow for the integration of mentor feedback, enabling them to refine their products and strategies (Cohen et al., 2018; Hallen et al., 2020; Winston Smith & Hannigan, 2015). In essence, pitching events are dynamic feedback loops that enable founders to gather and integrate market knowledge to improve their offerings and achieve product-market fit.

Another important design element of startup accelerators is seed funding. Seed funding is the lifeblood of many startups, especially in their nascent stages (Winston Smith et al., 2013). While accelerators like Y-Combinator might offer substantial financial resources, others, such as Google for Startups, emphasize mentorship and skill development. This variation in whether accelerators offer seed funding for participating startups implies different resources available for founders for experimentation and learning (Chen et al., 2022; Kerr et al., 2014; Manso, 2016). Early-stage capital, irrespective of its form—grants or investments—empowers startups to build and test prototypes and minimum viable products (MVPs), and transition from the idea to the testing phases. From ideation and prototyping to achieving a product-market fit and planning for initial scaling, funding is instrumental in materializing ideas into tangible business operations.

Moreover, the educational programming that accelerators offer varies in both structure and content yet remains a fundamental pillar in startup development (Cohen et al., 2018; Cohen et al., 2019). While some accelerators like INhatcher in Guatemala embrace flexibility, offering bespoke workshops and tailored advice, other programs like the Ampersand Accelerator in Singapore take a more standardized approach to educational programming, encompassing structured online learning modules, weekly workshops, and intensive boot camps. The nature and depth of knowledge imparted—from product creation strategies to sales techniques—are often tailored to the startup's phase and the founders' expertise. Whether through a structured curriculum or a more flexible approach, educational components provide startups with knowledge of foundational and advanced concepts, strategies, and techniques vital for success.

Industry focus is another defining design element where there is considerable variation across accelerators. The choice between an industry-specific or industry-agnostic programming can greatly shape the depth and breadth of knowledge available to startups, not only from a cohort perspective, but also from a program content perspective. An industry-specific accelerator dives deep into the specifics of industries such as artificial intelligence or biotechnology, equipping founders with specialized knowledge tailored to their sector. This specificity ensures that startups garner insights and skills with direct relevance and applicability to their targeted industry. By contrast, sector-agnostic programs may not deliver this specificity of knowledge but focus on generalist knowledge and best practices for startup development.

Finally, program duration is more than just a temporal element of program design; it is about the depth and extent of engagement with programming design elements. While longer program duration requires a bigger investment of founders' time and attention, an extended program provides startups with prolonged access to mentorship, educational resources, and peer interactions. Longer program duration allows startups not only to form lasting bonds with peers but also to assimilate and implement their learnings based on their own and their peers' experience (Chen et al., 2018; Cohen & Levinthal, 1990; Herriott et al., 1985; Posen & Chen, 2013), enabling startups to apply their learning to improve performance.

In sum, knowledge-building programming can provide a vibrant learning environment for startups that potentially enhances their performance post acceleration (Cohen, 2013; Cohen et al., 2018; Winston Smith & Hannigan, 2015). The blend of structured feedback mechanisms, financial support, educational programming, industry-specific insights, and extended learning opportunities ensures that startups are equipped to thrive after program completion. We, therefore, offer the following hypothesis about the role of knowledge-building programming within accelerators:

Hypothesis 2 (H2). Conditional on being accelerated, startups derive greater benefits on average, ceteris paribus, from accelerator programs incorporating more knowledge-building programming elements in their designs than those incorporating fewer such elements.

3 | DATA AND METHODS

3.1 | Data collection

The data for our study come from the Entrepreneurship Database Program, a collaborative data collection effort between the Aspen Network of Development Entrepreneurs, a worldwide coalition of organizations supporting entrepreneurship in emerging economies, and Emory University. To compile the data, program staff used a multi-stage sampling process grounded in research on startup accelerators. First, they conducted online searches of secondary sources to create a comprehensive list of accelerator programs worldwide that support early-stage startups. This search identified hundreds of organizations supporting early-stage startups in more than 176 countries. Second, staff members carefully checked accelerators' websites to ensure that these programs met the inclusion criteria for the sample, based on the definition of accelerators established in the academic literature (Cohen, 2013; Cohen & Hochberg, 2014). Accelerators are defined as limited-duration programs that help cohorts of startups "define and build their initial products, identify promising customer segments, and secure resources, including capital and employees" (Cohen, 2013, p. 19). Accordingly, programs were included if they had a time-bound, limited duration program, typically 6–9 months, and a cohort intake of startups, selected through a rigorous process. This data collection process produced a diverse sample of accelerator programs, with varying program designs.

After identifying the list of programs, staff members sent survey questionnaires to program directors and applicants to collect data about these applicants in terms of their characteristics 1 year before and at the time of applying, as well as information about the selection status of these applicants—whether they were selected initially (i.e., they made it past the initial screening process at the accelerator), selected at the final stage of the process, showed up to participate, and completed the full program (i.e., whether they were accelerated). Program staff followed up with *both* selected and rejected applicants over time to collect information about these startups' performance and outcomes. This rich dataset enables us to evaluate whether the effect of accelerator participation is positive for accelerated startups, and how the benefits of accelerators for startups that participated vary with different program design elements.

3.2 | Methodology overview

We evaluate the benefits of accelerator participation among startups that apply to accelerator programs by employing a comparative methodology based on two distinct groups. The first group for comparison consists of *all applicants that were selected in the initial round*, some of which ultimately were accelerated and some of which did not go through the acceleration process. The focal group for testing our baseline hypothesis (H0) is startups that were selected and participated. The counterfactual group is startups that were selected but were not accelerated. This comparison forms the basis for testing the effect of accelerator participation on venture outcomes *within* programs.

The second group for comparison in our analyses is more granular and includes *only startups that participated* in accelerator programs. That is, our analyses of how the benefits of accelerator participation vary with program design features are conditional on program participation. The counterfactual group in these analyses are startups that participated in different programs: those that emphasize depth over breadth in their cohorts (H1) and those that feature different knowledge-building programming elements (H2). Our analysis delves into variation in the benefits of accelerator participation for startups *across* programs with different designs.

Our analysis sample comprises 8580 startups that made it past the initial round of selection from a larger pool of 23,364 applicants across 335 cohorts at 408 programs in 176 countries between 2013 and 2019.[2] Of these applicants, 4020 were accelerated.

To conduct our analysis, we utilize the methodological framework proposed by Hallen et al. (2020). We begin by identifying a pool of accelerator applicants that passed the initial screening process in their respective accelerator programs from the larger pool of applicants. These applicants represent startups that were of sufficient quality to make it through accelerators' comprehensive quality-vetting process, which evaluates business model viability, potential for scalability, and alignment with the strategic objectives of these accelerators.

After establishing our analysis sample, we engage in a comparative assessment of the average effect of accelerator participation on startup performance post acceleration. We compare the performance of startups that ultimately participated in these programs 1 year after acceleration, to those that were initially screened in but did not participate, based on metrics such as the ability to secure external funding, grow revenue, and scale employment. We then focus on accelerated startups and evaluate how the effects of participation vary with program design.

To ensure the robustness of our findings, we adopt an IPTW estimation approach for all models (Azoulay et al., 2009; Elfenbein et al., 2010; Hallen et al., 2020; Hirano & Imbens, 2001), aligning with the methodology proposed by Hallen et al. (2020). This statistical approach allows us to account for varying probabilities of accelerator participation among initially screened applicants. It weighs ventures in the sample that were accelerated as $1/p$ (where p is the estimated probability of final selection and participation) and weighs the set of ventures that were not accelerated as $1/(1-p)$. This approach adjusts the regression coefficients in our models by the probability of treatment (accelerator participation), as a function of both venture and founder-level attributes. In our analyses, these attributes include a venture's prior revenue, number of founders, headcount of employees, age, industry sector, and country of operations, and the founders' prior work experience, prior founding experience, prior fundraising experience, and education (master's, Ph.D., and advanced technical degrees).

