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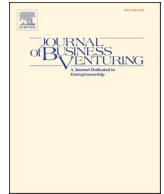
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Time to say goodbye? The role of SBIR funding, VC rounds, and initial alliance for director exit in new ventures

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ABSTRACT

Despite the significant interest in the composition and dynamics of new venture boards, our understanding of when directors exit the boards of new ventures is limited. Drawing on the organizational life cycles framework and resource dependence arguments, we posit that key life cycle events alter a venture's resource needs and dependencies on the board, occasioning director exit. Specifically, we argue that SBIR funding, Venture Capital rounds of funding, and first alliance act as markers of new venture evolution that render existing dependencies obsolete, increasing the likelihood of director exit. Interviews with board members in the semiconductor industry informed and substantiated our theoretical claims. The results show that SBIR funding and subsequent rounds of VC funding are linked to an increased likelihood of director exit, whereas a venture's first alliance is not. The paper sheds light on the interdependencies between the board's life cycle and the life cycle of the new venture.

1. Introduction

The board of directors plays a pivotal role in shepherding a new venture through the challenges linked to the liabilities of newness and smallness (e.g., Beckman et al., 2014; Daily et al., 2002; Garg, 2020; Stinchcombe, 1965; Zimmerman and Zeitz, 2002). Functioning as the apex decision-making unit, the board exerts a pervasive influence on a new venture's operations, strategy, innovation, and performance (e.g., Clarysse et al., 2007; Graebner and Eisenhardt, 2004; Knockaert et al., 2015; Knockaert and Ucbasaran, 2013). It oversees and counsels the incipient venture's management on selecting executives and investors, designing operating procedures, and defining the venture's strategic and innovation directions (e.g., Bagley and Dauchy, 2011; Boeker and Karichalil, 2002; Garg and Eisenhardt, 2017; Hellmann and Puri, 2002; Wasserman, 2003). A key finding emerging from this research is that board structure and composition have an enduring impact on the venture's outcomes (e.g., Beckman et al., 2014; Bruneel et al., 2020; Clarysse et al., 2007; Garg, 2013; Garg and Furr, 2017; Vandembroucke et al., 2016).

While there is significant interest in the composition and dynamics of venture boards, the understanding of the factors that lead to director exits from the board has received insufficient attention. This understanding is crucial to enrich our knowledge of venture dynamics, given the pivotal role directors play in providing valuable networks and capabilities that shape the venture's key decisions (e.g., Beckman et al., 2014; Bruneel et al., 2020; Clarysse et al., 2007; Garg and Eisenhardt, 2017; Wilson et al., 2013). The exit of a director from the board could have significant implications for a new venture. Director exits may result in the loss of knowledge and

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networks (e.g., Acharya and Pollock, 2021; Coff, 1997; Vandenbroucke et al., 2016) and can disrupt dynamics, routines, and communication among remaining members (Finkelstein et al., 2009), presenting risks and costs for new ventures. Conversely, director exits may also provide an opportunity for “board refreshment” (Papadopoulos, 2018), facilitating the inclusion of new board members with capabilities, experiences, and networks that can benefit the new venture (Chen et al., 2008; Husick and Arrington, 1998; Lynall et al., 2003).

For understanding the antecedents that trigger director exit in new ventures, research exploring these factors remains scarce. The broader corporate governance literature examines the impact of firm events, such as bankruptcies and wrongdoing, as well as board characteristics like leadership structure, social structures, and motivations on director exit (e.g., Acharya and Pollock, 2021; Arthaud-Day et al., 2006; Boivie et al., 2012; Garg et al., 2018). However, despite the significance of these factors for public firms, they may not directly apply to new ventures that face unique early life cycle pressures and dynamics (Garg, 2013).

In this paper, we investigate the antecedents of director exits in new ventures by considering the unique life cycle pressures and dynamics in new ventures. Drawing on the organizational life cycles framework and resource dependence arguments, we argue that key life cycle events shift demands and uncertainties, which may render existing dependencies and requirements from board members redundant, leading to director exits. Specifically, we examine how SBIR funding (i.e., U.S. government funding program), Venture Capital (VC) rounds of funding, and first alliance formation relate to director exits in new ventures. We argue that SBIR funding, VC funding rounds, and first alliance formation are key transformative events because they not only ward off immediate survival threats, but also create a fork in the roadmap of the venture's evolution. They bring about changes that fundamentally alter the venture's uncertainties, resource needs and dependencies (Gans and Stern, 2003; Lerner, 2000; National Research Council, 2008; Ozmel et al., 2013; Stuart et al., 1999). Accordingly, in the aftermath of SBIR funding, subsequent VC funding rounds, and the first alliance the likelihood of director exits increases, reflecting adjustments in the board to align with the venture's evolving needs and dependencies (Hillman et al., 2000; Zahra et al., 2009).

We tested the hypotheses using a unique longitudinal database of new ventures in the US semiconductor industry from 2000 to 2016. We combined hand-collected data with other proprietary datasets to gather comprehensive information on new ventures and their board members. The results from our analyses show that receiving SBIR funding and subsequent rounds of VC funding are linked to an increased likelihood of director exit. However, we do not find sufficient evidence in support of our prediction that the initial alliance influences the likelihood of director exit. Although the empirical analysis in this study is quantitative, we also conducted 15 interviews with board members from the new ventures in our sample to better elucidate the mechanisms at play. The interviewees argued that the reason for board members to leave the board following these events is the change in the needs of the new venture.¹ Following prior work, we draw on information gained from these interviews to illustrate and substantiate our theoretical claims e.g., Balachandran (2024); Balachandran and Eklund (2024); Garg et al. (2018, 2019); Sytch and Kim (2021).

Our study makes several contributions. First, it contributes to the burgeoning literature on venture boards (e.g., Bruneel et al., 2020; Clarysse et al., 2007; Garg, 2013; Garg and Eisenhardt, 2017; Lerner, 2022; Li et al., 2020) by shedding light on the understudied aspect of director exit in early-stage ventures. The theoretical framework and findings offer an understanding of when director exits are more likely to occur. This provides a critical step in better comprehending changes in board composition in early-stage new ventures. The study also highlights the interdependencies between the new venture's and the board's life cycles. Quantitative evidence shows key life cycle events — SBIR funding and VC rounds — increase the likelihood of director exits, and qualitative evidence through the interviews reveals that board members leave due to changes in the venture's needs following these events. Additionally, the results show that the formation of the first alliance does not significantly affect the likelihood of director exit. This finding suggests that to the extent that board members are instrumental in making the connections for the alliance formation (e.g., Beckman et al., 2014), they stay to help and guide the venture and its alliance.

Second, it contributes to the entrepreneurship literature by examining resource dynamics in new ventures (e.g., Bhawe et al., 2016; Brinckmann et al., 2019; Lichtenstein and Brush, 2001; Stuart et al., 1999; Williams et al., 2021; Zahra, 2021). Previous research has primarily focused on understanding how a new venture's acquisition of resources changes the external environment, influencing external stakeholders' perceptions and facilitating further access to resources (e.g., Hsu, 2004; Islam et al., 2018; Stuart et al., 1999; Toole and Czarnitzki, 2007). We extend this work by shifting the attention to the internal environment of new ventures. Specifically, we clarify how financial resource acquisition through SBIR and VC funding alters new ventures' resource requirements and interdependencies, triggering pruning in the venture board (e.g., Beckman et al., 2014; Bruneel et al., 2020; Zimmerman and Zeitz, 2002). Understanding when new ventures align the board with the evolving requirements of the internal environment has important implications for the survival of new ventures (Lynall et al., 2003).

Third, our study contributes to the broader literature on board turnover (e.g., Acharya and Pollock, 2021; Boivie et al., 2012; Garg et al., 2018) by highlighting the dynamic nature of resource dependence of new ventures and how that relates to director exit. We do so by integrating insights from organizational life cycles framework and resource dependence arguments. Prior work in this area has primarily focused on examining how agency problems related to internal (e.g., Withers et al., 2012) and external crises (e.g., McDonnell and Cobb, 2020) as well as board-level characteristics, such as leadership structure, social structures, and motivations (e.g., Acharya and Pollock, 2021; Boivie et al., 2012; Garg et al., 2018), impact director exits. Our study extends this work by shedding light on the role of SBIR and VC funding for director exit.

