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Creating New Industries: The Generative Role of Heterogenous Actors

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Abstract: How nascent industries evolve and contribute to economic growth and societal advancement has long been a central topic for research and practice. In this review, we focus on the generative role of the heterogenous actors who contribute to industry creation. Integrating robust literature streams spanning management, economics, marketing, and sociology, we highlight how industries emerge from the purposeful action and interplay of firm and non-firm actors. Our synthesis provides an overarching framework wherein we situate individual research articles based on their examination of actor attributes (endowments, identities, and inducements) and actions (when to engage; capability development and reconfiguration; modes of interactions). The engagement and attributes of heterogeneous actors and feedback loops across various actions are critical for outcomes at both industry and actor levels. Our article also reveals opportunities for future research: these include a deeper focus on actor attributes to address the imbalance in studies of firm and non-firm actors, expand attention to a broader set of markets, and examine emerging contexts.

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INTRODUCTION

Economic growth and societal advancement rely on the uncertain undertaking of new industry creation, which requires purposeful action by heterogeneous actors. We review the multi-faceted scholarship about the endogenous and generative role of actors in creating industries. We undertake a systematic integration and offer a framework that synthesizes insights from the growing body of research that addresses these questions: What is the role of heterogeneous actors in creating new industries? How do these actors contribute to industry creation, and how do their attributes shape actions they undertake, for outcomes at organizational, industry, and societal levels?

Scholars have shown that an industry progresses via incubation (Moeen & Agarwal, 2017), growth with technical design and customer experimentation (Agarwal & Bayus, 2002; Anderson & Tushman, 1990; Golder & Tellis, 1997), through shakeout and decline stages (Gort & Klepper, 1982; Lieberman, 1990). Yet, classic studies are often silent about the strategic actions that shape industry-level trends. Early studies often presumed that industry trends predate strategy, so strategy was about an ex-post accounting for environmental conditions (McGahan & Porter, 1997). Our review switches the spotlight to recent studies about the role of heterogeneous actors in resolving uncertainties and creating industries (Moeen, Agarwal & Shah, 2020; Pontikes & Rindova, 2020).

By drawing on research using disparate lenses and contexts, our conceptual framework links actors, their attributes, their choices, and the resultant outcomes. We consider a broad set of firms and non-firm actors such as universities, user communities, industry associations, non-profit organizations, regulators, media, and individuals. We incorporate within and across heterogeneity in actors' attributes in terms of endowments, identities, and inducements, the combination of which directs whether, when, and how they engage in new industry creation. The system-wide linkages across actors highlight how heterogeneity in actor attributes shapes their purposeful action to resolve uncertainties that pervade nascent industries and prevent their emergence. These actions encompass when to engage with the industry, how to develop and reconfigure capabilities, and what modes of product market, non-market, and intermediation interactions to pursue. Taken together, these actions are critical to shaping whether, when, and with what structural features an industry emerges, enabling

buyers and sellers to enter relevant markets and sustain the industry's growth and impact.

The contributions of this review are as follows. First, we systematically distill insights from a wide and multi-disciplinary body of research to bridge and create a link between actor-level and industry-level phenomena and studies. Besides the in-depth description of studies that have each shed light on one element of the framework, we link insights about each element and propose a dynamic process of industry creation. Second, in contrast to extant models of interactions between firms and customers in product markets, our framework reveals the expanded focus on actors and actions. We account for actors who engage in complementary markets to address gaps in knowledge and capability portfolios. Further, the role of non-firm actors and non-market interactions emerges as pivotal for shaping the industry. Third, our framework relies on empirical studies about numerous contexts in various historical periods. This integration highlights how single-industry studies have cumulatively built a body of empirical research for broader generalizable inference. Finally, we propose areas that have received comparatively little attention and offer fruitful avenues for future research.

