



## TECHNOLOGY ENTREPRENEURSHIP

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### INTRODUCTION

This special issue explores research questions at the nexus of entrepreneurship and technology, a relatively unexplored domain that offers rich opportunities for scholarly inquiry. Our intent is to advance understanding of critical theoretical and managerial issues at this nexus. The genesis for the issue is the West Coast Research Symposium on Technology Entrepreneurship (WCRS), an annual gathering that is funded by the Kauffman Foundation and five centers of entrepreneurship and innovation at leading universities along the West Coast of the United States.

The United States West Coast has been an extraordinary breeding ground for ventures that marry cutting-edge technology with nascent markets and novel products. Thus, it has been the birthplace of venerable technology-based companies like Apple,

Microsoft, Amgen, Cisco, Amazon, and Google, as well as a host of promising new ones like Tesla, Zynga, Amyris, and Twitter, and the relocation destination for still others like Facebook. West Coast research universities have been catalysts for many of these technology-based ventures. Equally important, these universities are home to research scholars who have a ‘front row seat’ on the entrepreneurial ferment of their region and actively study it.

In 2001, a group of like-minded technology entrepreneurship researchers housed in universities located in Washington, Oregon, and California established the West Coast Research Symposium. The initial impetus was to bring together scholars from these geographically dispersed universities to form a critical mass of technology-entrepreneurship scholars. Congregating annually to present papers, discuss research methods, mentor doctoral students, and create an intellectual ‘vibe’ around technology-entrepreneurship, the WCRS is a self-organizing and self-funded social cluster with no formal interuniversity infrastructure. The WCRS is now 10 years old. Over this past decade, participants have expanded to include not only faculty and doctoral students from the sponsoring universities, but also

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colleagues from other West Coast universities and, indeed, from the rest of the country and world.<sup>1</sup> The symposium focuses on discussion and debate of evolving trends in *technology entrepreneurship research*.

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More than two decades ago, Baumol (1989: 66) offered the provocative assertion that the study of business without the study of entrepreneurship is akin to the study of Shakespeare in which ‘the Prince of Denmark has been expunged from the discussion of Hamlet.’ Over the past decade, researchers have paid increasing attention to the entrepreneurship phenomenon or what can be simply defined as the study of the emergence of new firms—e.g., who starts them, when, where, and why they are started, and how they evolve (or not) over time. Central to the study of entrepreneurship is its focus on the creation and discovery of novel opportunities. We distinguish technology entrepreneurship from mainstream entrepreneurship research by its focus on how these opportunities are fostered through innovations in science and engineering. As such, technology entrepreneurship is critically concerned with technical innovations and the nascent markets and novel products they often enable. Research in technology entrepreneurship draws from two established but related fields, entrepreneurship and technology-based innovation, and research in the area often blends theories from multiple perspectives to both clarify the focal entrepreneurial phenomena and advance the underlying theories with insights from the very dynamic context of technology entrepreneurship.

In our view, technology entrepreneurship exists when developments in science or engineering constitute a core element of the opportunity that enables the emergence of a venture, market, cluster, or industry. These technical developments may lead to business models that rely on network effects, first mover advantages, technical standards, and declining costs. They may generate substantial market disruption. The value-creating features of technical innovations can be lodged in a new product, activity

system, distribution channel, customer segment, or simply intellectual property. Technology entrepreneurship constitutes an important lens through which to understand organizational and economic theories because its dynamic character adds life to equilibrium-based theories. It is also an important focus of research in its own right because it is an influential source of scalable economic growth and has demonstrated dramatic improvements in social welfare, ecological sustainability, and wealth creation.

## INTRODUCTION TO ARTICLES IN VOLUME 1 OF THE SPECIAL ISSUE

For the special issue, scholars from entrepreneurship, strategy, innovation, economics, history, sociology, and technology studies contributed papers. We encouraged multilevel studies with: (1) a variety of methodologies, from statistical and mathematical modeling to qualitative techniques; (2) traditional as well as emerging theoretical approaches to technology entrepreneurship; and (3) a focus on the creation or transformation of technology-based industries or on venture formation, growth, and survival.