Finally, our study offers a valuable framework for stakeholders in the entrepreneurial ecosystem to better anticipate and manage

¹ The interviewees argued against alternative explanations when asked if other reasons could explain board member departures following the three life cycle events.

director exits. Specifically, entrepreneurs gain insights into the relationship between life cycle events that are linked to venture growth and board configuration. Especially, first-time or academic entrepreneurs who might lack experience in managing new ventures would benefit from understanding when director exits are likely to occur and when the board needs to change. For investors and board members, our findings provide evidence, helping them move beyond anecdotal accounts and make informed decisions about changes in the board composition. Grasping these dynamics is critical for prospective investors and board members as new ventures are privately held and information about the reasons behind directors' exit is often scarce and opaque.

2. Theoretical background and hypotheses

2.1. Evolution of new ventures

The organizational life cycles framework has been central to describing the evolution of firms over time (Boone et al., 2020; Chandler, 1962; Fisher et al., 2016; Kazanjian, 1988; Penrose, 1952; Quinn and Cameron, 1983). This framework suggests that firms evolve through recognizable stages of development and that as stages change, so do firms' strategies and structures (Chandler, 1962). While there are several models of life-cycle stages with various labels and stage numbers (e.g., conception, commercialization, growth, and stability), the common theme across these models is that they describe similar processes and concerns underpinning venture evolution (Fisher et al., 2016; Kazanjian, 1988; Smith et al., 1985).

The life cycle perspective posits that the needs and challenges of new ventures change over time (Chandler, 1962). In different stages of a new venture's life cycle, not only the types and amounts of resources but also the dependencies on these resources evolve, bringing different resource demands and dependencies at each stage (Katila et al., 2022; Kazanjian, 1988; Pfeffer and Salancik, 1978). Each stage embodies a unique strategic context that gives rise to new uncertainties and resource acquisition challenges (Hite and Hesterly, 2001; Reese and Aldrich, 1995). The shifting context recasts the priorities as to what the critical resources are and who the primary resource providers are of those resources (Fisher et al., 2016). Keeping these uncertainties as well as dynamics in resource needs and dependencies in mind, new ventures must adapt the organizational elements that enable them to meet the ever-morphing demands of their life cycle (e.g., Boeker and Wiltbank, 2005; Hite and Hesterly, 2001; Vohora et al., 2004).

While the need for adapting core organizational elements might not be immediately apparent, life cycle events enable new ventures to anticipate and recognize shifting priorities and dependencies (Scott and Bruce, 1987; Smith et al., 1985). Specifically, prior work recognizes SBIR funding, VC funding rounds, and first alliance as key life cycle events that shape the new ventures' strategic direction, resource demands and dependencies (e.g., Fisher et al., 2016; Howell, 2017; Hsu, 2006; Nicholson et al., 2005; Stuart et al., 1999). In this paper, we systematize these ideas to argue that SBIR funding, VC funding rounds, and first alliance as key life cycle events influence new ventures' adaptations to the core organizational elements.²

2.2. Venture boards

The organizational element of interest to us is the board of directors of a new venture. The board of directors is the apex decision-making authority of any incorporated organization (Fama and Jensen, 1983). The board serves two critical functions: monitoring and resource provisioning (Beckman et al., 2014; Bruneel et al., 2020; Clarysse et al., 2007; Garg, 2013; Garg and Furr, 2017; Graebner and Eisenhardt, 2004). By fulfilling these two functions, the board influences the new venture's operations, strategy, innovation, and performance (Beckman et al., 2014; Clarysse et al., 2007; Garg and Eisenhardt, 2017; Knockaert and Ucbasaran, 2013).

The monitoring function involves overseeing and ratifying executive decisions to ensure they align with shareholder interests and firm's long-term goals (Fama and Jensen, 1983; Garg, 2013; Hillman and Dalziel, 2003). The theoretical basis of this function is rooted in agency theory, which assumes that executive and shareholder interests may diverge due to the separation of ownership and control (Fama and Jensen, 1983; Jensen and Meckling, 1976). The resource provisioning function refers to the board's ability to bring resources to the new venture (Beckman et al., 2014; Hallen and Eisenhardt, 2012). This function's theoretical underpinnings lie in the resource dependence theory, which assumes that firms depend on external resources and asserts that the board reflects the firm's resource dependencies (Hillman and Dalziel, 2003; Pfeffer and Salancik, 1978). Because new ventures are privately held, they are less prone to the agency concerns stemming from dispersed ownership and the separation of ownership and control, implying that the resource provisioning function takes a primary role (Garg, 2013; Garg and Furr, 2017; Reuer et al., 2024).

The resource provisioning functions of a new venture's board are multifaceted. Directors bring crucial resources, including expertise and skills, advice and counsel, information, legitimacy, and access to key constituents like investors, suppliers, buyers, and other important decision-makers (Beckman et al., 2014; Hillman and Dalziel, 2003; Zahra et al., 2009; Zimmerman and Zeitz, 2002). The board also supports the venture by guiding and motivating executives on how to accumulate needed resources, how to effectively configure and bundle them, and how to leverage their use to create value (Zahra et al., 2009). It does so by being involved in the formulation of strategy and other important firm decisions such as product introductions, personnel issues, various operational activities, and resource acquisition (Boeker and Wiltbank, 2005; Ehrlich et al., 1994; Hellmann and Puri, 2000). The board also contributes by bolstering the public image of the new venture, increasing communication with the environment, and building relations with important entities to facilitate access to needed resources (Beckman et al., 2014; Graebner and Eisenhardt, 2004; Hallen and

² In the following, we present and discuss each event in the order of the life cycle stage they most frequently occur. Each event constitutes a separate milestone in the life of a new venture meaning that firms need not to go through one milestone to reach the next.

Eisenhardt, 2012).

2.3. Director exit

Given their preeminent function as the apex decision-making unit, boards can facilitate adaptation to the demands of different stages of the venture life cycle by pruning director membership. Indeed, new venture boards frequently experience director exits. Understanding the antecedents that trigger director exit is crucial for new ventures, given that directors contribute valuable networks, personal influence, and capabilities that are instrumental in shaping the venture's critical decisions (e.g., Beckman et al., 2014; Bruneel et al., 2020; Clarysse et al., 2007; Garg and Eisenhardt, 2017; Wilson et al., 2013). On the one hand, director exits may pose risks and costs for new ventures as the departing director takes valuable knowledge, capabilities, and networks with them (Acharya and Pollock, 2021; Coff, 1997; Vandembroucke et al., 2016). Director exits may disrupt dynamics, work routines, and communication among the remaining members, disruptions that necessitate adjustments and time to rebuild (Finkelstein et al., 2009). On the other hand, director exits can pave the way for "board refreshment" (Papadopoulos, 2018). They allow board members with different capabilities, experiences, and networks to join and help the new venture (Chen et al., 2008; Husick and Arrington, 1998; Lynall et al., 2003).

Although director exits are frequent, their relation to the venture life cycle requires a better understanding because of their salience for new venture evolution. The broader corporate governance is not particularly informative in this regard because it has tended to concentrate either on events such as bankruptcies and wrongdoing or on board-level factors such as leadership, social structure, and motivations (e.g., Acharya and Pollock, 2021; Arthaud-Day et al., 2006; Boivie et al., 2012; Cowen and Marcel, 2011; Garg et al., 2018; Srinivasan, 2005). Notwithstanding the importance of these antecedents from the standpoint of public corporations, they are extraneous from the perspective of new ventures and the early life cycle pressures and dynamics they are subject to (Garg, 2013).

