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EXPERIMENTATION IN EARLY-STAGE VENTURES

Andrea Contigiani

Modern entrepreneurship places strong emphasis on experimentation. However, while its learning benefits are well-accepted, we have limited understanding of the potential costs of this strategic approach. Motivated by this gap, this dissertation investigates the role of experimentation in early-stage ventures. I argue that experimentation drives performance through three channels: learning, adaptation, and appropriability. I develop a model to explain this process, combining spatial differentiation and Bayesian learning. I test the theory in two settings: a university-based venture competition and the US software industry. This dissertation contributes to the literature on entrepreneurship, and offers practical implications for entrepreneurs, investors, and policy-makers.

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1 Purpose

Modern entrepreneurship emphasizes the role of experimentation. Practitioners largely agree that running rapid and frequent experiments is critical to successfully navigate the ambiguity of new venture creation. This perspective is promoted by a variety of practitioner-oriented approaches, such as Customer Discovery (Blank, 2005; Blank and Dorf, 2012; Blank, 2013), Discovery Driven Planning (McGrath and MacMillan, 2009), and the Lean Startup (Ries, 2011, 2017).

Many thought leaders in the entrepreneurial arena embrace this view. Reid Hoffman – early employee of Paypal and co-founder of LinkedIn – is one of the main voices in this camp. Hoffman and Casnocha (2012) synthesize this perspective by writing "Whatever the situation, actions, not plans, generate lessons that help you test your hypotheses against reality." However, some disagree. A famous case among the "dissidents", Peter Thiel – co-founder of Paypal and Palantir – argues against the value of experimentation, suggesting that understanding a business idea *ex ante* is more valuable than learning about it during the process. Thiel and Masters (2014) summarize this thought by writing: "Darwinism may be a fine theory in other contexts, but in startups, intelligent design works best."

This debate mirrors a traditional conversation in the strategic management literature. Mintzberg and Waters (1985) talks about two "schools of thought": deliberate strategy formation and emergent strategy formation. Ghemawat and Del Sol (1998) explores the contrast between commitment and flexibility. Only recently, in response to the popularity of the Lean Startup movement among

practitioners, the literature has discussed this dichotomy in the context of starting a business. Among the first to prompt this conversation, Eisenhardt and Bingham (2017) view the strategy process in entrepreneurial ventures as a combination of “doing” and “thinking”.

While the academic literature recently started to explore it, there has been little systematic analysis of experimentation in entrepreneurship. As a result, while its learning benefits are mostly undisputed, our understanding about its boundary conditions is still limited. As a first step in filling this gap, this dissertation investigates the role of experimentation in early-stage ventures, proposing a theoretical framework and testing its main components.

2 Related Literature

This dissertation draws primarily on three research traditions within the broader management literature: entrepreneurship, organizational learning, and product development. I briefly discuss each tradition highlighting the contributions that inspired this work.

Historically, the entrepreneurship has conceptualized new venture creation as a rational process of searching and exploiting an opportunity (Shane and Venkataraman, 2000) and emphasized the value of business planning (Delmar and Shane, 2003). Perhaps closest to the way we view entrepreneurship today, (Sarasvathy, 2001) introduces the notion of “effectuation”. Starting with Murray and Tripsas (2004), more recent work has emphasized the importance of experimentation in entrepreneurship (Kerr, Nanda, and Rhodes-Kropf, 2014; Manso, 2016). Currently, a growing literature is examining experimentation in the effort of offering broader conceptualizations of entrepreneurial strategy. Ott, Eisenhardt, and Bingham (2017) and Eisenhardt and Bingham (2017) discuss strategies based on “doing” and strategies based on “thinking”. Gans, Stern, and Wu (2019) offer a comprehensive taxonomy of entrepreneurial strategies and emphasize the contrast between the “control approach” and the “execution approach”.