KEY DEFINITIONS, CONCEPTS, AND MOTIVATION FOR REVIEW

Definitions of Foundational Constructs

Historically, the term 'industry' has been used to categorize businesses, and to organize and analyze economic data, as in the Standard Industrial Classification Code (SIC) developed in the late 1930s by the U.S. Bureau of Budget and later, the Bureau of the Census. When replacing the SIC codes with the modern day NAICS (North American Industry Classification System), the Economic Classification Policy Committee (1993) noted two conceptual criteria when determining industry boundaries: supply-based similarity in production processes and technologies, and demand-based similarity in products and services according to use and distribution. Together, the criteria create the problem-solution nexus definition of an industry as a group of firms that use similar technologies to create products or services that cater to similar needs of customers.

Relatedly and based on scholarly work in technology management, a 'technology' is defined as a set of components utilizing scientific base principles that are combined within an architecture to serve a focal purpose and use (Arthur, 2009). These technologies are embodied within production processes

used by firms within vertical or horizontal value chains that constitute an ‘ecosystem,’ defined as a group of interacting actors that contribute to the value proposition of a product or service (Adner, 2017; Jacobides, Cennamo & Gawer, 2018). Further, based on scholarly work in sociology, a ‘category’ is defined as the social structure among producers and stakeholders for a shared meaning and interpretation of a product or service (Pontikes, 2018).

These interactions chiefly occur within markets, which historically were characterized as “a time and a place” (e.g., the village square on a Saturday afternoon) wherein two or more parties meet to engage in an economic transaction that constitutes buying or selling a good or a service. Building on this, the Merriam-Webster dictionary defines a ‘market’ as a platform or context for economic exchange wherein “buyers and sellers come together, and the forces of supply and demand affect prices.” Markets are further distinguished based on what is being transacted, as in markets for products or services, resources, technology, or corporate control. Interactions also occur in non-market settings, defined as social, political, and legal arrangements wherein firm and non-firm actors such as the government, interest groups, activists and the general public engage with each other (Baron, 1995)¹.

The Nascent State of Industries

The above definitions describe established industries, which presuppose their emergence along with their technologies, ecosystems, and categories. Such emergence may be triggered by scientific discoveries or recognition of unmet needs that unlock the prospect of a new industry resulting from a novel problem-solution nexus relative to current offerings (Agarwal, Moeen & Shah, 2017). Scientific discoveries create novel base principles that can be utilized for creating technological systems and components to address a focal purpose (Arthur, 2009; Dosi, 1982; Rosenberg, 1992). Alternatively, unmet needs at personal, organizational, or societal levels can also trigger search for novel solutions (Baldwin, Heinerth & von Hippel, 2006; Mowery, 2012; Tripsas, 2008).

While the above triggers portend many to-be-industries, pervasive uncertainties hinder their emergence and establishment of stable economic exchange of products and services (Rosenberg,

¹ The term “non-market interactions” is broader than the concept of “non-market strategy,” which pertains to the subset of *firms* as actors and their strategic behavior to effectively manage the non-market environment (e.g., lobbying, creating barriers to entry) to shape the markets within which they operate and for competitive advantage.

1982). Integrating across multiple lenses and studies, Moeen et al. (2020) define a nascent industry as a state characterized by multi-dimensional interdependent uncertainties, the resolution of which is necessary for industry emergence. ‘Technological uncertainty,’ defined as partial knowledge about technical components and their linkages, hinders the acceptable design of products and technological systems. ‘Demand uncertainty,’ defined as partial knowledge about customers’ functional and price preferences, hinders the targeted fulfillment of their heterogeneous needs. ‘Ecosystem uncertainty,’ defined as partial knowledge about the nature and configuration of interdependent value chain activities, hinders the delivery of core, complement, and intermediate products. ‘Institutional uncertainty,’ defined as partial knowledge about social and legal institutions that structure the exchange of products, hinders the legitimacy and legality of an industry.