Our call for papers attracted many high-quality articles, leading the journal editors to devote two successive *SEJ* issues to technology entrepreneurship. The five articles in this first special issue of *SEJ* reflect a rich and diverse set of theoretical and empirical approaches and take the firm as the primary unit of analysis. Although all five articles examine research questions that lie at the heart of technology entrepreneurship, they invoke different theoretical arguments, examine distinctive empirical contexts, and utilize novel data collection and analytic methodologies. For example, while Katila, Chen, and Piezunka (2012, this issue) integrate the evolutionary theory and competitive dynamics literatures to develop their theoretical arguments, Bingham and Haleblian (2012, this issue) delve into the organizational and group learning literatures to ground their multiple case inductive study, Rindova *et al.*, (2012, this issue) combine arguments from network theory and the resource-based view of the firm to examine how new firms access and combine resources to grow, and Gaba and Bhattacharya (2012, this issue) ground their hypotheses in the behavioral theory of the firm. The empirical contexts include some of the most vibrant and influential technology-based industries such as Internet search (Rindova *et al.*, 2012, this issue), information technology (Bingham and

<sup>1</sup>The five sponsoring schools are the engineering school at Stanford University, and the business schools at the University of Washington, the University of Oregon, the University of Southern California, and the University of California, Irvine.

Haleblian, 2012, this issue), and biotechnology (Powell and Sandholtz, 2012, this issue). The empirical research methods span state-of-the-art quantitative and qualitative approaches including multi-case inductive studies (Bingham and Haleblan, 2012, this issue; Rindova *et al.*, 2012, this issue), comparative cases using hierarchical clustering (Powell and Sandholtz, 2012, this issue), experiential simulation (Katila *et al.*, 2012, this issue), and longitudinal, quantitative analysis (Gaba and Bhattacharya, 2012, this issue).

While all five articles in this volume invoke a firm-level unit of analysis, each focuses on different stages in the life of a technology venture, as well as different strategic issues and firm-level outcomes. We start with Powell and Sandholtz's (2012, this issue) understanding of the emergence of new organizational forms, in particular the emergence of commercial vs. scientific prototypes among dedicated biotechnology firms. Next, we turn to the consequences of strategic choices made by new firms. Katila *et al.* (2012, this issue), examine the strategic choices to compete in new or established markets, as well as the most effective R&D strategies. They compare the best strategies for entrepreneurial relative to more established technology ventures. Rindova *et al.* (2012, this issue) complement this work on strategic decisions by examining alliance strategies over the first decade of a firm's life. They find that high-performing entrepreneurial ventures use alliances to access resources, recombine them, and grow. Bingham and Haleblan (2012, this issue) take us inside entrepreneurial strategic decisions to examine how entrepreneurs learn heuristics that form the 'strategy as simple rules' for processes like internationalization, product development, and alliance formation. Finally, Gaba and Bhattacharya (2012, this issue) take the perspective of large organizations deciding to create or abandon corporate venture capital units in their efforts to create value through technology ventures. These five articles take us from emergence to established organizations, offering insights on key strategic decisions of technology ventures and the consequences of those decisions.

A comparison of the research questions, empirical approaches, empirical context, theoretical base, and major findings from the five articles included in this volume of the special issue are presented in Table 1. We follow with a brief summary of each of the five articles in the order that they appear in the special issue.

Powell and Sandholtz (2012, this issue) study the emergence of new organizational forms by focusing on the founding models of the entrepreneurs who started the first generation of 26 dedicated biotechnology firms in the United States. Working from case histories, they use hierarchical cluster analysis to reveal four distinct founding architectures that represent two underlying models—a commercially oriented prototype and a science-oriented prototype. By offering an analytic approach and a methodological technique for studying organizational forms, this article should inspire studies shedding fresh light on how entrepreneurs go about creating new business models and erecting new organizational forms.

Katila *et al.* (2012, this issue) use an experiential simulation and interviews with participants to identify the causal effects of different competitive actions on firm-level market share in successive rounds of competition. They find that, in established markets, entrepreneurs gain market share when they adopt exploitative R&D moves and exploratory market moves. However, in newer markets, entrepreneurial firms succeed by being more proactive and risk taking—both exploratory R&D and exploratory market moves work in new markets. In sum, while entrepreneurial firms face an uphill battle in established markets, they are in greater control of their destiny in new markets.

Employing a multi-case inductive study, Rindova *et al.* (2012, this issue) examine how new firms leverage their networks to enact distinctive value-creation strategies. Using network theory and the resource-based conceptions of the firm, they illustrate how such distinct value-creation logics contribute to generating and sustaining different growth patterns and performance. Their insightful observations should extend the current thinking within entrepreneurship research on the strategic use of entrepreneurial networks and the resource-based concepts of the firm regarding external and internal sources of heterogeneity in firm performance.