3.3 | Measures

3.3.1 | Dependent variables

To provide a comprehensive evaluation of the effect of accelerator participation on venture outcomes, we considered several dependent variables that reflect different aspects of venture performance and scaling. We acknowledge that entrepreneurs have diverse goals, and some performance metrics may be more relevant than others to specific ventures and founders.

[2]Table A1 (a) and (b) lists the countries and programs, respectively, included in our sample.

Therefore, we used a triangulation approach measuring six different outcomes, spanning capital raising, revenue scaling, and employment and wages paid.

We evaluated a startup's ability to raise external capital using a binary measure, *raised VC equity funding*, which indicates whether a venture secured VC in the year following application to the accelerator program. This measure aligns with prior research noting the importance of raising external capital for venture growth and scaling (Davila et al., 2003; Lee et al., 2011; Samila & Sorenson, 2011). We also measured the *amount of VC equity funding raised* in the year following the accelerator program application, adjusted by taking the natural logarithm of the funding amount (in thousands of US$). This measure accounts for the varying levels of funding and enables a more accurate comparison of funding amounts across ventures (Hallen et al., 2020). We also measured the *planned VC equity raise over the next 12 months*, which is the amount of capital that the venture aimed to raise in subsequent fundraising efforts for the year following the accelerator program application. This measure provides insights into the fundraising aspirations of the startups (Hsu, 2004, 2007).

Next, we measured ventures' ability to scale revenue as the *sales revenue* of the startup (in thousands of US$) for the year after the accelerator program application. This outcome is indicative of growth in a venture's customer or user base and the achievement of product-market fit. Further, we measured the number of *full-time employees* of the startup (other than the cofounders) who worked for the venture for at least 40 h per week in the year following the accelerator program application, adjusted by the natural logarithm of the headcount to correct for skew. This measure reflects the venture's ability to scale its workforce (Hallen et al., 2020). Finally, we measured the natural logarithm of the value of *wages paid* in salaries to employees (in thousands of US$) in the year following the accelerator program application. This measure provides insights into the startups' ability not only to scale employment but also to attract highly skilled employees and talent (Sorenson et al., 2021).

3.3.2 | Accelerator participation

We measured the effect of accelerator participation as a dummy variable indicating whether a venture participated in an accelerator. To control for differences in the applicant pool across cohorts and programs, we included corresponding dummy variables for the applicant pool for each cohort and program, which absorb time-invariant factors that may affect venture outcomes apart from the variables we measure.

3.3.3 | Knowledge-building peer interactions

We included two measures capturing differences in cohort composition (Winston Smith et al., 2016) that may affect participating ventures' access to knowledge for vicarious learning from peers (Avnimelech et al., 2021; Dushnitsky & Sarkar, 2018; Posen & Chen, 2013). For both measures, we defined a cohort as the ventures that applied to, were selected for, and participated in the same program during the same time.[3] We measured the *knowledge depth of peers*

[3]Programs in our sample hosted in-person, on-location programming during the observation period. Due to data limitations, our cohort analyses include programs of 6 months or more. We acknowledge this as a limitation to our analyses.

as a continuous index, mean centered at zero with a standard deviation of one, for each cohort in our sample. This index was created using weights from factor analysis with orthogonal rotation based on three primary variables measuring the depth of peer knowledge: the prior formal education of other founders in the cohort, the years of industry work experience of other founders, and the fraction of other founders who had a Ph.D., master's, or other advanced technical degree.[4] Next, we measured the *knowledge breadth of peers* as a continuous index, mean centered at zero with a standard deviation of one, for each cohort in our sample. This index was created using the same method as above with weights from factor analysis with orthogonal rotation based on three primary variables measuring the breadth of peer knowledge: the heterogeneity of other founders' operating models in the cohort, the fraction of other founders with international work experience, and the heterogeneity of other ventures' industry sectors.[5] We also controlled for any unobservable and time-invariant cohort-specific factors using cohort dummy variables and included cohort size as a control variable in our analyses (Cohen, 2013; Cohen et al., 2019).

3.3.4 | Knowledge-building programming

Accelerators vary considerably in their program design elements beyond their cohort size and composition, including in external feedback opportunities (pitching events), funding opportunities, formal education, industry sector focus, and program duration (Cohen et al., 2018; Cohen et al., 2019). While it is difficult to measure and compare differences across all potential features within a large and heterogeneous global sample, we used five distinct measures that capture considerable variation in some of the most prevalent programming elements offered by accelerators in our analysis sample, as described below.

First, we measured whether the program *features pitch nights or demo days* as an indicator variable. These events are formal pitching opportunities that enable founders to obtain external feedback from a diversity of sources and thereby improve venture performance (Cohen et al., 2018, Cohen et al., 2019). The inclusion of pitch nights or demo days as an indicator variable is important for several reasons. These events provide a structured opportunity for founders to receive constructive input from knowledgeable outsiders about the potential and viability of their ideas. This diversity of perspectives can be instrumental in identifying blind spots, refining business strategies, and improving overall venture performance. As well, participating in pitch nights or demo days increases a venture's visibility in the entrepreneurial ecosystem. It showcases the startup to potential investors and customers, providing a platform for broader exposure which can be critical for early-stage ventures looking to gain traction. Presenting to a diverse audience also allows startups to gauge market interest and validate their

[4]Ln denotes that the variable was adjusted for skew by taking the natural logarithm of its value. For zero values, one was added before taking the natural logarithm to keep the log-transformed value at zero. The cohort measures were constructed using factor analysis with orthogonal rotation, loading onto a single factor, and were adjusted to a standard normal distribution with a mean of zero and a standard deviation of one to facilitate their interpretation in the models. The factor loadings used to construct these measures are provided in Table A2.

[5]Operational models describe the way in which a business operates to earn revenue, for example, through product manufacturing, processing or packaging, distribution, wholesale or retail sales, or services. Industry captures the specific industry sector, for example, energy, environment, financial services, healthcare, or ICT. We measured heterogeneity in these models as one minus the sum of the squared proportions of ventures in each operational model or industry category.

business propositions. The immediate reactions and questions from an informed audience serve as an impromptu focus group, providing valuable market insights.

Second, we measured whether an accelerator program *provides financial grants or investments*, an indicator for whether the program provides seed funding to participants. Seed funding is an important feature that may help founders develop their products and engage in valuable product-development and experimentation during the acceleration process (Cohen, 2013; Cohen et al., 2019). As well, since accelerators are mentor-based programs that provide guidance and support to participating startups, the provision of funding to participants often in exchange for equity in these startups heightens the stakes for mentors, program directors, and founders to provide high-quality and actionable feedback (Cohen et al., 2018, Cohen et al., 2019).

Third, we measured whether the program has a *structured curriculum*, an indicator for whether an accelerator program includes structured education comprising a paced, written curriculum that covers specific topical areas for startup development to build entrepreneurs' knowledge.[6] This curriculum may include workshops, masterclasses, and seminars on specific topics such as marketing, fundraising, product development, and customer acquisition. Typically, the content is delivered in a series of core modules through slide decks and mentors are usually responsible for evaluating deliverables, providing feedback, and signing off on final versions. These educational components may add additional value to startups by enabling founders to build their knowledge and capabilities (Gonzalez-Uribe & Leatherbee, 2017).