We build on the organizational life cycles framework and resource dependence arguments to examine the effects of events that mark a new venture's evolution. Specifically, we consider how SBIR funding, VC rounds, and first alliance relate to director exit. We argue that new ventures face uncertainties, resource demands, and resource dependencies that are not stable but vary over time (Katila et al., 2022; Pfeffer and Salancik, 1978). These shifts are often invoked by key events that bring a fundamental shift in the venture's relationship with its environment and thus mark a new phase in its evolution (Scott and Bruce, 1987). Such tectonic shifts often occur with the influx of financial and commercial resources that not only temporarily stave off survival threats but also create a fork in the roadmap of the venture's evolution (Lerner, 2000; National Research Council, 2008; Ozmel et al., 2013; Stuart et al., 1999). SBIR funding, VC funding rounds, and first alliance formation represent such key transformative events where the decisions made are not just about overcoming immediate challenges but also about shaping the venture's long-term direction. Following these events, the venture confronts different problems and challenges, thus facing different resource requirements (Zahra et al., 2009).

The extent to which directors benefit the firm depends on whether they are able to grasp and respond to the modified resources demands and dependencies (Hillman et al., 2009; Pfeffer and Salancik, 1978), lower transaction costs associated with the new venture's external linkages (Williamson, 1984), increase legitimacy, and ultimately aid in the survival of the new venture (Singh et al., 1986). Consequently, following these events, the likelihood the board will change—to reflect what resources the new venture has already and what resources it needs to accomplish its goals—increases (Hillman and Dalziel, 2003; Lynall et al., 2003; Zahra, 2021; Zahra et al., 2009). Next, we draw on these foundations to elucidate the relationships of interest.

2.4. SBIR funding and director exit

The conception stage of a new venture begins when the new venture is formed (Hite and Hesterly, 2001). The primary focus during this initial phase of the life cycle is on developing the concept and the underlying technology (Boone et al., 2020; Kazanjian, 1988). This is the phase where the foundational aspects of the venture are established. New ventures, however, lack the critical resources, capabilities, and routines needed to develop the technology and ensure survival (Stinchcombe, 1965; Stuart et al., 1999). These deficiencies can hinder the development of technology and pose threats to the venture's survival. The conception phase is characterized by high degrees of technical and organizational uncertainty, a strong dependence on external parties for resources and support, and low levels of legitimacy or recognition in the market and industry (Fisher et al., 2016; Kazanjian, 1988; Zimmerman and Zeitz, 2002).

Confronted with significant resource constraints and uncertainty about the viability of their technology, new ventures in the conception stage seek funding to bridge their financial gaps (Cooper, 2003; Drover et al., 2017; Gans and Stern, 2003; Hsu, 2004, 2006; Lerner, 2000; Link and Scott, 2010). The largest public funding initiative in the United States is the SBIR program (Gans and Stern, 2003; Lerner, 2000). SBIR is a highly competitive program designed to assist new ventures in high-tech sectors with their research and development endeavors. Its primary objective is to support innovative, but unproven, ideas (Acs and Audretsch, 1988; National Research Council, 2008). The selection is based on the extent to which the project "proposes a novel approach that addresses pressing problems or needs, is unproven, and involves an element of technical risk" (www.sbir.gov). Consequently, the SBIR funding is tailored for very early-stage ventures developing technology that is deemed promising, but too new to validate its commercial potential (Lerner, 1999; National Research Council, 2008). Over the years, the SBIR funding has served as a catalyst for the early-stage development of numerous high-tech firms. For instance, some of the most successful and innovative firms have been recipients of the SBIR funding, including Apple, Intel, Compaq, and Federal Express among others (Lerner, 2000).

To be eligible, the new venture must be American owned, organized as a for-profit entity, and have <500 employees. Funding is provided through contracts or grants and recipients typically receive multiple grants. The SBIR program follows a two-phase structure.³ Phase I helps new ventures to assess the feasibility, technical merit, and commercial potential of the project. Subsequently, Phase II expands on Phase I results. It allows ventures to sustain and expand upon the research and development efforts initiated in Phase I (SBIR, www.sbir.gov). The SBIR program does not require the government to take an equity stake in exchange for the grant nor take a seat at the board of directors (Hsu, 2006; Lerner, 2000).

Obtaining SBIR funding marks a key life cycle event for a new venture in the conception stage for several reasons. First, it enables the new venture to advance with its technology by providing a much needed yet difficult to obtain early-stage flux of funding (Huang and Pearce, 2015; Lanahan et al., 2021). For instance, a board member said to us:

“What I’ve observed over the last couple of decades, is a slow drying up of real early-stage funding...If I want to start a company, I need \$100,000, it’s becoming more and more difficult to find that. So, I think the SBIR funding can fill that gap...so, I think it’s really important.”

Another board member mentioned the financing challenges new ventures in high-tech sectors face and suggested that SBIR funding is a crucial support mechanism for these ventures.

“For deep tech such as semiconductors, lasers, advanced materials... Such projects are on the edge of fundamental research. I don’t think venture capitalists are well suited to fund those opportunities. We don’t have the right time horizon. We don’t have patience. We cannot really de-risk those opportunities early on, quickly enough for our liking. And so here the companies have the best chance to rely on very, very patient government funds.”

This infusion of funds helps the new venture in assessing the technology’s feasibility (Lerner, 2000). A board member illustrated this by saying “it [SBIR] gives them [entrepreneurs] the ability to leave their job or to hire some people to get the concept running...it gives the opportunity for the startup to get further and not come in with none of the risk mitigated”.

Second, SBIR funding contributes to the new venture’s evolution by conferring credibility to the new venture (e.g., Howell, 2017; Islam et al., 2018; Lerner, 2000; National Research Council, 2008; Toole and Czarnitzki, 2007). Specifically, a board member noted that receiving SBIR funding means that “the idea has legs... someone in government, the people who are directors at SBIR that have good technical background believe in the idea and the opportunity”. Consequently, receiving SBIR funding enhances the credibility of both the technology and the new venture, signifying that the project has met the stringent eligibility requirements of novelty, feasibility, and potential. For instance, another board member said:

“In order to award you the SBIR grant, you go through a competitive process where academics are providing the input and analyze pros and cons of different ideas and proposals. In a sense it de-risks the deal for other investors, it shows that the U.S. government analyzed this stuff... so it’s potentially doable.”

Finally, SBIR funding assists the growth of the new venture by unlocking avenues to supplementary resources. Specifically, by reducing resource providers’ uncertainty about the technology’s prospects, it facilitates access to subsequent SBIR phases, other governmental funding, other sources of private funding, and resources beyond financial backing (National Research Council, 2008). This frequently includes opportunities for mentorship, networking, and access to facilities, all of which can substantially enhance the venture’s chances of success. For instance, a board member noted that “to the extent that SBIR helps eliminate the very early part of the risk cycle, it is going to be helpful for both angel investors and early-stage seed investors to come in... it is early money, gives you runway, gives you the opportunity to make your product, technology, idea more mature, so that it’s more attractive to third party investors.” Further, because the SBIR program aims to fund innovative ideas that meet the specific R&D needs of the government, the government might sometimes show intent to become the customer for these ventures. This provides new ventures with new knowledge about customer demands. For example, one of our interviewees mentioned the following:

“One of the firms where I’m an advisor...their early-stage funding almost exclusively came from research grants. There was intent [to buy the product]...in this case it’s the US Air Force, they really wanted this technology to be implemented in certain platforms in the future... they saw a real need to do this.”

The benefits SBIR funding confer to new ventures facilitate their evolution and growth by transforming their resource needs, dependencies, and uncertainties. To the extent that SBIR funding alters ventures’ strategic and operational needs, it could make the current board’s skill set, expertise, and network less relevant, thereby necessitating some board pruning. Indeed, prior research suggests that the roles board members play evolve significantly throughout a venture’s life cycle (Zahra et al., 2009; Zahra and Pearce, 1989). In the conception phase, uncertainty regarding a venture’s quality is the highest; consequently, the board’s primary role is to bestow legitimacy on the venture (Huse and Zattoni, 2008; Zimmerman and Zeitz, 2002), provide a link with the external environment (Macmillan et al., 1989) to facilitate resource access and regulatory navigation (Field et al., 2013; Rosenstein, 1988). The board might offer general guidance on idea development (Gan and Erikson, 2022).