Bingham and Haleblan (2012, this issue) examine how convergent or divergent attributions (as opposed to more traditionally examined internal or external attributions) result in heuristics that allow firms to learn from negative outcomes. When the attributions converge, firm members in their sample were able to consolidate their learning into heuristics, and when attributions diverged, firm members failed to form heuristics. Additionally, they observed that a firm that engaged in formal communication—communications that were

Table 1. A brief summary of the five articles in this volume

Authors	Research question	Empirical approach	Empirical context	Theoretical base	Key findings
<b>Powell and Sandholtz (2012)</b>	Where and how do new models of organizing science- and technology-based ventures originate?	Multimethod comparative case study employing hierarchical cluster analysis.	26 U.S. biotech ventures founded from 1972 to 1981.	New organizational forms arise from two mechanisms: reconfiguration and transposition.	The authors argue that when entrepreneurs launch new businesses in familiar domains, they usually reconfigure familiar organizational attributes and elements to construct recognizable forms. When they venture into unfamiliar domains, however, entrepreneurs often transpose the elements they know to construct new-to-the-world organizational forms.
<b>Katila, Chen, and Piezunka (2012)</b>	What competitive moves are high performing for entrepreneurial firms in new vs. established markets?	Experiential simulation, Markstrat 3, Two-market, five-firm simulation scenario. Data collected over eight academic quarters spanning 1999 to 2006.	Two hypothetical products markets; one established and one new. Thirty-two industries and 160 firms.	Evolutionary theory; competitive dynamics.	Successful entrepreneurs use competitive moves that vary depending on whether a market is new or established. In new markets, entrepreneurial firms succeed by moving in and out of opportunities ahead of large (established) firms. In established markets, they succeed by adopting relatively invisible (below the radar) competitive moves. In both markets, competitive moves that emphasize the skillful search for new opportunities matter more for entrepreneurial than established firms.
<b>Rindova, Yeow, Martins, and Faraj (2012)</b>	How do new firms use partnering to access novel resources and how do they combine these resources into new products to enter new markets?	Multiple case inductive study.	Internet search market.	Interorganizational relationship in network theory and resource-based view of the firm.	The authors show that the high-performing new firms they studied configure their alliance portfolio to reflect and support distinct value-creation logics. These differing logics then helped them generate and sustain different patterns of growth and performance.
<b>Bingham and Halebian (2012)</b>	How do entrepreneurial firms learn heuristics from negative outcomes?	Multiple case inductive study.	Entrepreneurial firms from the information technology industry located in Singapore, the United States, and Finland.	Organizational learning, attributions, and learning in groups literatures.	In contrast to prior literature that suggests learning and the development of heuristics is strongly affected by whether attributions for negative outcomes are internal or external, these authors show how entrepreneurial firms learn heuristics is more dependent on whether attributions are convergent or divergent across hierarchical levels. Also, they found that formal communication patterns within a firm influenced the convergence and divergence of such attributions.
<b>Gaba and Bhattacharya (2012)</b>	Under what conditions do organizational risks associated with CVC units become more or less acceptable to decision makers in a context characterized by strong institutional pressures to expand and withdraw from CVC activity?	Large sample study using longitudinal data from 1992 to 2003.	Sample of IT firms drawn from Forbes 500 list.	Behavioral theory of the firm.	The authors find that an IT firm is more likely to adopt, and less likely to terminate, a CVC unit when its innovation performance matches its aspiration levels. Interestingly, they found that innovation performance relative to social aspiration (rather than historical performance) is a better predictor of CVC adoption and termination.

rhythmic, multi-hierarchical, and occurring in a fixed amount of time—experienced a greater convergence in negative attributions which, in turn, influenced heuristics formation.

Last, but not the least, Gaba and Bhattacharya (2012, this issue), drawing on the behavioral theory of the firm, posit that a firm's propensity to adopt or terminate corporate venture capital (CVC) units is a function of its *performance aspirations* for innovation-related goals, and they test their prediction using a large longitudinal sample of Forbes 500 firms from the IT sector. They found that a firm is more likely to adopt and less likely to terminate a CVC unit when its innovation performance matches its aspiration levels. Their study is the first to employ the behavioral theory perspective to investigate a firm's decision to both adopt *and* terminate CVC units. By doing so, they offer a more comprehensive explanation regarding a firm's motivation to externalize R&D through CVC activity.

The five articles highlighted in this volume provide valuable insights into firm-level processes and outcomes. The five articles in the second volume of the special issue complement the firm-level unit of analysis that dominated the studies presented here with an individual or team-level analysis. We hope these articles inspire you to join the ongoing research conversation on technology entrepreneurship and help maintain the intellectual excitement and energy around the domain.

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