The literature on organizational learning has investigated different types of learning processes. An important stream has analyzed the tradeoff between exploration and exploitation. In a

classic work, March (1991) emphasizes how organizational processes relying on exploitation more than on exploration may be effective in the short term but self-destructive in the long term. A long series of studies has refined and developed this view theoretically and empirically (Gupta, Smith, and Shalley, 2006). In a perspective closer to this dissertation, Gavetti and Levinthal (2000) examine forward-looking and backward-looking search processes, offering a perspective on advantages and disadvantages of experimental learning.

The literature on product development (Brown and Eisenhardt, 1995; Krishnan and Ulrich, 2001; Schilling and Hill, 2011) has investigated the process of acquiring and incorporating information early in the development process. Barkan and Iansiti (1993) study the practice of “rapid prototyping”. MacCormack, Verganti, and Iansiti (2001) discuss the importance of flexible product development in settings of rapid technological change. Thomke (2001) and Thomke (2008) conceptualize different modes of experimentation in the product development process.

3 Methodology

This dissertation is largely guided by qualitative work. I conducted a series of semistructured interviews to guide the investigation and then validate the findings. The first wave, between Summer 2016 and Summer 2017, involved 24 interviews, seeking to explore the tensions that arise in the context of experimentation. The second wave, in Spring 2018, included 12 interviews, seeking to validate the findings that emerged in the empirical work. I personally executed all the interviews, either on the phone or in person. All interviewees were cofounders or top managers of the early-stage ventures in software, hardware, or biotechnology. Also for qualitative purposes, I ran a survey to the ventures in the sample used in Chapter 5. The survey collected information about ventures’ strategy and performance, seeking to infer the rationale for their choices around experimentation. The survey was approved by the University of Pennsylvania’s Institutional Review Board in June 2018. It had a 6% response rate (67 responses).

The theoretical work, combining the existing literature and the insights from the qualitative

data, uses both a verbal approach and a formal approach. The verbal theorizing seeks to offer a broader and more comprehensive conceptualization of experimentation. The formal modelling helps clarify the key ideas and obtain testable implications.

The empirical work uses microeconometrics techniques, including panel regressions, difference-in-differences regressions, and statistical matching. Much of the data in Chapters 4 and 5 were collected using the standard approach of content analysis (Krippendorff, 2013).

4 Overview

The dissertation contains four chapters beyond Introduction and Conclusion, each chapter being based on a research article. Chapter 2 offers a conceptual framework of experimentation. Chapter 3 formalizes its key components into a stylized model. Chapters 4 and 5 test the key insights of the theoretical work.

Chapter 2 develops a conceptual framework defining the construct and examining the factors driving its impact. Combining literature and practice, I define experimentation as disclosing an incomplete product to obtain market feedback. This definition is essentially the notion of “minimum viable product” (MVP) used by practitioners. I argue that learning, adaptation, and appropriability are the primary factors driving its effect on value creation and value capture.

Chapter 3 constructs a stylized model combining elements of spatial differentiation and Bayesian learning. I imagine a venture with an initial idea facing the choice between direct entry and experimental entry. Besides the upfront cost of getting a market signal, experimental entry implies adaptation costs and expropriation risks. The model formalizes the notion that experimentation is optimal when market uncertainty and signal precision are high. Furthermore, it produces theoretical implications about the role of the other factors and their interactions.

Chapter 4 explores the cost of adaptation. A central driver of adaptation capability is organizational structure. I argue that experimentation requires low formal structure, while planning is best combined with high formal structure. I test this argument on a proprietary dataset of venture

pitches from a university-based venture competition. If evaluators are sensitive to this complementarity, teams combining experimentation and low formal structure or planning and high formal structure should receive more positive evaluations than those displaying alternative combinations. The analysis reveals robust correlations consistent with the argument.