The arrival of SBIR funding sets the stage for the new venture to take the next steps in its growth journey. It is time for the new venture to tackle critical technical challenges, work on developing a prototype, and define the market segments of interest. This phase

³ There is also Phase 3, but it is not funded by the SBIR program. Phase 3 is funded by the specific federal agencies interested in funding the technology further and is aimed to strengthen the support from Phase 1 and 2.

demands more capital for hiring specialized talent and establishing clear organizational structures (Sine et al., 2006). Success hinges on effectively sourcing and securing these resources. Here, the board's involvement becomes crucial, guiding the venture through the strategic decisions and the inherent risks (Garg, 2013; Huse and Zattoni, 2008; Sapienza et al., 1996). Their advice and guidance are sought in various critical areas, from recruiting specialized employees (Hellmann and Puri, 2000) to securing funding and other crucial resources for successful commercialization (Gan and Erikson, 2022). To effectively do so, more specialized knowledge as well as more frequent oversight and active involvement and collaboration with the CEO are required from the board members (Gan and Erikson, 2022; Hellmann and Puri, 2000; Sapienza et al., 1996; Zahra and Pearce, 1989). Such a shift could prompt current board members to exit as their contribution might no longer align with the venture's evolving requirements. For example, a board member explained that the changing needs of the venture necessitate a different set of expertise that current board members might not possess, leading to departures, as illustrated by the following:

“Normally, that's where the transition between board members happens...the reason that board members decide to move on is because the company has different types of needs. It takes a different type of person and background. That's a different skill set, that's a different person, you can't have all of those culminate in a single person where they have the wherewithal to take something off the ground, and then to grow it. That's just two different types of expertise needed.”

Given the change in the new venture's needs, we expect an increased likelihood of director exits following SBIR funding. Hence, **Hypothesis 1.** There is a positive relationship between a new venture receiving SBIR funding and the likelihood of a director exit.

2.5. Rounds of VC funding and director exit

During the commercialization stage, new ventures not only refine and advance their technology, but also engage in strategies to mitigate market uncertainties. The focus is on turning the technology to a product for a market, establishing product-market fit, launching, and selling the product to that market (Ries, 2011). To achieve this, the venture needs to focus on improving the product so that it performs as expected, as well as on setting up the production, distribution, marketing, and sales efforts (Blank, 2013; Gaibraith, 1982; Waldron et al., 2013).

At this stage, new ventures typically rely on VC funding (Zider, 1998). VC firms invest in new ventures in exchange for equity through sequential rounds of financing (Gompers, 1995; Hoenen et al., 2014; Ruhnka and Young, 1987). Through these rounds, VCs make staged capital infusion to new ventures when they have attained certain goals that reflect progress and resolution of uncertainty (Hallen and Eisenhardt, 2012; Steier and Greenwood, 1995). Such goals relate mainly to technical feasibility and progress as well as economic feasibility through market assessment (Gompers, 1995). In subsequent rounds of funding, on average the amount of capital invested increases to reflect the growing needs of the new venture (Hand, 2007; Kaplan and Strömberg, 2003). Consequently, subsequent rounds of VC funding are pivotal in driving the growth and evolution of the new venture, serving as significant life cycle events for its development (Davila et al., 2003; Hallen and Eisenhardt, 2012).

In each funding round, the terms for board representation are negotiated between investors and the current board, which often results in changes in the board (Garg, 2013). This process allows for board pruning and refreshment as directors exit the board (Bagley and Dauchy, 2011). At this stage, the venture board typically consists of three to five members of both inside and outside directors (Beckman et al., 2014; Garg, 2013; Lerner, 1995). The inside directors include the CEO, who may or may not be a founder, as well as one or two additional executives. The outside directors include non-executive investor-directors representing private investors, founders who are no longer employed by the firm, and independent directors holding senior positions in relevant industries (Bagley and Dauchy, 2011; Garg and Furr, 2017). The motivations, knowledge, and networks of the directors vary greatly. This affects both their willingness and capacity to monitor effectively, as well as the level and quality of resources they provide (Beckman et al., 2014; Garg, 2013; Garg and Eisenhardt, 2017). For instance, while VCs often seek board seats in funding rounds to protect their investment and support the venture's growth (Bagley and Dauchy, 2011; Gorman and Sahlman, 1989), they also tend to specialize in specific developmental stages to offer more focused support (Gompers et al., 2020). Similarly, independent directors who were helpful at the early stage may not provide as much value in the subsequent stage. Consequently, the board may recommend these directors to get off the board. Below is an excerpt from a director illuminating how subsequent rounds of VC funding lead new ventures to outgrow capabilities of the current board, hence prompting board members to leave:

“I can think of multiple phases in the evolution of the startup, and they revolve around new rounds of funding. At an early stage, the most important need for the company is investment, you tend to bring people onto the board that either have money or have connections that can bring in the money. Once the company starts to grow a little bit, there's a real need for strategic thinking. There's also a need to bring in more money because typically the actual product development starts to take place and that can be pretty costly. So, again you need investors, more money, more rounds, but you also need people who have some product development experience, more technical expertise, things like that.

Probably the next phase is when you've got a product, or a prototype and you need to start engaging with customers to get feedback. And so, you need people that have connections with potential customers, and perhaps some sales and marketing expertise. And for each of those phases you can kind of imagine that there's a different set of skills, experience, background.

All along the way there's always a financing need. As the board cannot be too large (3–5 people), this develops the turnover idea. Some board members recognize the need to maybe bring in a board member with a different experience and they agreed to step back from the board to allow that to happen. In high functioning boards all the board members will recognize that there's a need for the right skill set at the right time and the ones that are really interested in seeing the company succeed are willing to step back.”

As a venture secures subsequent rounds of VC funding it evolves and so do the needs for skills and contributions from directors, thereby increasing the likelihood of director exit. Therefore,

Hypothesis 2. There is a positive relationship between a new venture receiving subsequent rounds of VC funding and the likelihood of a director exit.

2.6. First alliance and director exit

The commercialization stage continues until the new venture develops an efficient and effective task system and overcomes the technical challenges associated with product development (Kazanjan, 1988). When the product achieves some market success, the venture transitions into the growth phase (Fisher et al., 2016). To navigate the constraints encountered during these stages, new ventures often seek to form alliances with other firms to access the necessary resources (Eisenhardt and Schoonhoven, 1996; Katila et al., 2008; Pisano, 2006). These partnerships enable new ventures to overcome resource constraints by quickly accessing complementary resources, such as marketing, production, and technology related resources, as well as human and financial resources⁴ (e.g., Ahuja, 2000; Kapoor and Furr, 2015; Katila et al., 2008). Alliances are crucial for new ventures in high-tech sectors as they shape innovation strategy (Anand et al., 2010; Dushnitsky and Lenox, 2005; Pisano, 2006).

However, it is widely acknowledged that forming alliances introduces significant collaborative challenges, necessitating well-structured mechanisms for organizing and governing joint activities (Devarakonda and Reuer, 2019; Gulati et al., 2005; Gulati and Singh, 1998). Successfully navigating these challenges demands understanding and experience of how to adjust and adapt behaviors, processes, and strategies in response to changing circumstances, uncertainties, and the evolving needs of the alliance (Kale and Singh, 2009; Ozcan and Eisenhardt, 2009). In this process, the board's involvement and guidance are crucial for new ventures to surmount inexperience with the challenges associated with navigating alliances (Beckman et al., 2014; Devarakonda and Reuer, 2019).