Fourth, to further understand the impact of accelerator programs on startup success, we measured the *industry sector focus* of each program. This variable identifies whether an accelerator is industry-agnostic, meaning it supports startups regardless of the industry they operate in, or if it has a specific sector focus, catering exclusively to startups within a particular industry such as healthcare, technology, clean energy, or finance. The distinction between industry-agnostic and sector-specific programs is critical for several reasons. First, sector-specific accelerators may offer more specialized resources, mentors, and networks that are tailored to the unique challenges and opportunities within a given industry. This can include access to specialized equipment, industry-specific regulatory guidance, or introductions to potential customers and partners within the industry. Second, the cohort experience in a sector-specific accelerator may foster deeper peer-to-peer learning and collaboration. Startups operating in the same industry can share insights and strategies that are more directly applicable to each other's business models than they could in a more diverse, industry-agnostic setting.

Finally, *program duration* represents the length of time that startups are actively engaged in an accelerator program. This variable is crucial because the duration of a program can significantly influence the benefits that startups derive from their participation. Longer programs, for example, may provide more extensive support, allowing for a deeper dive into the participants' needs. This extended period can facilitate more comprehensive mentorship, longer-term strategic planning, and the implementation of complex business models or technologies. As well, a longer duration can lead to more opportunities for networking with peers, mentors, investors, and industry experts. These relationships can be invaluable, providing ongoing support, advice, and potential business opportunities. Finally, longer programs may offer the chance to iterate on business models, products, or services and then receive feedback on those adjustments, fostering a more refined final offering.

[6]In our analyses, we only consider whether programs provided a structured curriculum, and do not have information about whether founders attended or participated in this programming and if so, how many sessions they completed.

3.3.5 | Founder and venture controls

We include both founder and venture level controls in our models, following the prior literature on the role of founders' human capital (Davidsson & Honig, 2003; Dimov, 2010; Tzabbar & Margolis, 2017) and firm characteristics (Eddleston et al., 2016; Khan & Manopichetwattana, 1989). At the founder level, we followed the literature and controlled for the *number of founders* of the venture, the *years of work experience*, *prior founding experience* (whether any member of the team had previously founded a for-profit venture), and whether any of the founders of the venture had *Ph.D.*, *master's*, *or other advanced technical degrees* (Hallen et al., 2020). We also controlled for whether the founders *previously raised VC*, an important measure of fundraising experience (Busenitz et al., 2005; Hsu, 2007). At the venture level, we controlled for several factors influencing performance (Hallen et al., 2020): the venture's *age* (years since founded), *prior revenue*, a measure of the operating revenue at the time of applying, and *full-time employees*, a measure of its size at the time of applying to the accelerator. The inclusion of these control variables accounts for differences in founders' backgrounds, experience, and venture characteristics that could influence venture outcomes independently of accelerator participation.

3.4 | Descriptive statistics

We provide our descriptive statistics and correlations for our variables in Table 1.[7]

4 | RESULTS

4.1 | Tests of baseline hypothesis

We begin by evaluating the results of our tests of the baseline hypothesis (H0). Our results, presented in Table 2, provide evidence in support of the baseline hypothesis that on average, accelerator participation is positively associated with startup performance. In all six models testing the relationship with different venture outcomes, accelerator participation was found to have an economically meaningful relationship with post-accelerator venture performance for startups that were accelerated, compared to non-accelerated counterparts.[8] For example, compared to nonparticipants, accelerator participants were 3.4% more likely to raise VC (Model 1) and raised $1.8 million more capital, on average (Model 2). They also planned to raise $2.64 million more capital, on average, over the next 12 months (Model 3). Accelerated startups also generated more revenue (Model 4), hired more full-time employees (Model 5), and paid more in wages to their employees (Model 6), on average. In supplementary analyses, we found similar results when evaluating the robustness of these results in the set of ventures that made it to the

[7]Some programs in our sample issued an open call for applications in a specific year or round but did not accept any applicants.

[8]These effects can be interpreted as treatment effects conditional on selection. They reflect both differences in which startups applied to these programs and were selected by the accelerators, as well as differences in which startups participated in these programs conditional on being selected.

TABLE 1 Descriptive statistics and correlations for accelerator applicants that made it past the initial stage of selection ($N = 8580$).

	Variable	Mean	SD	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	Raised VC equity funding (binary)	0.03	0.2	0.0	1.0									
(2)	Amount of VC equity funding (ln US$ mil.)	1.43	3.7	0.0	18.1	0.45								
(3)	Planned VC equity raise (US$ mil.)	11.27	2.4	0.1	22.1	0.19	0.30							
(4)	Sales revenue (ln US$ 000)	6.82	4.9	0.0	21.8	0.07	0.10	0.13						
(5)	Full-time employees (ln count)	1.16	1.1	0.0	16.7	0.11	0.13	0.12	0.45					
(6)	Wages paid to employees (ln US$ 000)	4.89	4.9	0.0	22.1	0.07	0.14	0.17	0.34	0.41				
(7)	Accelerator participation (binary)	0.17	0.4	0.0	1.0	0.08	0.10	0.13	0.09	0.04	0.08			
(8)	Cohort knowledge depth of peers	0.00	1.0	−3.4	7.8	0.05	0.09	0.20	0.10	0.08	−0.02	−0.02		
(9)	Cohort knowledge breadth of peers	0.00	1.0	−5.9	2.6	−0.07	−0.10	−0.21	−0.05	0.01	0.06	0.01	−0.47	
(10)	Program features pitching events	0.70	0.5	0.0	1.0	0.04	0.06	0.09	0.00	−0.06	−0.06	−0.01	−0.05	−0.19
(11)	Program provides funding	0.60	0.5	0.0	1.0	0.03	0.08	0.14	−0.05	−0.02	−0.03	−0.08	−0.03	−0.18
(12)	Program uses a structured curriculum	0.59	0.5	0.0	1.0	0.01	0.01	−0.01	0.04	0.01	−0.03	0.01	−0.03	−0.20
(13)	Program has a specific industry sector focus	0.34	0.47	0.0	1.0	0.09	0.12	0.23	0.01	0.03	−0.10	−0.01	0.27	−0.54
(14)	Program duration	0.42	0.49	0.0	1.0	−0.04	−0.09	−0.12	0.06	0.10	−0.02	−0.03	0.01	0.22
(15)	Prior revenue (ln US$ 000)	4.75	5.1	0.0	22.3	0.03	0.02	0.07	0.54	0.40	0.22	0.07	0.12	−0.03
(16)	#Founders	2.18	0.8	0.0	3.0	0.04	0.05	0.00	0.08	0.11	0.06	0.03	−0.01	−0.05
(17)	Prior full-time employees (ln count)	0.9	0.6	0.0	11.9	0.03	0.03	−0.04	0.07	0.14	0.05	0.01	0.04	−0.06
(18)	Yrs. work experience	7.07	6.7	0.0	84.0	−0.02	0.00	0.07	0.02	0.04	0.00	−0.03	0.17	−0.06
(19)	Prior founding experience	0.49	0.5	0.0	1.0	0.04	0.01	0.10	0.07	0.07	0.03	0.00	0.08	−0.13
(20)	PhD, masters, or technical degrees	0.38	0.5	0.0	1.0	0.04	0.05	0.08	0.05	0.04	−0.02	0.02	0.18	−0.10
(21)	Previously raised VC	0.17	0.4	0.0	1.0	0.21	0.40	0.25	0.12	0.15	0.10	0.08	0.15	−0.14
(22)	Startup age (yrs. since founding, ln)	0.99	0.7	0.0	4.7	0.00	0.01	0.06	0.33	0.32	0.15	0.00	0.15	−0.06
(23)	Cohort size	17.32	20.8	0.0	151.0	−0.02	−0.04	−0.12	−0.02	−0.02	0.05	0.18	−0.42	0.34

