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# **How Strategy Evolves In Entrepreneurial Nascent Technology Firms**

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## **Abstract**

Through a multi-year longitudinal field study of seven early stage energy and cleantech hardware firms, I explore how and why entrepreneurial firms developing novel technologies evolve their strategies and technology products. In the first paper, I examine when and how entrepreneurial firms decide to make strategic change and when that change constitutes a ‘pivot’. In the second, I examine how entrepreneurial technology firms in a dynamic and uncertain context learn from the process of choosing not to change their strategies. Lastly, I examine how these entrepreneurial firms manage the challenges of partnering with established firms to develop their novel technologies.

## **Executive Summary**

Entrepreneurship is about acting under uncertainty (McMullen and Shepherd 2006; Loasby 2007; Aldrich and Ruef Forthcoming). Entrepreneurial firms developing novel technology innovations are acting under even more uncertainty – or as one VC labelled a firm in my study: they are “startup squared”. Entrepreneurial technology firms are theorized as flexible, able to adapt to the uncertainties they face (Aldrich and Fiol 1994; Ambos and Birkinshaw 2010; Gavetti and Rivkin 2007); yet, while entrepreneurial firms have the potential to change, we understand little about when they will or what kinds of changes they will make. Too many strategy changes can heighten a firm’s instability in the eyes of external stakeholders, resource providers, and partners who value coherence and continuity. Too few strategy changes can spawn the same rigidities that lead established firms to fail in dynamic technological markets. To address this, my dissertation asks: How and why do entrepreneurial firms developing novel

technology evolve their strategies and technology products?

The core of this dissertation is a longitudinal field study of strategy and technology product evolution at seven early stage energy and cleantech hardware firms. During five and a half years of data collection, I conducted 112 interviews with founders, managers, engineering and other team members, board members, investors, and advisors. The bulk of data collection happened between 2012 and 2105, which was the period of study originally proposed to the participating firms. After that time, four of the seven firms agreed to continue in the study and data collection of those firms continued through 2018. I collected additional data through onsite observations as well as internal and external firm documents such as board presentations and business plans, stakeholder communications, press releases, and news stories. From this data, I was able to examine three key processes for entrepreneurial firms: changing, learning, and getting assistance. Each process is addressed in one of the three papers of this dissertation.

### ***What is a Pivot? Explaining When and How Entrepreneurial Firms Decide to Make Strategic Change and Pivot<sup>1</sup>***

Entrepreneurs and the popular press have embraced the word “pivot” as a strategic action that leverages a firm’s technology innovations, adapts them for new markets, and enables the firm to survive like a phoenix from the ashes. Yet, they use the term to describe nearly any strategic shift made by a firm, a person, or even a government, without consistency and with scant attention to the scholarly literature on strategic change. One explanation for this disconnect is that scholars of strategic change have primarily devoted their attention to how mature firms make strategic change to refresh or renew established strategies (Agarwal and Helfat 2009; Rajagopalan and Spreitzer 1997; Williams, Chen, and Agarwal 2017) with less attention to how

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<sup>1</sup> The paper in this chapter has been co-authored for publication with Siobhan O’Mahony.

entrepreneurial firms make changes to nascent strategies. Scholarship suggests that mature firms are motivated to make a strategic change when they perceive a performance gap between a firm's target and expected performance (Cyert and March 1963; Levitt and March 1988). However, entrepreneurial firms must decide whether to change their strategy without extensive firm history and must make sense of either thin or ambiguous data, especially when engaged in innovation. Entrepreneurial firms developing novel technology innovations know that their strategies include untested beliefs that could later prove to be inaccurate – they just do not know which ones would prove false. Under these conditions, establishing a gap between target and expected performance may be less relevant to explaining when and how entrepreneurial firms decide to change or pivot their strategies.

To address this gap, theories of strategic change need to explain how change decisions are made when firms are engaged in the process of developing new innovations – before comparable performance targets can be established. Entrepreneurs attempting to create novel technology frequently encounter new information that may trigger them to consider strategic change prior to the opportunity to receive feedback on the firm's performance. Thus, with the data from this longitudinal field study, we examined when and how decision makers decided to make strategic change. Through periodic interactions over a one to three year period, we interviewed and observed founders and team members regarding decisions that affected the fundamental definition and core processes of their firms to obtain the full set of strategic decisions at risk for change. This approach permitted equitable treatment of the decision to either select or reject strategic change.

From our analysis of 93 strategic decisions at risk for change, pooled from the seven firms we studied, we found that firms rarely chose to change their strategies. When confronted

with new information triggers that interrupted the firm's planned activities, either problems or opportunities, decision makers considered strategic change. Most often, decision makers retained their beliefs and rejected the option to make a strategic change. Only about one fifth of the time did decision makers choose to make a strategic change. We found that when decision makers' beliefs were expanded by a favorable opportunity trigger, they chose to make a strategic addition, adding a new element to the firms' strategy. When decision makers' beliefs were contradicted by an unfavorable problem trigger, they chose to make a strategic exit, discontinuing the affected product.