The first alliance, especially, introduces the venture to previously unencountered challenges (Kelly et al., 2002). This makes the formation of the first alliance a key life cycle event (Colombo et al., 2006), signifying that the first alliance is not merely about creating a partnership but also strategically navigating the initial complexities and decisions that will shape the venture's future trajectory (Nicholson et al., 2005). The formation of the first alliance can place significant pressure and expectations on board members; they are tasked with the crucial roles of adeptly advising on how to manage the alliance partner and ensuring that the venture's interests are protected (Beckman et al., 2014; Devarakonda and Reuer, 2019). For instance, a board member said, "so yeah, it's not easy, it's kind of like navigating a ship through rocks." Board members might be called upon to advise on making critical resource allocation decisions, as alliance partners often advocate for reallocating resources to support joint projects (Ozmel et al., 2013). For instance, a board member explained that such demands may place additional pressures on the venture's strategic direction and resource management by saying:

"So, it would be a project that says this is what we're going to develop together. And me as a big company, I'm interested in your technology, I'm going to put in, let's say X millions of dollars in the project. We're going to decide we're going to have an agreement about who does what with the rights of the intellectual property that's been developed...just the logistics of managing the technology development requires a lot of time and a lot of resources. And the alliance might detract from your product, your own product development."

These complexities may bring to the fore any lack of expertise or perspectives needed to tackle the challenges and seize the opportunities that arise with the formation of the first alliance. Some board members may find themselves in unfamiliar territory, lacking a clear frame of reference. This can lead to not only varied assumptions, attitudes, and expectations about the alliance, but also private concerns regarding their role in it (Kelly et al., 2002). Indeed, a board member illustrated this by saying the following:

"I think it's really the type of stewardship and advise the founders need, and if there is a mismatch with your expertise, let's say you tend to be about product market fit and all that kind of stuff rather than dealing with partnerships, you know all that kind of stuff. So, usually if there is an expertise mismatch, most board members, believe it or not, will go off the board because it's just not worth their personal time."

To the extent that the formation of the first alliance increases workload and pressure as well as reveals a mismatch between the needed expertise and that of the current directors, the likelihood of directors leaving may increase in the aftermath of the first alliance. Therefore,

Hypothesis 3. There is a positive relationship between a new venture forming its first alliance and the likelihood of a director exit.

3. Methods

3.1. Data collection and sample

We tested our predictions using a hand-collected sample of new ventures in the U.S. semiconductor industry between 2000 and 2016. This sector serves the purpose of our study well for two reasons. First, this industry is highly capital intensive; new ventures rely on external funding to develop and commercialize their products (e.g., Hsu and Ziedonis, 2013; Sporck and Molay, 2001). Second, this sector has consistently attracted private and governmental investments (e.g., Islam et al., 2018; Lerner, 2000; Paik, 2014) due to the

⁴ Partnerships usually finance specific research projects within the venture, unlike venture capital funding that invest in the venture itself (e.g., Ozmel et al., 2013; Robinson and Stuart, 2007).

vital role semiconductor products play in advancing modern technology and national security (National Research Council, 2008).

Data on board of directors of new ventures is not readily available in standard databases. To overcome this challenge, we combined and triangulated data from multiple data sources. We obtained a list of new ventures in the semiconductor industry from VentureSource (now CB Insights) (Ewens and Marx, 2018; Gompers et al., 2005; Tumasjan et al., 2021). VentureSource provides firm and individual level data, including details about the board of directors. We compared and combined the data from VentureSource with data from CrunchBase and VentureXpert, which provide detailed information on VC investments (Dutta and Folta, 2016; Ko and McKelvie, 2018; Wadhwa et al., 2016). We augmented and validated the new venture board data using Form D filings⁵ (available through the SEC EDGAR database) and LinkedIn data. The Form D filings and the data from LinkedIn allowed us to observe the start and end year of board appointments. The data on governmental funding came from SBIR awards (www.SBIR.gov). Data on the patent applications was obtained from the United States Patent Office's (USPTO) patentsview initiative (www.patentsview.org). We tracked the alliances formed using the Strategic Alliance database of the Securities Data Company (SDC). The data on the competition in the industry came from the US Bureau of Labor Statistics (www.bls.gov).

To construct our sample, we applied several screens to the list of 466 new ventures from VentureSource. To ensure a comprehensive and representative analysis, we included new ventures that had formalized information about their boards and included directors with board rights beyond the founders. Such formalizations take place when the venture receives equity financing. We, thus, included new ventures that received equity financing at least once during the sample period. Additionally, to track board member start and end years effectively, we considered only those new ventures that either had at least one Form D filing or whose board members had LinkedIn profiles within the observation period. Following these steps, we obtained a sample comprising 325 new ventures, 443 unique board members, and 824 unique new venture-board member pairs. Our analysis sample is an unbalanced firm-board member-year panel. To construct our panel, we track each new venture from founding till the end of the sample period or until exit through dissolution, acquisition, or IPO. Accordingly, our final sample for analysis consists of 3356 new venture-board member-year observations.

Finally, while the empirical analysis in this study is quantitative, we also carried out 15 interviews with board members from new ventures in the sample. We contacted a random sample of 100 board members from our data through LinkedIn, and 15 of them agreed to be interviewed. The interviews were semi-structured, lasted between 30 and 60 min, were conducted over zoom, recorded, and transcribed. The interviewees had varying degrees of experience as board members. Some of them had experience as insider board members and later as investors, others were investors, and others independent board members. In line with prior work, these interviews were conducted to sharpen and illustrate the theoretical arguments, to validate the assumptions, and to develop an understanding of the mechanisms underlying the observed quantitative relationships in the data e.g., Balachandran (2024); Balachandran and Eklund (2024); Garg et al. (2018, 2019); Sytch and Kim (2021). The interviews were not meant to represent a rigorous standalone qualitative research exercise.

3.2. Measures

3.2.1. Dependent variable

Following prior work, our dependent variable, *Board member exit*, is measured as a dummy variable (e.g., Busenbark et al., 2022; Cowen and Marcel, 2011). It takes the value of one in year (t) when a director exits the board of the focal new venture, and zero otherwise.

3.2.2. Independent variables

Following prior research, the first variable, *SBIR funding*, was measured as a binary variable and it takes the value of one if the focal new venture received SBIR funding in the previous year ($t-1$), and zero otherwise (Hsu, 2006).⁶ The second explanatory variable, *VC rounds*, was measured as the number of rounds of VC funding the focal new venture received until the previous year ($t-1$) (Davila et al., 2003). Our third explanatory variable, *First alliance*, was measured as a dummy variable and it takes the value of one if the focal new venture formed its first alliance in the previous year ($t-1$), and zero otherwise.

3.2.3. Control variables

We incorporated a range of control variables at the individual and firm level plausibly associated with our variables of interest and director exit (e.g., Acharya and Pollock, 2021; Boivie et al., 2012; Garg et al., 2018). The first set of controls captures individual level characteristics of directors. To account for gender differences between board members we included *Board member gender* a dummy variable that takes the value of one if the board member is a female, and zero otherwise. We also controlled for the experience of the board member by including *Board member experience*, measured as the number of years of working experience.

The second set of control variables accounts for firm level characteristics. To accommodate variations in venture age, we included

⁵ Form D is a document that private companies in the U.S. file with the Securities and Exchange Commission (SEC) when they issue securities in a private offering to raise capital. It is a requirement under Regulation D of the Securities Act of 1933, which provides exemptions from certain registration requirements for these private offerings. Form D filings notify the SEC about the details of the offering, including information about the company, the securities being offered, the names and addresses of directors and executive officers, and other relevant information.

⁶ A dummy variable effectively captures the timing of the funding decision, whereas the actual disbursement of funds occurs in installments (usually 50 %, 35 %, and 15 %) and may be delayed. This approach allows us to more accurately model both the timing of the SBIR funding event and the timing of the director's exit.

Firm age measured as the number of years since founding. In addition, the new ventures' innovation output can be an important predictor of board member turnover. For this purpose, we included *Firm patents*, measured as the number of patent applications filed and eventually granted in each year using a five-year moving sum. We took the natural logarithm of this variable to account for skewness. We also controlled for *Board size* measured as the number of board members, which might influence director exit. Further, the local competition from firms in the same industry can plausibly influence funding, alliance formation as well as director exit. To address this, we included *Local competition* measured as the location quotient of semiconductor establishments. It is calculated as the proportion of semiconductor establishments in the county where the new venture is located relative to the proportion of semiconductor establishments nationwide (Delgado et al., 2014; Fernhaber and Li, 2013). Finally, we included year-fixed effects to control for idiosyncratic shocks over time.