Motivation of Review and Guiding Questions

Alleviating uncertainties is critical for an industry to transition out of the nascent state. Such a transition is neither certain nor exogenous, rather it requires concerted efforts at knowledge development by heterogeneous actors within an endogenous process that may well span decades before resulting, if ever, in fruition. Given the consequential role of industry emergence for economy and society levels of analysis, rich literature streams have employed disparate conceptual lenses (see literature reviews by Agarwal and Tripsas (2008) that synthesizes papers using economics, technology management, organizational theory perspectives; by Durand and Khaire (2017) and Grodal, Krabbe, and Chang (2023) that focus on sociology and technology perspectives; by Forbes and Kirsch (2011) that appraises methodological approaches). Much of this work has centered on aggregate processes that determine industry or technology evolution (e.g., forces of variation, selection, and retention), but in doing so, abstracted away from underlying within-and across heterogeneity of actors, their attributes and actions that may lead to emergence. Thus, we lack a systematic integration and an encompassing framework that distill insights from the rapidly growing body of conceptual and empirical knowledge that addresses the following questions: What is the role of heterogeneous actors in creating and shaping new industries? How do these actors contribute to industry creation and how do their attributes shape actions they undertake, for outcomes at organizational, industry, and societal levels?

REVIEW METHODOLOGY

Methods for Identifying Articles for Review

Our premise for selecting and curating studies was to discover and assess actors who contribute to the process of industry emergence as an outcome of the search process, rather than to ex-ante pre-define or limit our search to the types of actors we expect to be engaged in this process, due to assumptions and insights in the literature and our own knowledge. We used “industry,” “technology,” “market,” “category,” and “institutional fields” as principal keywords and appended the premodifiers “nascent” and “emerging” to form our search phrases.² We also combined each phrase with “formation,” “emergence,” “inception,” “incubation,” “evolution,” “growth,” “stage,” and “life cycle.” We used “product life cycle” as a stand-alone search phrase.

Given the breadth of disciplinary lenses included in our review, we extracted publication outlets from Scopus, an abstract and citation database with broad disciplinary and geographic coverage, which extends beyond the Financial Times 50 list or the UT Dallas ranking list. To select publication outlets, we adhered to two criteria. First, we started from the Scopus categories for the subject areas of social sciences, business, management, accounting, economics, econometrics, and finance. Second, the journals had at least three publications that linked to our search phrases. This selection resulted in 591 publication outlets. Two of the authors independently scrutinized these outlets to assess the relevance of their aim and scope, frequency and impact of publications in our topic of interest, their global standing, and their publisher’s affiliation. They then compared and discussed their selection, until agreement on inclusion was reached. This structured, multi-stage, and iterative process led to a refined list of 93 publication outlets spanning a range of disciplines.

We combined a quantitative search-based approach with the qualitative judgment-based expertise of the co-author team to curate the sample of research articles for our review. In the search-based approach, we extracted articles and book chapters that refer to any of our selected search phrases in their title, abstract, or keywords, and appear in one of the outlets on our refined list. The search,

² We excluded the phrase “emerging market,” as this term is used widely in international business and global strategy and often appears in conjunction with other search phrases in the context of nascent industries

conducted across the entire timespan of content stored in Scopus, yielded a total of 1,695 articles. Two of the authors independently assessed this corpus of articles and applied these exclusion criteria: (i) articles about the regional emergence of an existing industry, (ii) articles about industry evolution at later stages, (iii) articles equating emergence with high-velocity markets, (iv) articles without an adequately specific industry stage and context. This screening separated core articles from those with a peripheral relevance, which we dropped. In the judgment-based approach, we relied on the expertise of the co-author team to identify relevant articles. To this end, we assessed backward and forward citations of the above set of articles and included articles with central relevance to our literature. Our literature review is based on a final list of 411 articles.