Chapter 5 examines the role of appropriability. Ventures are able to capture value if they can protect their intellectual property (IP). The primary way to protect IP is formal IP (FIP), the legal tools such as patents, copyrights, and trademarks. Alternatively, they can use informal IP (IIP), strategic approaches such as complexity, lead time, and networks. I argue that IIP is relatively weak prior to product launch. Hence, when formal intellectual property is weak, the learning benefits of experimentation may be offset by the expropriation risks. I test this argument on a hand-collected dataset of 1200+ US-based software ventures, exploiting the 'software release life cycle terminology' to measure experimentation and the US Supreme Court landmark ruling 'Alice Corp v CLS Bank International' (Alice) as a negative shock to patent protection. Following the ruling, the affected ventures are less likely to engage in experimentation. However, this effect is weaker for ventures with strong incentive to learn - particularly, ventures building artificial intelligence (AI) software.

5 Contributions to Research

This dissertation contributes to four streams of work in the academic literature in strategic management: entrepreneurship, organizational learning, structure, and appropriability.

Early-stage ventures choose between two alternative routes: an adaptive approach and a predictive approach. The adaptive approach involves obtaining information through early contact with the market and iterating towards the final product. The predictive approach relies on information obtained through internal analysis and postpones interaction with the market to a later stage of the product development process. A recent stream of work in entrepreneurial strategy (Eisenhardt and Bingham, 2017; Gans et al., 2019) explores this dichotomy. This dissertation offers a novel frame-

work to conceptualize experimentation and its key tradeoffs, contributing to this conversation.

The literature on organizational learning has investigated different types of learning processes. While this work has highlighted the behavioral limitations of learning (Levinthal and March, 1993), there has been little systematic examination of the “strategic costs of learning”, especially in early-stage ventures. This dissertation focuses on one type of learning – purposeful, experiential learning (Murray and Tripsas, 2004) – and highlights how this approach implies costs related to adaptation and appropriability.

There is no clear view on the role of formal structure in entrepreneurial venture. A traditional view suggests that early-stage firms should have a flexible structure (Alvarez and Barney, 2005). A more recent perspective emphasizes the advantages of formalized structure in environments where speed matters (Sine, Mitsuhashi, and Kirsch, 2006). The evidence found in Chapter 4 suggests that structure is complementary to strategy. If a venture relies on an experimentation-driven strategy, a high degree of formal structure may not be an effective approach.

Finally, this work contributes to the literature on appropriability. The analysis of Chapter 5 suggests that experimentation may be one channel reducing appropriability. Furthermore, by focusing on the software industry, it contributes to the understanding of appropriability in digital environments (Teece, 2018; Miric, Boudreau, and Bo Jeppesen, 2018).

6 Implications for Practice

Beyond contributing to the academic literature, this dissertation seeks to generate relevant insights for practice (Toffel, 2016). The work has potential implications for three main categories of practitioners: entrepreneurs, investors, and policy makers.

First, these findings may be relevant to founders and managers of entrepreneurial ventures. The theoretical analysis and the empirical evidence suggest that the use of experimentation can be costly. Therefore, when choosing their commercialization strategy, entrepreneurs should take this factor into account. The one-size-fits-all approaches based on experimentation – such as the Lean

Startup – may be counter productive, because the use of experimentation has boundary conditions.

Second, this study should be informative for investors. Currently many investors appear to value experimentation highly when evaluating ventures. While not clearly estimating the causal impact of experimentation, the analysis suggests that, under some conditions, experimentation does not improve the chance of survival and growth. The implication for investors is therefore to carefully consider the amount and type of experimentation the target venture is engaging in prior to making investment decisions, paying particular attention to its consequences in terms of appropriability.

Finally, this work may have implications for public policy. If experimentation is socially desirable, policy-makers can influence the environmental factors that hinder experimentation. In particular, the evidence found here shows that a weaker FIP environment – as established by events such as Alice – leads ventures to do less experimentation. If experimentation is optimal in markets with high uncertainty, this may limit the survival of ventures that are building radically innovative products. In the longer run, this may also lead fewer entrepreneurs to build radically innovative products. This dynamic may have, beyond private costs, substantial social costs. While there are other disadvantages of strong IP protection (Boldrin and Levine, 2013), the design of IP should take into account its impact on experimentation in early-stage ventures.

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