4. Results

4.1. Main results

Table 1 reports summary statistics and correlations at the unit of analysis, which is the new venture-board member-year. This data structure tracks covariates from the founding of each venture in the sample till the end of the sample period or until exit (through dissolution, acquisition, or IPO). At the venture level, 48 firms (15 %) have secured at least one round of SBIR funding, 278 firms (86 %) have secured at least one round of VC funding, 50 firms (15.5 %) have formed at least one alliance, and 315 firms (97 %) have at least one patent granted. On average, the board members in our sample have about 19 years of working experience. Also, the average venture board size is two board members, while the maximum is six members. From the total number of exits, majority are outsiders (i. e., 96 %) and only 15 are insiders (i. e., 4 %). Finally, the firms in our sample are located across 24 states, with 216 firms (66 %) located in California and 32 firms (10 %) in Massachusetts.

We now turn to the regression analyses that test our predictions. Table 2 presents the results for our hypotheses using Probit estimates. All specifications contain robust clustered standard errors at the startup level (clusters = 325). Model 1 reports the results including the control variables only. Models 2–4 report the results of the main hypotheses. In model 1, the positive and significant coefficient ($p < 0.01$) for both *Board member experience* shows that board members with greater experience are more likely to depart. Also, in line with prior work, the coefficient for *Firm age* is positive and significant ($p < 0.01$), suggesting that as firms grow older, the likelihood of losing board members increases. Further, contrary to conventional wisdom, the negative and significant ($p = 0.094$) coefficient of *Board size* indicates that board members are less likely to leave when the size of the board increases.

Hypothesis 1 predicted that the likelihood of board member exit is positively associated with a new venture receiving SBIR funding. In Model 2, the coefficient of *SBIR funding* is positive and significant ($\beta = 0.587$; $p < 0.01$), providing empirical support for Hypothesis 1. Holding all else equal, the average marginal effect indicates a 10 % increase in the likelihood of board member exit in ventures that have obtained SBIR funding. This relationship remains the same in Models 3 and 4.

Hypothesis 2 posited that subsequent rounds of VC funding are positively linked to the likelihood of board member exit. In Model 3, the coefficient of *VC rounds* is positive and significant, corroborating Hypothesis 2 ($\beta = 0.035$; $p < 0.05$). Holding other factors constant, the average marginal effect suggests that with one more round of VC funding the likelihood of board member exit increases by 0.62 percentage points.

Hypothesis 3 argues that forming the first alliance is positively associated with the likelihood of board member exit. In Model 4, the coefficient of *First alliance* is positive but not significant at conventional levels ($\beta = 0.228$; $p = 0.175$). Hence, Hypothesis 3 is not supported.

4.2. Sensitivity analyses

We conducted additional sensitivity analyses to assess the robustness of the main results. The findings are robust to an OLS fixed effects specification (i. e., Linear Probability Models) that account for unobserved factors that tend to remain stable over time. Table 3 displays the OLS fixed effects estimates. These results provide additional support for our Hypotheses 1 and 2, with a positive and significant coefficient for SBIR funding ($\beta = 0.178$; $p < 0.001$) and for VC rounds ($\beta = 0.014$; $p = 0.033$). In addition, our findings are robust to a Logit estimation model. Table 4 shows the estimates from the Logit estimation model, which are consistent with our main results. We also estimated our models using the Generalized Estimating Equation (GEE) approach (Liang and Zeger, 1986) that accounts for history dependencies/within subject dependencies. The GEE approach accounts for any correlation between the residuals of the same firm, as any unobserved heterogeneity that is influencing the dependent variable should be reflected in the correlation between the residuals of the same firm (Ahuja and Katila, 2001; Ahuja and Lampert, 2001). We specified a GEE model using a probit link function and a binomial distribution to model the error covariance structure. We also treated the within-firm correlation as exchangeable. We used heteroskedasticity robust standard errors to construct confidence intervals for the parameter estimates. These results show that while there might be some history dependence, the estimates are similar to our main results.

We carried out further sensitivity analyses (available on request). Our findings are robust when we control for the years of experience that a board member has in the new venture. Also, our findings are robust when we account for the amount of SBIR funding. Lastly, our findings are robust when accounting for the number of alliances formed.

Table 1
Summary statistics and correlations table.

	Variables	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9	10
1	Board member exit	0.11	0.31	0.00	1.00	1.00									
2	SBIR funding	0.05	0.22	0.00	1.00	0.09	1.00								
3	VC rounds	4.74	3.11	0.00	16.00	0.13	0.03	1.00							
4	First alliance	0.05	0.21	0.00	1.00	0.03	-0.01	0.05	1.00						
5	Board member gender	0.03	0.16	0.00	1.00	0.00	0.01	0.04	-0.02	1.00					
6	Board member experience	18.78	10.61	1.00	43.00	0.08	-0.02	0.16	0.00	-0.04	1.00				
7	Firm age	7.46	3.72	1.00	17.00	0.16	0.01	0.61	0.01	0.05	0.19	1.00			
8	Firm patents	2.92	1.58	0.00	7.06	0.05	0.09	0.41	0.08	0.04	0.13	0.46	1.00		
9	Board size	2.03	1.12	1.00	6.00	-0.01	0.01	0.24	0.12	0.00	0.02	0.20	0.22	1.00	
10	Local competition	1.43	0.60	0.00	2.40	0.00	-0.07	0.07	-0.02	-0.01	0.04	0.04	0.05	0.04	1.00

Note. $N = 3356$ (firm-board member-year).

Table 2

Probit estimation models of the effects of SBIR funding, VC rounds, First alliance on the probability of Board member exit.

Variables	(1)	(2)	(3)	(4)
SBIR funding		0.587 (0.123) [0.000]	0.579 (0.120) [0.000]	0.582 (0.119) [0.000]
VC rounds			0.035 (0.014) [0.011]	0.036 (0.014) [0.010]
First alliance				0.228 (0.168) [0.175]
Board member gender	0.043 (0.169) [0.800]	0.042 (0.176) [0.811]	0.033 (0.178) [0.853]	0.037 (0.179) [0.836]
Board member experience	0.009 (0.003) [0.002]	0.010 (0.003) [0.001]	0.009 (0.003) [0.002]	0.009 (0.003) [0.002]
Firm age	0.089 (0.021) [0.000]	0.094 (0.020) [0.000]	0.076 (0.019) [0.000]	0.075 (0.019) [0.000]
Firm patents	-0.004 (0.024) [0.860]	-0.016 (0.025) [0.526]	-0.025 (0.025) [0.329]	-0.028 (0.025) [0.267]
Board size	-0.060 (0.036) [0.094]	-0.058 (0.033) [0.076]	-0.070 (0.033) [0.034]	-0.077 (0.035) [0.029]
Local competition	-0.035 (0.059) [0.547]	-0.020 (0.060) [0.742]	-0.020 (0.060) [0.744]	-0.013 (0.061) [0.825]
Year Fixed effects	Yes	Yes	Yes	Yes
Constant	-1.698 (0.303) [0.000]	-1.743 (0.305) [0.000]	-1.757 (0.304) [0.000]	-1.758 (0.305) [0.000]
Loglikelihood	-1098.530	1086.203	1082.140	1080.761

Note: $N = 3356$. Clustered robust standard errors in parentheses (Clusters = 325). P -values in square brackets.

4.3. Post hoc exploration

We now turn to post hoc empirical explorations (available on request).⁷ We next explore empirically the extent to which the timing of attainment of these milestones affects the likelihood of director exit. To test this we considered whether the age of the new venture, which captures the time elapsed since founding, moderates the relationships of interest. The results show that the timing of attainment matters only for SBIR funding as the coefficient of *SBIR funding* * *Firm Age* is positive and significant ($\beta = 0.043$; $p = 0.001$). This result suggests that board member exit is more likely when the new venture receives SBIR funding in later years of its life. The coefficients for the other interaction effects are not significant at the conventional levels.