TABLE 1 (Continued)

	Variable	Mean	SD	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
(10)	Program features pitching events	−0.19												
(11)	Program provides funding	−0.18	0.11											
(12)	Program uses a structured curriculum	−0.2	0.34	0.11										
(13)	Program has a specific industry sector focus	0.16	0.26	0.20										
(14)	Program duration	−0.38	−0.29	−0.17	−0.25									
(15)	Prior revenue (ln US$ 000)	0.00	−0.08	0.03	−0.01	0.07								
(16)	#Founders	0.05	0.02	0.04	0.04	−0.03	0.05							
(17)	Prior full-time employees (ln count)	0.02	−0.02	0.03	0.04	0.01	0.06	0.77						
(18)	Yrs. work experience	−0.02	−0.02	−0.04	0.06	0.03	0.07	0.01	0.07					
(19)	Prior founding experience	0.01	−0.01	0.02	0.11	0.00	0.05	0.07	0.08	0.09				
(20)	PhD, masters, or technical degrees	0.01	−0.01	0.02	0.09	0.04	0.03	0.00	0.03	0.11	0.06			
(21)	Previously raised VC	0.04	0.05	0.06	0.15	−0.06	0.11	0.07	0.06	0.02	0.07	0.11		
(22)	Startup age (yrs. since founding, ln)	0.01	−0.05	0.02	0.01	0.07	0.50	0.03	0.09	0.19	0.00	0.03	0.06	
(23)	Cohort size	−0.20	−0.03	0.00	−0.25	0.18	−0.06	−0.03	−0.05	−0.06	−0.10	−0.05	−0.07	−0.08

TABLE 2 Venture outcomes among applicants that made it past the initial stage of selection—Hypothesis tests.

	Dependent variable					
	Venture's outcome					
	(1)	(2)	(3)	(4)	(5)	(6)
	Raised VC equity funding	Amount of VC equity funding	Planned VC equity raise	Sales revenue	Full-time employees	Wages paid to employees
Nature of outcome	**Binary**	**Ln ($ mil)**	**Ln ($ mil)**	**Ln ($000)**	**Ln (count)**	**Ln ($000)**
Accelerator participation (H0)	0.034 [.000]	0.588 [.000]	0.974 [.000]	0.863 [.000]	0.213 [.000]	0.844 [.000]
Knowledge-building peer interactions (H1)						
Cohort knowledge depth of peers	0.113 [.000]	2.743 [.000]	−0.007 [.980]	1.891 [.000]	0.124 [.086]	−7.799 [.000]
Cohort knowledge breadth of peers	0.237 [.000]	7.265 [.000]	0.424 [.372]	0.121 [.852]	0.145 [.271]	−20.922 [.000]
Knowledge-building programming (H2)						
Program features pitching events	0.281 [.000]	5.405 [.000]	5.052 [.000]	5.950 [.000]	1.340 [.000]	−10.906 [.000]
Program provides funding	0.945 [.000]	28.148 [.000]	4.346 [.004]	9.978 [.000]	1.038 [.027]	−44.902 [.000]
Program uses a structured curriculum	−0.003 [.876]	1.589 [.000]	0.262 [.539]	0.839 [.246]	−0.245 [.012]	−0.198 [.711]
Program has an industry sector focus	0.120 [.000]	1.385 [.001]	0.168 [.626]	0.516 [.364]	−0.405 [.000]	−7.753 [.000]
Program duration	0.422 [.000]	9.803 [.000]	2.156 [.088]	3.582 [.088]	0.665 [.013]	−7.285 [.000]
Controls						
#Founders	0.012 [.065]	0.175 [.102]	0.062 [.492]	0.173 [.246]	0.031 [.320]	0.350 [.010]

TABLE 2 (Continued)

	Dependent variable					
	Venture's outcome					
	(1)	(2)	(3)	(4)	(5)	(6)
	Raised VC equity funding	Amount of VC equity funding	Planned VC equity raise	Sales revenue	Full-time employees	Wages paid to employees
Nature of outcome	Binary	Ln ($ mil)	Ln ($ mil)	Ln ($000)	Ln (count)	Ln ($000)
Yrs. work experience	−0.001 [.127]	−0.004 [.646]	0.010 [.116]	−0.006 [.531]	0.001 [.603]	0.005 [.598]
Prior founding experience	0.006 [.393]	0.239 [.042]	0.324 [.000]	0.309 [.036]	0.113 [.000]	0.303 [.019]
PhD, masters, or technical degrees	0.002 [.848]	0.117 [.326]	0.009 [.918]	0.082 [.573]	−0.007 [.826]	0.160 [.220]
Previously raised VC	0.109 [.000]	3.626 [.000]	0.638 [.000]	0.544 [.003]	0.313 [.000]	1.146 [.000]
Prior revenue (ln US$ 000)	−0.001 [.468]	−0.004 [.801]	0.034 [.002]	0.407 [.000]	0.047 [.000]	0.149 [.000]
Prior full-time employees, (ln count)	0.002 [.826]	0.011 [.936]	−0.041 [.733]	−0.300 [.091]	0.064 [.139]	−0.201 [.244]
Venture age (yrs. since founding ln)	−0.006 [.173]	−0.110 [.218]	0.009 [.928]	0.465 [.001]	0.248 [.000]	0.687 [.000]
Cohort size	−0.032 [.005]	−0.889 [.000]	−0.144 [.472]	0.260 [.455]	0.117 [.008]	1.707 [.000]
Intercept	−0.713 [.000]	−16.733 [.000]	4.999 [.004]	−11.969 [.000]	−1.995 [.000]	22.024 [.000]
Industry sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cohort ID dummies	Yes	Yes	Yes	Yes	Yes	Yes
Program ID dummies	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Region dummies	Yes	Yes	Yes	Yes	Yes	Yes
Estimation model		Least squares	Least squares	Least squares	Least squares	Least squares

TABLE 2 (Continued)

	Dependent variable					
	Venture's outcome					
	(1)	(2)	(3)	(4)	(5)	(6)
	Raised VC equity funding	Amount of VC equity funding	Planned VC equity raise	Sales revenue	Full-time employees	Wages paid to employees
Nature of outcome	**Binary**	**Ln ($ mil)**	**Ln ($ mil)**	**Ln ($000)**	**Ln (count)**	**Ln ($000)**
	Linear probability model					
Standard errors	Robust, clustered by program	Robust, clustered by program	Robust, clustered by program	Robust, clustered by program	Robust, clustered by program	Robust, clustered by program
Weighting	IPTW	IPTW	IPTW	IPTW	IPTW	IPTW
R^2	.21	.32	.55	.42	.44	.54
N	8580	8580	4159	8580	8580	8580

Note: p-values in brackets. Ln denotes the natural logarithm; applicants that made the initial stage of selection are defined as those who passed the initial round of selection and had similar characteristics to the applicants that participated in the program. IPTW denotes the inverse probability of treatment weights.

final stage of selection.[9] These findings suggest that accelerator participation is associated, on average, with improved venture performance post-acceleration.