Drawing from our data and the literature on strategic change (Agarwal and Helfat 2009; Rajagopalan and Spreitzer 1997; Gioia et al. 1994; Van de Ven and Poole 1995), we defined a pivot as a change in a firm's strategy that reorients the firm's strategic direction through a reallocation or restructuring of activities, resources, and attention. While all but one firm made strategic changes, these changes did not, necessarily produce a pivot or full reorientation of the firm's strategy. When firms chose to change their strategy, they chose to change only one element in their strategy at a time, within the context of independently triggered decisions. They did not, in one decision, opt for a complete strategic reorientation through the reallocation or restructuring of activities, resources, and attention. Decision makers made strategy exits and additions as triggers emerged throughout the innovation process rather than as part of sequential, planned, linear decision making. When firms chose to make a strategic exit, they left a significant hole in their strategy, which was left unaddressed until decision makers faced a separate opportunity trigger and opted to make a strategic addition that could address this hole. When firms chose to make a strategic addition, they did not inherently redefine the direction of the firm with one decision. Firms that pivoted only did so through the gradual accumulation of

multiple strategic decisions over time, rather than reorient the firm's strategy with one decision at once. Thus, a pivot is not a single decision to change the firm from one strategy to another, but rather is the product of multiple independently triggered decisions that unfold over time. A firm pivots by reorienting the firm's strategic direction by exiting and adding elements to a strategy one at a time, eventually producing a cumulative reallocation or restructuring of activities, resources, and attention. This suggests that, for the entrepreneurial firms we studied, a change in strategic orientation was not the product of a single decision but rather a stream of accumulated decisions, punctuated by unanticipated triggers.

Revisiting each firm's case, this paper identifies a grounded theoretical model to explain the conditions under which entrepreneurial firms developing technology innovations pivot. In doing so, we contribute an explanation of strategic change that takes the entrepreneurial process of innovation into account.

### ***Keep Learning & Carry On: How Entrepreneurial Firms Learn While Choosing Not To Change Strategy***

Technology entrepreneurs are advised by investors, mentors, academics, and peers to learn as much as they can about their firm, market, technology, and financial options, so that they can change their strategies to improve their likelihood for success (Blank 2013; Murray and Tripsas 2004; Kerr, Nanda, and Rhodes-Kropf 2014; Ries 2011; McGrath and MacMillan 1995; Eisenmann, Ries, and Dillard 2013). Hero stories of successful entrepreneurial firms often paint a picture of a firm that succeeded because it changed its strategy, as if change is inherently the optimal decision. However, no one can truly know *ex ante* which path is the optimal choice for an entrepreneurial firm. While storytelling has emphasized the outcome of strategic change, what these entrepreneurial heroes did before that was more important: they learned.

Organizational learning is “the process of improving actions through better knowledge

and understanding” (Fiol and Lyles 1985: 803). Entrepreneurial technology firms act in a dynamic, uncertain context (Packard, Clark, and Klein 2017; McMullen and Shepherd 2006; Aldrich and Ruef Forthcoming). Under dynamic uncertainty, firms make decisions and choose their strategies based on a mix of accepted information and believed assumptions (Posen and Levinthal 2012). They continually learn so that their knowledge is more accurate and complete, which will improve their decision making. By learning, the entrepreneurial firm knows more about each potential strategy and is in a better position to assess which has greater odds for success.

Strategic change research focusing on established firms in stable contexts suggest that when, or if, a firm learns new information about its environment, the firm should change its strategy to fit that new knowledge (Rajagopalan and Spreitzer 1997; Agarwal and Helfat 2009; Zajac and Shortell 1989). However, as entrepreneurial technology firms act in a dynamic, uncertain context about which their knowledge includes a significant number of believed assumptions rather than factual information, existing theory may not directly apply. What they learn affects their knowledge about their environment through both their stock of accepted information and their believed assumptions. For these firms, the appropriate response to new learning might not be strategic change. In fact, while the hero stories may emphasize change, entrepreneurs are also praised for their passionate perseverance (Cardon et al. 2009) and are more likely to choose to not change their strategy than to change it . How do entrepreneurial technology firms in a dynamic, uncertain context learn during the process of choosing not to change their strategy?

Learning is how new knowledge and expertise is acquired, but how firms use what they learn during decision making could be unnoticeable to outsiders, particularly when they do not

make overt changes to their strategy. Through analysis of 80 strategic decisions for which the firm considered strategic change but chose not to change, I was able to examine and develop a three-phase framework of how firms learn during the decision to not change strategy. In each of the decisions examined, the firms acquired new knowledge and expertise, used that learning to appraise their current strategy, and then determined how to carry the firm forward without changing their strategy.

I found that firms moved through three phases: first, firms acquire new knowledge about the uncertainties they face; second, they use that learning to appraise their current strategy and activities; and third, they determine how best to carry the firm forward without changing their strategy. In learning, they improved the accuracy of their knowledge, added details, and found support or opposition to their believed assumptions. They then used that learning to clarify their goals, reassess tradeoffs, and refine their assumptions. From this, they decided between several ways to not change their strategy by abstaining from change, time shifting the current strategy, or adjusting to reinforce the current strategy. When an entrepreneurial firm carried on, they chose to do so as the culmination of learning and decision making.