We further explore how the attainment of multiple milestones simultaneously influences the likelihood of director exit. The results show that only the simultaneous attainment of SBIR and VC funding matters for board member exit. The coefficient of *SBIR funding* * *VC rounds* is positive and significant ($\beta = 0.045$; $p < 0.001$). This result suggests that board member exit is more likely when the new venture receives SBIR funding in later rounds of VC funding. The coefficients for the other interaction effects are not significant at the conventional levels.

We also explored some boundary conditions. First, we examined whether VC heterogeneity in terms of status, experience, and specialization influences the relationship between VC funding rounds and director exit. The results showed no significant differences. Second, we investigated whether heterogeneity in VC funding climate (i.e., supply and demand) influences the relationship between VC funding rounds and director exit, but the results showed no significant differences. Finally, we considered whether heterogeneity in founder characteristics (i.e., prior founding and working experience) influences the relationship of interest, but the results showed no significant differences.

Finally, given that the majority of the director exits in our sample are outside directors, we run our analyses using a dependent variable that captures outside director exits –i.e., a dummy variable that turns one when an outside director exits the board, and zero otherwise. The results show that SBIR funding and VC rounds are linked to an increased likelihood of outside director exit.

⁷ We thank anonymous reviewers for these suggestions.

Table 3

OLS fixed effects estimation models of SBIR funding, VC rounds, First alliance on the probability of Board member exit.

Variables	(1)	(2)	(3)	(4)
SBIR funding		0.179 (0.027) [0.000]	0.177 (0.027) [0.000]	0.178 (0.027) [0.000]
VC rounds			0.014 (0.007) [0.033]	0.014 (0.007) [0.033]
First alliance				0.011 (0.040) [0.778]
Board member experience	-0.038 (0.028) [0.177]	-0.034 (0.028) [0.228]	-0.033 (0.028) [0.232]	-0.033 (0.028) [0.233]
Firm age	0.089 (0.062) [0.155]	0.090 (0.062) [0.149]	0.086 (0.064) [0.178]	0.086 (0.064) [0.178]
Firm patents	-0.027 (0.009) [0.002]	-0.030 (0.009) [0.001]	-0.033 (0.009) [0.000]	-0.033 (0.009) [0.000]
Board size	-0.056 (0.016) [0.000]	-0.053 (0.017) [0.002]	-0.055 (0.017) [0.001]	-0.055 (0.017) [0.001]
Local competition	-0.007 (0.160) [0.966]	-0.025 (0.159) [0.877]	-0.039 (0.157) [0.803]	-0.041 (0.157) [0.796]
Year Fixed effects	Yes	Yes	Yes	Yes
Firm Fixed effects	Yes	Yes	Yes	Yes
Constant	0.249 (0.395) [0.529]	0.229 (0.389) [0.558]	0.249 (0.382) [0.516]	0.251 (0.384) [0.513]
R-squared	0.154	0.166	0.168	0.168

Note: N = 3356. Clustered robust standard errors in parentheses (Clusters = 325). P-values in square brackets.

5. Discussion

Director exits in new ventures are a critical but underexplored phenomenon, despite its ubiquity and importance. Research on venture boards has primarily concentrated on the composition of venture boards and their impact on venture outcomes (e.g., Beckman et al., 2014; Bruneel et al., 2020; Clarysse et al., 2007; Garg, 2013; Garg and Furr, 2017; Knockaert et al., 2015; Vandembroucke et al., 2016). Similarly, insights from the broader corporate governance literature (e.g., Acharya and Pollock, 2021; Garg et al., 2018), which focus on publicly traded firms, may not be fully applicable to new ventures due to distinct governance structures and unique challenges (Garg, 2013; Garg and Furr, 2017). Departing from prior work, our study investigates the antecedent factors influencing director exits in new ventures. We examine how SBIR funding, rounds of VC funding, and the formation of the first alliance relate to director exit in new ventures. Building on the organizational life cycle framework and resource dependence arguments, and insights from interviews with board members, we propose that these events crucially alter the venture's uncertainties and resource requirements triggering director exits.

For SBIR funding, which typically arrives at the conception stage, we argue that it helps the venture move on to a phase where it can begin to establish more structured operations, address key technical challenges, and develop prototypes. This new stage also demands different skills and capabilities for implementing clear organizational frameworks, structures, and routines, making the board's involvement more important than ever (Garg, 2013; Huse and Zattoni, 2008; Sapienza et al., 1996). To meet these expectations, board members must possess different types of expertise than those required during the conception stage, when the primary focus was on gaining legitimacy and leveraging board members' credibility (Huse and Zattoni, 2008; Zimmerman and Zeitz, 2002). Following SBIR funding—and the expected changes in strategy, resource needs, and organizational structure—some board members may no longer be the right fit and will need to step down to make space for others with more relevant experience and skills. As a board member noted “The reason that board members decide to move on has to do with different types of needs. It's a crude analogy to a growing child. You know, if now it needs a lot of feeding and care, all roll up their sleeves and kind of help the CEO and the management team. So, it takes a different type of a person and background.”

For VC funding rounds, the influx of capital also enables the venture to scale, which bring new challenges and requires different expertise from the board. Because directors' motivations, knowledge, and networks vary widely, their willingness and capacity to provide effective oversight, as well as the level and quality of their contributions, can differ significantly (Beckman et al., 2014; Garg, 2013; Garg and Eisenhardt, 2017). For instance, VCs tend to specialize in specific growth stages to offer more targeted support (Gompers et al., 2020), and independent directors who were highly valuable at an earlier stage may not be as beneficial at a later one. The directors we interviewed indicated that directors recognize how the venture's needs evolve as it progresses through successive VC funding rounds and are prepared to step aside, making room for board members better aligned with the current requirements.

Table 4

Logit estimation models of the effects of SBIR funding, VC rounds, First alliance on the probability of Board member exit.

Variables	(1)	(2)	(3)	(4)
SBIR funding		1.097 (0.204) [0.000]	1.086 (0.196) [0.000]	1.094 (0.197) [0.000]
VC rounds			0.067 (0.025) [0.007]	0.067 (0.025) [0.006]
First alliance				0.428 (0.309) [0.166]
Board member gender	0.059 (0.305) [0.847]	0.045 (0.320) [0.887]	0.022 (0.325) [0.946]	0.028 (0.327) [0.932]
Board member experience	0.018 (0.005) [0.001]	0.019 (0.006) [0.000]	0.018 (0.006) [0.001]	0.018 (0.006) [0.001]
Firm age	0.163 (0.032) [0.000]	0.174 (0.032) [0.000]	0.142 (0.031) [0.000]	0.140 (0.031) [0.000]
Firm patents	-0.002 (0.044) [0.970]	-0.023 (0.046) [0.614]	-0.040 (0.047) [0.397]	-0.046 (0.047) [0.333]
Board size	-0.111 (0.065) [0.088]	-0.106 (0.061) [0.084]	-0.128 (0.061) [0.036]	-0.139 (0.064) [0.030]
Local competition	-0.080 (0.115) [0.485]	-0.050 (0.116) [0.665]	-0.048 (0.119) [0.688]	-0.039 (0.119) [0.745]
Year Fixed effects	Yes	Yes	Yes	Yes
Constant	-2.972 (0.595) [0.000]	-3.079 (0.606) [0.000]	-3.106 (0.603) [0.000]	-3.114 (0.608) [0.000]
Loglikelihood	1099.942	1086.968	1082.575	1081.183

Note: N = 3356. Clustered robust standard errors in parentheses (Clusters = 325). P-values in square brackets.

For first alliance formation, we posit that this critical milestone would likely reveal gaps between the venture's evolving needs and the board's current capabilities, thus increasing the likelihood of director exit. Although our interviewees mentioned that a venture's first alliance intensifies workload, increases pressure, and may reveal gaps in directors' expertise—factors that could prompt directors to leave—we did not find enough quantitative evidence to support this hypothesis.