4.2 | Tests of Hypothesis 1

Next, we compared outcomes within the group of accelerated ventures to understand how, conditional on being accelerated, venture outcomes varied with the design elements of the program in which they participated. We began by evaluating the effects of accelerator participation for startups that participated in programs emphasizing greater knowledge depth (over breadth) within their cohort. We posited that this program design choice would predict greater revenue scaling but lower ability to attract external capital among accelerated ventures (H1) and would be associated with sector-specific programs (versus sector agnostic).

Consistent with our hypothesis, we found that accelerator program industry sector focus was positively correlated with the knowledge depth of peers in a cohort (Pearson $r = .27$, Table 1). We also found that program sector focus was negatively correlated with the knowledge breadth of peers (Pearson $r = -.54$, Table 1). Our results show that, on average, program designs that emphasize greater knowledge *depth* within cohorts are associated with greater revenue scaling (coefficient = 1.891, $p < .000$, Table 2) while designs emphasizing knowledge *breadth* are associated with greater ability to raise external funding (coefficient = .237, $p < .000$, Table 2), lending support for the relationships proposed in (H1). These effects are economically meaningful: the effect of a 1 SD increase in cohort knowledge *depth* corresponds to having $6.62 thousand (exp(1.891)) higher revenue post acceleration, on average. As well, the effect of a 1 SD increase in cohort knowledge *breadth* corresponds to a 24% increase in the likelihood of raising VC post acceleration, or the equivalent of nearly an eightfold increase relative to the baseline probability in our sample, given that the average probability of raising VC post acceleration was 3%. These results suggest positive effects of knowledge-building peer interactions within a cohort.

4.3 | Tests of Hypothesis 2

We proceed to evaluate whether, conditional on being accelerated, startups that participated in accelerators benefitted more on average from programs that had multiple knowledge-building programming elements, compared to participants in programs with fewer knowledge-building-design elements (H2). Here, we evaluate five distinct program elements that are present in many accelerators: pitching events (e.g., pitch nights, demo days); seed capital; structured educational curriculum; industry sector focus; and program duration.

We began by evaluating the benefits associated with programs featuring *pitching events* as a design element. Nearly 70% of programs in our sample incorporated this design element, showcasing its popularity. Our findings showed that this design element had a robust, economically meaningful—and nearly universally positive—association with post acceleration performance for participating ventures: Startups that participated in programs with pitching events were 28% more likely to raise VC (coefficient = 0.281, $p < .000$, Model 1, Table 2). This effect represents a ninefold increase from the baseline probability of raising VC, which in our sample was only 3%.

[9]Results reported in appendix Table A6.

These results lend evidence that pitching events indeed "work" in the sense of helping startups gain visibility, attention, and funding from potential investors. We find similar large and economically meaningful effects for other indicators of growth and scaling, such as revenue scaling—where participants in programs with pitching events go on to earn $383 thousand more in revenue (coefficient = 5.950, $p < .000$, Model 4, Table 2) and hire about *twice* as many full-time employees as the average startup in our sample (coefficient = 1.340, $p < .000$, Model 5, Table 2). These findings suggest that programs that enable founders to receive external feedback through formal pitching opportunities provide greater performance benefits to participating ventures, on average, consistent with (H2).

We turn next to the role of *seed capital*, another popular design feature of startup accelerators. More than 60% of accelerator programs in our sample feature some form of seed capital, whether in the form of grants or equity-based funding. On average, we find that accelerated ventures that participate in programs providing seed capital are more likely to grow and scale post acceleration compared to participants in programs that do not offer seed capital. These participants, for example, are 94.5% (coefficient = 0.945, $p < .000$, Model 1, Table 2) more likely to raise VC than accelerator participants in programs that do not provide seed capital as part of their program design. They also raise—and plan to raise—more capital (Models 2 and 3) and achieve higher revenue and full-time employment growth (Models 4 and 5), on average, than accelerator participants in programs that do not provide seed funding.

Concerning the use of a *structured curriculum*, another popular design element that is present in 59% of accelerator programs in our sample, we find mixed results. While on average, participants in programs with a structured curriculum are not more likely to raise VC (Model 1, Table 2), they do raise about $4.85 million (exp(1.589)) more capital, on average (coefficient = 1.589, $p < .000$, Model 2, Table 2), compared to participants in programs that do not feature a structured curriculum. However, we do not find evidence that using a structured curriculum is associated with differences in revenue scaling (Model 4, Table 2).

The effects of *sector focus* on accelerator participants' growth and scaling are mixed. On the one hand, ventures that participate in accelerator programs with an industry sector focus are 12% more likely to raise VC, on average (coefficient = 0.120, $p < .000$, Model 1, Table 2) and also raise about $4 million more in funding, on average (coefficient = 1.385, $p < .001$, Model 2, Table 2), compared to participants in programs without an industry focus (i.e., industry-agnostic accelerators). However, participation in industry-specific accelerators is associated with slower employment scaling (coefficient = −.405, $p < .001$, Model 5, Table 2) and slower wage growth (coefficient = −7.753, $p < .000$, Model 6, Table 2). These effects may reflect a different approach to scaling and growth, where the focus is on securing external capital and growing revenues before expanding hiring.

Finally, the effects of *program duration* on growth and scaling are almost universally positive across multiple indicators of startup growth and scaling, except for wage growth. On average, participants in accelerator programs with longer durations are 42% more likely to raise VC (coefficient = 0.422, $p < .000$, Model 1, Table 2), raise about nine times as much VC as the average startup in our sample (coefficient = 9.803, $p < .000$, Model 2, Table 2) and scale revenue by about $35.8 thousand (exp(3.582)) more per year (coefficient = 3.582, $p = .088$, Model 4, Table 2) and scale employment by about 60% more per year (coefficient = .665, $p = .013$, Model 5, Table 2) than accelerator participants in shorter-duration programs. These results reinforce the notion that accelerators' knowledge-building design elements, both cohort design and specialized programming, are more valuable when participants have more time interacting with peers and absorbing the knowledge from the program.

Overall, the results suggest that programs with more knowledge-building program design elements—and longer program durations—were associated with greater benefits for participating ventures, lending support for the relationship proposed in Hypothesis (H2). While all five elements we evaluated were strongly associated with greater VC fundraising and greater revenue scaling for accelerated ventures, the magnitude of these effects varied across outcomes. These differences suggest that which design elements are beneficial may be highly contingent on the specific scaling goals of founders and their ventures and depend on the stage of development of the venture, its industry, and the expertise of its founders—important considerations that we explore as boundary conditions on these results.

4.4 | Boundary conditions

In Table 3, we summarize our results of the boundary conditions of the effects of accelerator participation on venture outcomes. Panel A presents the results summary for the VC funding ventures obtained post acceleration, while Panel B presents the results for revenue scaling post acceleration. We discuss each set of boundary conditions below.

4.4.1 | Venture stage

First, venture stage is a crucial factor in determining the benefits of accelerator participation. To evaluate the role of venture stage, we conducted split sample analyses, looking at the benefits of knowledge-building peer interactions and knowledge-building programming across seed stage versus early-stage ventures.[10] Seed-stage ventures may greatly benefit from accelerators as they provide access to crucial resources such as seed funding, mentorship, and guidance. Accelerators can help these ventures refine their business models, develop MVPs, and provide exposure to potential investors. On the other hand, more mature ventures that have revenue or VC funding might already have a solid foundation and established networks, making the benefits of accelerator participation less significant. These ventures might have specific needs, such as access to larger-scale funding or strategic partnerships, which may not align with the offerings of typical accelerators.