### ***Navigating Misalignment: How Entrepreneurial Firms Manage the Challenges of Partnering with Established Firms***

Entrepreneurial firms developing new technology knowledge to create or disrupt markets face significant uncertainty (McMullen and Shepherd 2006; Aldrich and Ruef Forthcoming). One way for them to mitigate some of that uncertainty is to partner with an established firm (Alvarez and Barney 2001; Baum, Calabrese, and Silverman 2000; Eisenhardt and Schoonhoven 1996). Established firms who do not want to be left behind by discontinuous technological change but do not have either the capabilities or the willingness to take the risk on whether or not this innovation will bring that change can be motivated partners (Cozzolino and Rothaermel

2018). Yet, while both firms may believe in the future of this technology development, in the present, the entrepreneurial firm needs to manage the challenges of partnering under high uncertainty and from a position of low power.

Recent research that has taken the perspective of the entrepreneurial firms has begun to show that, while weaker, entrepreneurial technology firms are not powerless in their relationships with more established firms (Graebner and Eisenhardt 2004; Katila, Rosenberger, and Eisenhardt 2008; Santos and Eisenhardt 2009). As owners and developers of technology with the potential for creative destruction, these entrepreneurial firms do have some power. This paper further explores what power entrepreneurial firms developing new technology knowledge hold and how these firms manage power asymmetry when partnering with established firms.

Research on alliances has developed recommendations for how best to design a partnership to maximize the chances for success and minimize opportunism for the goals and partners involved (Gulati and Singh 1998; Panico 2017; Lerner and Merges 2003; Kale and Singh 2009). Firms collaborating on uncertain technology development need to both be committed to the goal, for which they should share equity in the result to insure alignment and deter opportunism. Also, they should contract clear roles and processes to coordinate their actions and continued alignment (Gulati and Singh 1998; Kale and Singh 2009). However in this context, where the greatest value asset the entrepreneurial firm has is its technology, their key concern will be to retain control and ownership of their technology and will focus on defending against misappropriation of their IP by their partner. At the same time, the established firm, who sees enough uncertainty in this technology to be unwilling to invest the resources to develop it internally, will be willing to commit only a small amount of resources and will be unwilling to waste resources on too many formal controls. High uncertainty combined with asymmetry

between partners can lead to non-optimized partnership structures (Aghion and Tirole 1994; Grossman and Hart 1986) as well as with tensions that corrode the interactions between the firms and challenge partnership success (Doz 1987).

How do these entrepreneurial firms manage the challenges of partnering with established firms to develop their new technology innovations? I address this research question with longitudinal field data on five entrepreneurial-established firm partnerships created to support new technology development at an entrepreneurial firm in the energy and cleantech sector. I found that when designing their partnerships, the firms structured an option value arrangement that addressed each firm's key concerns: misappropriation of IP for the entrepreneurial firm and risk for the established firm. The established firm provided financial resources in return for a future option value of first mover exclusivity with the technology but no equity, while the entrepreneurial firm retained full ownership and control of the technology development. During the partnership, when the established firm took actions that challenged their success, the entrepreneurial firm managed those challenges by using one or more of four strategies: 1) wait, 2) explore outside options, 3) resolve specific challenge content, and 4) address the established firm's motivations. The result of these managing strategies was either that the established firm realigned its commitment to the partnership or the entrepreneurial firm terminated the relationship.

By studying entrepreneurial-established firm partnerships through a longitudinal field study, this research extends our understanding of how partners act within the governance and control structures more often studied. Furthermore, by taking the perspective of the entrepreneurial firm, this study expands our understanding of the managing strategies that the less powerful partner can take, and to what avail. By examining the entrepreneurial firm not as

an R&D supplier to the established firm but as a partner, this research broadens our view into how entrepreneurial and established firms can work together toward technology change.

Entrepreneurship is idiosyncratic, so much about each firm and founding is unique. One consistent theme is uncertainty: entrepreneurial firms must build themselves, their strategies, and their products through uncertainty. For entrepreneurial firms developing novel innovations from new technology knowledge, this is amplified. Uncertainty is at the foundation of the biggest questions entrepreneurial technology firms face: Will the technology work? Do we have product-market fit? Do we have the right strategy? How can we get the resources to bring this to market and appropriate a profit from our efforts?

My goal with this dissertation was to examine how these ‘startup squared’ firms manage the uncertainties they face from a very early stage of their firm and their technology. I designed my longitudinal field study to maximize the opportunity to observe this by focusing on very early stage firms developing new technology knowledge that had previously only existed in a lab into a novel hardware innovation. In my interviews with team members at these firms, I focused on their strategic decisions to capture how they managed their strategy and technology development in the face of uncertainty and how they handled the realization when they had been wrong about some uncertainty. From this data, I was able to examine three key processes for entrepreneurial firms: changing, learning, and getting assistance.

*“Uncertainty is a quality to be cherished, therefore – if not for it, who would dare to undertake anything?” — Villiers de L'Isle-Adam*

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