Our study enriches the entrepreneurship theory and practice with valuable insights. First, we extend the flourishing literature on venture boards (e.g., Beckman et al., 2014; Bruneel et al., 2020; Clarysse et al., 2007; Garg, 2013; Garg and Eisenhardt, 2017; Lerner, 2022; Li et al., 2020; Zimmerman and Zeitz, 2002) by elucidating the factors influencing director exits in early stage new ventures. Specifically, our research illuminates the significant role that early-stage SBIR funding and subsequent VC funding rounds play in the likelihood of director departures. In doing so, our study reveals the dynamic interdependencies between the board's life cycle and the venture's life cycle. Our qualitative evidence suggests that the arrival of funding can render old resource dependencies on the current board become redundant, leading to director exits. Such exits subsequently enable ventures to strategically update their board composition, catering to their evolving resource needs and management challenges. Consequently, our study not only sheds light on the factors driving director exit, but also suggests that such exits could serve as a means for new ventures to achieve better alignment with their development stage. Although prior work has alluded to the importance of venture boards closely aligning with the specific needs of their current life cycle stage (Lynall et al., 2003), it does not offer guidance on how this process works. Our study adds to this work by shedding light on the director exits in new venture boards.

Second, we contribute to the literatures on resource dynamics in new ventures (e.g., Bhawe et al., 2016; Brinckmann et al., 2019; Lichtenstein and Brush, 2001; Williams et al., 2021; Zahra, 2021) and on new venture evolution (Lynall et al., 2003) by integrating insights from venture life cycle literature with resource dependence arguments (Chandler, 1962; Katila et al., 2022; Pfeffer and Salancik, 1978). We do so by focusing on the interplay between key resources for early-stage ventures: the board of directors and financial resources from SBIR and VC funding. By demonstrating that SBIR and VC funding rounds correlate with an increased probability of director exits, our findings illuminate when board compositions change. Moreover, our results also reveal that the formation of the first alliance, contrary to our expectations, is not related to an increase in director exits. This implies that the formation of the first alliance either does not compel board members to depart or that such departures could introduce a level of discontinuity that raises the venture's uncertainty and risk, which board members may wish to avoid. By exploring these relationships, we contribute to a deeper understanding of the complex ways in which resources interact. These insights are crucial in guiding a venture's evolution effectively and gaining a deeper understanding of the strategic implications associated with resource management. Understanding when new ventures align the board with the needs of the firm has important implications for the survival of new ventures (Lynall et al., 2003).

Third, our paper contributes to the broader literature on board turnover in two important ways. First, we add to this work by shedding light on the factors that lead to director exit in the critical early years of a new venture's life cycle. Prior work in this area has mainly focused on mature public firms (Boivie et al., 2012) or young public firms soon after their IPO (e.g., Acharya and Pollock, 2021; Garg et al., 2018). The mechanisms and processes governing director exit in public firms are significantly different from those of new ventures. Second, we extend this literature by examining how events linked to growth shape director exits. Prior literature has mostly looked at events, such as “aggressive” accounting practices (Arthaud-Day et al., 2006) and negative evaluations by external audiences (Harrison et al., 2018), or it has looked at the board's leadership structure, social structures, and motivations (e.g., Acharya and Pollock, 2021; Boivie et al., 2012; Cowen and Marcel, 2011; Garg et al., 2018).

5.1. Practical implications

Our study offers valuable implications for entrepreneurs, investors, and board members by shedding light on director exits in new ventures—a phenomenon that several board members in our interviews noted as important to understand due to the challenges external entities face in evaluating the reasons behind such exits. We identify the factors contributing to a higher likelihood of director exits. In doing so, we provide a rationale for how SBIR funding and subsequent rounds of VC funding, by helping the new venture evolution, can render ventures' resource dependencies on the current board obsolete. This insight points to reasons why director exits become necessary or desirable, emphasizing the importance of board reconfiguration to align with ventures' evolving needs. Our theory and findings offer a framework for stakeholders to better anticipate and manage director exits. Entrepreneurs gain insights into the relationship between venture growth and board configuration, highlighting the need for boards to adapt to changing resource needs and dependencies. First-time or academic entrepreneurs, who often lack experience in managing both venture and board needs, would greatly benefit from understanding the timing and reasons for director exits. This knowledge would help them make more strategic decisions about when and from whom to raise funding. Investors may be better able to have an informed decision-making when assessing how well the current board meets the venture's resource requirements. Also, board members receive valuable perspectives on exit dynamics, improving governance strategies. Consequently, illuminating these dynamics holds particular significance for all parties involved in the entrepreneurial ecosystem, ensuring better governance and strategic alignment as ventures grow and evolve.

5.2. Limitations and suggestions for future research

Although our study sheds new light on the factors that influence director exit, it also has limitations that offer avenues for future research. First, a key challenge in addressing a research question like ours is that detailed, longitudinal, micro-level data on the board composition, timing of entry and exit of new ventures is difficult to obtain. We overcame this data challenge by using secondary data from Form D filings and LinkedIn. Although this approach allows us to achieve our research goals of detecting the effects of milestone achievement on director exit, the micro foundations by which directors exit the firm are not analyzed. Future research could examine these effects by designing suitable experiments or surveys that explore individual level motivations of the board member to exit a venture's board.

Second, our paper sheds light on how SBIR funding, VC funding rounds, and first alliance relate to the likelihood of director exits. This opens further avenues for research into exploring which board members are more prone to leave following these life cycle events. Future studies could delve into the impact of individual characteristics, such as gender, skills, and experience, among others, to provide an understanding of who leaves the board. Another fruitful area for research is whether other types of firm-level events that alter the resource needs of the new venture are linked to direct exit. While the focus of our study was on the antecedents of director exit, future research could examine the consequences of director exits and the conditions under which such exits may affect the new venture.

Third, for VC funding rounds, our key premise is that subsequent VC rounds recalibrate the venture's priorities and dependencies. This recalibration may render previous resource dependencies on the current board members redundant, thereby increasing the likelihood of director exit. Although interviews with board members generally support this argument, it is also possible that incoming venture capitalists demand greater control, leading to the displacement of current board members. Future research could qualitatively explore, in greater depth, the processes and conditions under which directors exit the board, whether voluntarily or otherwise. Also, for first alliance formation, while our argument is that this key lifecycle event would increase the likelihood of a director exit, we do not find enough evidence. Future research could explore this relationship further to understand whether and under what conditions alliances might affect the board composition and board exits. For instance, are there differences between equity and non-equity alliances or how does the timing of alliances influence board composition.

Fourth, our paper examines the factors that influence the likelihood of directors exiting new venture boards — a significant yet overlooked aspect of new venture governance. However, we do not explore how these same factors influence the recruitment of new board members. Our theoretical argument is that SBIR funding, VC funding rounds, and first alliance help new venture evolution, rendering dependencies on current board members obsolete. It is quite possible that these factors increase the likelihood of new board member additions. This scenario presents a fruitful area for future research to investigate how these life cycle events affect who joins the board.

Finally, whereas the semiconductor industry offers a suitable and interesting empirical context for examining our research question, it is characterized by high rates of new entry as well as private and public funding (e.g., Brittain and Freeman, 1986; Islam et al., 2018; Lerner, 2000; Paik, 2014; Srinivasan, 2005), which may limit the generalizability of our results. We would expect SBIR funding, VC rounds, and first alliance to be an important drivers of director exit in other technology-intensive industries such as biopharma and

medical device industries. But, the results may be less generalizable to low technology sectors like the professional service industry.

6. Conclusion

Our study examined how SBIR funding, VC funding rounds, and first alliance formation relate to director exits in new ventures. We argue that SBIR funding, VC funding, and the initial alliance formation, which propel progress, can render previous resource dependencies on the current board redundant, thereby inducing director exits. Interviews with board members in the semiconductor industry validated our theoretical claims. Our results show that SBIR funding and subsequent VC funding rounds are associated with an increased likelihood of director exits, whereas first alliance formation does not significantly affect the likelihood of director exits. Our study highlights the interdependencies between ventures' life cycle and board's life cycle, underscoring the dynamic relationship between venture development and board changes.

CRedit authorship contribution statement

Vilma Chila: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Koen van den Oever:** Writing – review & editing, Writing – original draft, Project administration, Methodology, Conceptualization.

Data availability

Data will be made available on request.

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