Our results show that both seed stage and early-stage ventures benefit from accelerator participation, on average; however, the effect of knowledge breadth on VC funding is slightly stronger for seed-stage (coefficient = 7.727, $p < .000$, Panel A, Table 3) than early-stage ventures (coefficient = 7.337, $p < .000$, Panel A, Table 3), while the effect of knowledge depth on VC funding is stronger for early-stage ventures (coefficient = 3.230, $p < .000$, Panel A, Table 3), than seed-stage ventures (coefficient = 2.205, $p < .000$, Panel A, Table 3). These results suggest that ventures at the seed stages of development may reap greater benefits from programs that emphasize knowledge breath within a cohort, but those at later stages of development may benefit more from programs that emphasize knowledge depth within a cohort. As well, the effect of knowledge depth (coefficient = 3.468, $p < .000$, Panel B, Table 3) and knowledge breadth (coefficient = 2.438, $p < .000$, Panel B, Table 3) on revenue scaling are stronger for early-stage

[10]We present these results in appendix Table A3. Seed stage ventures are defined as venture that are in the earliest stages of their development, i.e., those that do not yet have any revenue or external equity funding. Early-stage ventures are defined as those that have started to earn revenue or have attracted equity funding from investors.

TABLE 3 Results summary—Boundary conditions by venture stage, industry, and founder expertise.

Panel A: VC funding, Ln ($ mil)	**Accelerator participation**	**Cohort knowledge depth**	**Cohort knowledge breadth**	**Program features pitching events**	**Program provides funding**	**Program uses a structured curriculum**	**Program has a sector focus**	**Program duration**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Full sample	0.588 [.000]	2.743 [.000]	7.265 [.000]	5.405 [.000]	28.148 [.000]	1.589 [.000]	1.385 [.001]	9.803 [.000]
Stage: Seed stage[a]	0.600 [.000]	2.205 [.000]	7.727 [.000]	4.326 [.000]	30.061 [.000]	1.609 [.000]	0.301 [.575]	9.269 [.000]
Stage: Early stage	0.518 [.001]	3.230 [.000]	7.337 [.000]	6.113 [.000]	0.939 [.019]	1.619 [.000]	1.882 [.001]	8.253 [.000]
Industry: High-tech[b]	0.668 [.000]	1.861 [.000]	7.157 [.000]	5.867 [.000]	29.753 [.000]	1.773 [.000]	0.149 [.802]	9.767 [.000]
Industry: Not high tech	0.496 [.002]	4.308 [.000]	4.884 [.000]	4.245 [.000]	16.445 [.000]	1.746 [.000]	2.355 [.000]	4.531 [.000]
Expertise: No prior founding experience[c]	0.450 [.001]	3.441 [.000]	9.289 [.000]	8.378 [.000]	27.211 [.000]	0.615 [.120]	−0.796 [.144]	5.262 [.001]
Expertise: Prior founding experience	0.721 [.000]	−1.674 [.166]	−2.635 [.311]	0.669 [.617]	−1.679 [.848]	−1.912 [.157]	1.779 [.006]	6.085 [.000]
Panel B: Revenue, Ln ($000)	**Accelerator participation**	**Cohort knowledge depth**	**Cohort knowledge breadth**	**Program features pitching events**	**Program provides funding**	**Program uses a structured curriculum**	**Program has a sector focus**	**Program duration**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Full sample	0.863 [.000]	1.891 [.000]	0.121 [.852]	5.950 [.000]	9.978 [.000]	0.839 [.246]	0.516 [.364]	3.582 [.088]
Stage: Seed stage	1.111 [.000]	0.471 [.000]	0.902 [.000]	−2.327 [.115]	−6.706 [.102]	0.727 [.367]	−3.429 [.000]	−1.136 [.659]

TABLE 3 (Continued)

Panel B: Revenue, Ln ($000)	Accelerator participation	Cohort knowledge depth	Cohort knowledge breadth	Program features pitching events	Program provides funding	Program uses a structured curriculum	Program has a sector focus	Program duration
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stage: Early stage	0.682 [.000]	3.468 [.000]	2.438 [.001]	10.608 [.000]	8.746 [.000]	1.966 [.000]	2.586 [.000]	3.930 [.003]
Industry: High-tech	1.001 [.000]	1.639 [.000]	1.316 [.122]	4.954 [.000]	20.465 [.000]	2.492 [.000]	1.695 [.002]	9.725 [.000]
Industry: Not high tech	0.751 [.000]	4.069 [.000]	−0.055 [.960]	6.484 [.006]	4.883 [.221]	0.662 [.540]	0.636 [.514]	−1.992 [.527]
Expertise: No prior founding experience	0.738 [.000]	3.967 [.000]	4.705 [.000]	8.855 [.000]	15.671 [.000]	0.345 [.658]	1.129 [.171]	1.595 [.515]
Expertise: Prior founding experience	0.919 [.000]	1.580 [.122]	0.563 [.796]	5.059 [.001]	19.557 [.005]	2.912 [.006]	0.724 [.180]	9.122 [.000]

Note: *p*-values in brackets. Ln denotes the natural logarithm; IPTW methodology; tables with full results presented in the appendix.

[a]Seed stage category comprises ventures that did not have any revenue or equity funding at the time when the founders applied to the accelerator program. Early-stage ventures are those that either had revenue from paying customers or had equity funding from angel investors or other sources at the time when the founders applied to the accelerator program.

[b]Ventures in high-tech industries are defined as those whose business models are based on commercializing an invention. Industries for technology-based ventures include Information and Communication Technology, Healthcare, Energy, and Financial Services. The industries for non-tech ventures include Agriculture, Education, Housing Development, and Artisanal.

[c]This category includes ventures where no member of that team had any prior experience founding a for-profit venture. The prior experience category includes ventures where at least one founder on the team (or the solo founder) reported previously founding at least one for-profit venture.

ventures than for seed-stage ventures. These results suggest that ventures farther along in their development may reap greater benefits from accelerator participation for revenue scaling post acceleration than ventures that are at more nascent stages.

In terms of programmatic elements, we find that programs that feature pitching events are more beneficial, on average, for early-stage ventures raising VC funding (coefficient = 6.113, $p < .000$, Panel A, Table 3) than for seed-stage ventures (coefficient = 4.326, $p < .000$, Panel A, Table 3). However, programs providing venture funding (financial grants or investments) are nearly 30 times more beneficial, on average, for seed-stage ventures raising VC funding (coefficient = 30.061, $p < .000$, Panel A, Table 3) than for early-stage ventures (coefficient = 0.939, $p = .019$, Panel A, Table 3). These results suggest that accelerator funding is paramount for seed-stage ventures, but pitching events are more beneficial for early-stage than for seed-stage ventures looking to raise VC funding, while a structured curriculum appears equally beneficial for both seed-stage and early-stage ventures raising VC funding. We also find that programs with a sector focus as associated with greater fundraising (coefficient = 1.882, $p = .001$, Panel A, Table 3) and revenue scaling (coefficient = 2.586, $p < .000$, Panel B, Table 3) but only for early-stage ventures. Finally, programs with longer duration were more beneficial for fundraising among seed stage (coefficient = 9.269, $p < .000$, Panel A, Table 3) than early-stage ventures (coefficient = 8.253, $p < .000$, Panel A, Table 3).

4.4.2 | Venture industry

Second, the industry in which a venture operates can influence the benefits derived from accelerator participation. Different industries have unique characteristics, market dynamics, and growth trajectories. To evaluate the role of venture industry, we conducted split sample analyses, looking at how the benefits of accelerator design varied across ventures in high-technology versus non-high-technology industries.[11] We found that the benefits of accelerator participation for fundraising and revenue scaling were positive, on average, for ventures in both high-tech (coefficient = 0.668, Panel A; coefficient = 1.001, Panel B, Column 1, Table 3) and non-high-tech industries (coefficient = 0.496, Panel A; coefficient = 0.751, Panel B, Column 1, Table 3); however, the magnitude of these effects was larger for high-technology industries.

As well, while the effects of knowledge depth on revenue scaling were stronger for ventures in non-high-tech industries (coefficient = 4.069, Panel B, Column 2, Table 3) than those in high-tech industries (coefficient = 1.639, Panel B, Column 2, Table 3), the effects of knowledge breadth on fundraising were stronger for ventures in high-tech (coefficient = 7.157, Panel A, Column 3, Table 3) versus non-high-tech industries (coefficient = 4.884, Panel A, Column 3, Table 3). Programs featuring pitching events and seed funding, and programs with longer duration were more beneficial, on average, for ventures in high-technology industries, compared to those in non-tech industries (Columns 4, 5, and 8, Panels A and B, Table 3). Programs with an industry sector focus, by contrast, were more beneficial for ventures raising VC funding in non-high-tech industries, compared to those in high-tech industries. These findings

[11]We present the results of these analyses in appendix Table A4. Ventures in high-tech industries are defined as those that are based on commercializing an invention (54.69% of the sample). Industries for technology-based ventures include Information and Communication Technology, Healthcare, Energy, and Financial Services. Ventures in non-high-tech industries are those whose business models are not based on an invention (45.31% of the sample). The industries for non-tech ventures include Agriculture, Education, Housing Development, and Artisanal.

demonstrate that pitching events and seed funding are generally more beneficial for ventures in high-tech industries than those in non-tech industries, while industry sector focus appears more beneficial for ventures in non-tech industries. Therefore, there is not a one-size-fits all design that is universally beneficial for different types of ventures, but that the specific design features that accelerators may want to emphasize vary by venture industry.

4.4.3 | Founder expertise

Finally, founder expertise—which encompasses pre-entry knowledge and prior experience in entrepreneurship (Agarwal et al., 2004, 2010; Agarwal et al., 2007; Cao & Posen, 2023; Chen et al., 2018, 2022) could play an important role in which program design elements are most beneficial for specific founders and ventures. While founders with prior experience in entrepreneurship might leverage the resources and mentorship provided by accelerators more effectively, the resources and programming that accelerators provide might be more of a value-add for less experienced founders. To evaluate the role of founder expertise, we conducted split sample analyses, looking at the benefits of program design for founders with prior founding experience compared to those without any prior founding experience.

We found that, on average, the effects of accelerator participation for both fundraising and revenue scaling were greater for founders with some prior founding experience (coefficient = 0.721, $p < .000$, Panel A; coefficient = 0.919, $p < .000$, Panel B, Table 3) compared to those with no prior experience (coefficient = 0.450, $p = .001$, Panel A; coefficient = 0.738, $p < .000$, Panel B, Table 3). Experienced founders were more likely to raise VC, raised more capital, had higher fundraising aspirations, and scaled revenue and employment by more than first-time founders, on average.[12] Interestingly, certain program design elements were more beneficial for first-time founders than experienced founders. In the case of first-time founders, we find that greater knowledge breadth of peers in a cohort corresponds to greater benefits for both fundraising (coefficient = 9.289, Panel A, Column 3, Table 3) and revenue scaling (coefficient = 4.705, Panel B, Column 3, Table 3), but we found no effect for experienced founders. As well, greater knowledge depth of peers in a cohort corresponds to greater fundraising (coefficient = 3.441, Panel A, Column 2, Table 3) and revenue scaling (coefficient = 3.967, Panel B, Column 2, Table 3) for first-time founders but not for experienced founders.

As well, the benefits of elements such as pitching events and seed funding were concentrated within first-time founders. For instance, programs featuring pitching events were associated with eight times higher VC fundraising for first-time founders (coefficient = 8.378, Panel A, Column 4, Table 3) than for experienced founders. Programs featuring seed capital were associated with 20 times higher VC fundraising (coefficient = 27.211, Panel A, Column 5, Table 3) and 15 times higher revenue scaling (coefficient = 15.671, Panel B, Column 5, Table 3) for first-time founders compared to experienced founders. These findings suggest that the benefits of programming elements such as pitching events and seed funding are concentrated within first-time founders, who have more limited pre-entry knowledge and experience than serial entrepreneurs (Cao & Posen, 2023).

[12]We present the results of these analyses in Appendix Table A5. Founders with prior founding experience are those where at least one member of the founding team reported having founded a for-profit venture in the past (49% of founders in our sample).

4.5 | Robustness checks

We conducted several robustness checks on our results, trying to rule out alternative explanations for the results.[13]

First, while our research design mitigates concerns about comparing startups of different quality by evaluating only ventures that were of sufficient quality for accelerators to screen them into the initially selected group, it is possible that even at this screening stage, the ventures of founders that come to participate in an accelerator on day one may be different in unobserved features than those whose founders do not show up to participate. To mitigate this concern about the second type of selection, we conducted robustness checks to narrow our analyses to ventures that were not only successful at passing the initial screening process by the accelerators but also showed up to participate on day one of the program. This approach mitigates concerns about the self-selection of the ventures that show up to participate in the program, specifically that their founders might be more motivated or eager to participate, and these differences could be correlated with differences in venture outcomes. In our robustness checks, we still found that even after accounting for this type of selection, accelerator participation was associated with large and positive effects on venture outcomes, and that program design features explain variance in the benefits of accelerator participation among accelerated startups.[14]

Second, because much of our sample was drawn from emerging and developing economies, a concern here is that founders from these economies had lower levels of education, which may have resulted in an overstatement of the benefits of educational components for certain founders.[15] Prior research suggests that the benefits of formal educational components in entrepreneurial training programs might be greater for less educated founders (Assenova, 2020; Gonzalez-Uribe et al., 2022; Gonzalez-Uribe & Leatherbee, 2017). To mitigate these concerns, we evaluated whether the benefits of the program design elements we measured could be explained by lower levels of formal education among founders in emerging economies, compared to more developed economies where most of the prior studies of the benefits of accelerators have been conducted (Cohen et al., 2019; Hallen et al., 2020).[16] We find that on average, the benefits of accelerator participation were positive and large for both groups of founders. However, founders with advanced degrees (Ph.D., Master's, or technical degrees or who completed some graduate schooling) benefitted more from accelerator participation than founders whose highest level of education was a bachelor's degree or less. In terms of programming elements, we found (as expected) that programs that use a structured curriculum to teach foundational entrepreneurial knowledge and skills are associated with stronger positive effects for *less* educated (compared to more educated) entrepreneurs. Programs with structured curricula were associated with 24.2% higher likelihood of obtaining VC funding, $7.3 million more VC funding, and $33 thousand more revenue for founders with bachelor's degrees or less—but muted or negative effects for founders with advanced degrees. The reason may be that programs

[13]We present our results in the online Appendix, Tables A6 and A7.

[14]In this analysis, the calculation of the IPTW effects and the estimation of the treatment effects is based on applicants that made it to the final selection round, looking specifically at whether the treatment effect of acceleration participation for those that participated was positive, compared to nonparticipants.

[15]The majority (69.63%) of our sample comprised programs and applicants outside of North America (US and Canada). About 32.59% of our sample was from Latin America and the Caribbean, 10.75% from South Asia, and 19.14% from Sub-Saharan Africa, with the remainder from other world regions (Middle East and North Africa, Europe and Central Asia, Southeast Asia, the Pacific, and Oceania).

[16]We present split sample analyses of our data by founders' formal education in appendix Table A7.

that feature structured educational components in their designs might be more beneficial for founders with less formal education (Assenova, 2020; Martin et al., 2013; Ulvenblad et al., 2013) while potentially being seen as less helpful by founders with advanced degrees.

5 | DISCUSSION AND CONCLUSION

We set out to understand whether the average effect of accelerator participation on venture outcomes is positive, and if so, how the benefits of accelerator participation vary with accelerator program designs. Across multiple analyses, we found a positive association between accelerator participation and venture performance post acceleration. Evaluating variation in these benefits by program design, we found that designs emphasizing knowledge depth (over breadth) within cohorts are associated with greater revenue growth for participating ventures, while those emphasizing breadth (over depth) are associated with greater funding. We also found that on average, knowledge-building programming elements that many accelerators incorporate into their designs were associated with greater benefits for accelerator participants.

The specific mix of beneficial design elements, however, varied by venture stage, industry, and founder expertise. For example, the benefits of knowledge-building peer interactions were concentrated within seed-stage ventures, for which cohort knowledge depth and breadth were associated with larger and more economically meaningful benefits for venture growth and scaling than educational programming. Meanwhile, consistent with the literature on founders' pre-entry knowledge and experience (Cao & Posen, 2023), the benefits of structured educational programming were concentrated within ventures whose founders had less formal education, and provided little, if any, benefit for ventures whose founders had advanced degrees. Also, the benefits of pitching events were concentrated within early-stage ventures in high-technology industries, where future growth and scaling often depend on attracting VC investment through such pitching opportunities. By contrast, we found that seed funding was nearly universally associated with greater growth and scaling for accelerator participants in our sample, regardless of venture stage, industry, and founder expertise. These findings suggest that accelerator participation is beneficial for venture growth, but the magnitude of benefits varies substantially with program design and depends on venture and founder-specific factors.

Our study makes several contributions to the literature on startup accelerators and knowledge acquisition among early-stage startups. Our primary contribution is to the literature on startup accelerators (Hallen et al., 2020; Winston Smith et al., 2016; Winston Smith & Hannigan, 2014, 2015; Yu, 2019). We build upon and contribute to this literature by evaluating the effects of accelerator participation and the role of program design as a factor that explains variation in these effects. Our findings suggest that the benefits of accelerator participation are positive, on average, in a large sample of accelerator participants across programs with varying designs. These findings suggest that accelerators are not just beneficial for high-technology startups in established tech hubs in the United States but are also beneficial for other types of ventures in newer and less developed startup ecosystems such as those throughout Sub-Saharan Africa, Latin America and the Caribbean, South Asia, East Asia and the Pacific, and the Middle East and North Africa. Further, there is not a one-size-fits-all model that suits the goals and strategies of all ventures and founders; the benefits of accelerator participation vary widely with program design and are contingent on venture stage, industry, and founder expertise.

Our study also contributes to the organizational literature on knowledge acquisition among early-stage startups (Agarwal et al., 2007; Agarwal et al., 2010; Cao & Posen, 2023; Chen

et al., 2022; Posen & Chen, 2013). This literature has noted the importance of mechanisms such as vicarious learning (Posen & Chen, 2013) in helping entrepreneurs overcome limited absorptive capacity, which may contribute to failure and underperformance among new ventures. We complement and contribute to this literature by noting that in addition to drawing on the knowledge of incumbents, new ventures can build absorptive capacity and enhance performance through accelerator participation, specifically through the knowledge-building design elements of these programs. We suggest that drawing on the depth and breadth of knowledge of peers as part of the cohort structure of these programs, as well as specialized educational programming teaching the know "how" and "what" of entrepreneurship (Cohen et al., 2018; Hallen et al., 2020) gives founders a wealth of knowledge from which to build their absorptive capacity and improve startup performance (Beckman & Lee, 2020; Cohen & Levinthal, 1990, 1994; Posen & Chen, 2013). Our theoretical arguments imply that organizational sponsors of new ventures, such as accelerators, offer a valuable set of tools and resources to help founders build their absorptive capacity that are potentially beneficial for enhancing startup performance.

Our study has several practical implications. First, for accelerator managers, our findings suggest that these programs are systematically associated with improved venture outcomes among program participants across a variety of growth and scaling metrics. On average, these programs appear to deliver performance benefits to founders and to accelerators that invest equity in participating ventures (Gonzalez-Uribe & Leatherbee, 2017; Hallen et al., 2020; Leatherbee & Katila, 2020; Winston Smith & Hannigan, 2014, 2015). Second, our study suggests that programs that do not currently incorporate a mix of knowledge-building design elements such as pitching events, seed funding, structured curricula, industry-specific programming, and longer durations might consider incorporating some or all these elements, depending on the types of ventures and founders they look to develop, as doing so could enhance the value of these programs for founders. Finally, for startup founders, our findings indicate that although accelerators appear to be beneficial for improving startup performance, on average, their benefits are also highly variable and depend on venture stage, industry, and founder expertise—factors that affect how valuable different design elements are for growth and scaling.

Our study has several limitations. First, a condition for us to be able to use the applicant-level data is that all our data were anonymized at both the venture and program levels, which restricted the number and variety of design features we could investigate empirically. Due to these data limitations, our analysis focuses on a more restricted set of design elements, rather than the specific content of curricula, or the attendance rates for specific events that were part of the programming. Second, an important factor that affects the interpretation of our results is that participation in an accelerator program usually costs time, cash, and/or equity. Admitted startups may choose not to matriculate into these programs because the time and costs may be perceived as excessive. Since we do not have data on the costs (cash and or equity) that founders gave in exchange for accelerator affiliation, this is a limitation on our ability to evaluate how much these factors influence which startups participate. Finally, while our methodology enables comparison of applicants that made it past the initial filtering process for selection into these programs, our study is prone to the usual challenges of analyzing archival data, namely potential unobserved factors that could have affected both selection and subsequent venture outcomes.

Future studies can refine our methodology and consider how other aspects of program design, such as the abovementioned costs and variation in the aims and goals of different programs, may affect outcomes. As the seed accelerator phenomenon expands globally, careful program design could enable accelerator managers to deliver greater benefits from their programming to promising seed and early-stage ventures.

ACKNOWLEDGMENTS

This research was supported by a generous grant from the Dean's Research Fund at the Wharton School of the University of Pennsylvania. The authors thank Associate Editor Hart Posen and two anonymous reviewers for their most helpful and constructive comments. The authors gratefully acknowledge input from audiences at the Wharton School of the University of Pennsylvania; the Tuck School of Business at Dartmouth University; University of Maryland; Cornell University; the International Business Consortium (a collaboration between CUNY, Rutgers, Florida Atlantic University, and Queens College); the Brigham Young University and University of Utah joint Winter Strategy Conference; the 2023 INSEAD Doriot Entrepreneurship Conference; and the 2022 Academy of Management Annual Meeting. The authors would also like to thank the Entrepreneurship Development Program, supported by the Global Accelerator Learning Initiative, for providing the research data. Any errors are solely the responsibility of the authors. The authors declare no relevant or material financial interests that pertain to the research contained in this article.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the Entrepreneurship Development Program, supported by the Global Accelerator Learning Initiative. Restrictions apply to the availability of these data, which were used under license for this study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Assenova, V. A., & Amit, R. (2024). Poised for growth: Exploring the relationship between accelerator program design and startup performance. *Strategic Management Journal*, 1–32. https://doi.org/10.1002/smj.3581