Description of the Review Sample

We briefly summarize salient features of the review sample. The articles included in our review reveal the evolution of the literature across different disciplinary lenses, starting with seminal studies in the later part of the 20th century and a strong uptick in the last 30 years. Early studies stayed within disciplinary domains, but later ones, particularly within strategy and entrepreneurship, reflect significant cross-disciplinary integration. Among the empirical articles (93% of review sample), there is rich diversity in data sources (e.g., quantitative and qualitative, primary and secondary sources) and modes of inference (deductive, inductive, abductive). Almost all studies focus on a single country (U.S. and developed countries). Representing the historical context of technologies, industries, and economies, the review sample reveals an early focus on manufacturing relative to service industries, and a recent focus on high-technology and digital industries. Finally, and as reflected in the themes in subsequent sections, the review sample reveals an initial focus on industry and technology levels and an examination of firms at the actor level. Later studies show more heterogeneity across levels of analysis, including more attention to non-firm actors and individuals.

Analytical Synthesis Process for Emergent Themes and Framework

When engaging in the review, we distilled key ideas, compared within and across articles to identify distinctions and similarities, and crystallized themes within an iterative process. Of note, few papers in the review explicitly identify or follow the resultant integrative framework. However, the

articles individually provide important pieces, and collectively, they enable a holistic understanding of who engages in creating industries, why they do so, how, and for what outcomes. Moreover, when creating the framework, we placed primacy on the distinctiveness of the concepts, rather than the salience and frequency accorded to them in terms of scholarly studies that focused on these aspects. Thus, the themes presented below and integrated within the framework are the outcomes of our own sensemaking and iterative steps of assessing, theorizing, and filling gaps in the conceptual framing by revisiting and interacting with the articles in the review sample in light of the emergent framework.

Several themes arise from this analytical synthesis. Theme 1 “Intellectual Foundations” situates the evolution and premise of conceptual lenses on industry emergence. Theme 2 “Actors and their Attributes” coalesces studies that have identified critical actors. Theme 3 illustrate actors’ rationale regarding “When to Engage in a Nascent Industry.” Themes 4 and 5 describe the actions that advance the nascent industry, including “Capability Portfolio Development and Reconfiguration” and “Modes of Product Market and Non-market Interactions.” Theme 6 outlines “Outcomes” resulting from actors’ engagement in this process. By synthesizing these themes, we offer an integrative conceptual framework on the generative role of heterogeneous actors.

INTELLECTUAL FOUNDATIONS

We begin with situating our review within foundational studies that set the stage for current perspectives about the generative role of actors in industry creation. The intellectual foundations showcase aggregate industry-level evolutionary trends, and also draw upon disciplinary lenses in their examination of industry evolution in general, and industry creation and emergence in particular.

Stylized Evolutionary Trends of Industries

Sampling on industries that have successfully emerged, scholars have examined the temporal bracketing of industry stages from incubation through maturity. The incubation stage of a potential industry begins with scientific inventions or recognition of unmet needs (Agarwal et al., 2017). Studies documenting activities during incubation stage report the number of investing firms can range from seven to ten times more than subsequent commercializing firms, showing extensive experimentation during this stage (Kim, Agarwal & Goldfarb, 2024; Moeen & Agarwal, 2017). If and when a product

gains a customer's purchase, the first commercialization marks the industry inception.

Often, commercialization is undertaken by a single or few firms who operate in a quasi-monopoly setting during the pre-firm takeoff stage. Early products at this stage have a high price and rudimentary technological performance (Agarwal & Bayus, 2002; Golder & Tellis, 1997). Market entry by additional firms advances the industry to the milestone of firm takeoff, which is the inflection point after which the number of firms increases in an accelerated rate (Agarwal & Gort, 2001). These firms engage in significant innovations to offer technical designs embodying different price-performance parameters (Abernathy & Utterback, 1978; Anderson & Tushman, 1990), resulting in concomitant increases in products' technological performance and declines in price. Customers' demand for these improved, diverse, and affordable products propels the industry to the sales takeoff milestone, which is the inflection point after which the number of customers and sales begin to grow at an accelerated rate (Agarwal & Bayus, 2002; Golder & Tellis, 1997). Taken together, firm and sales growth signify the industry's commercial viability in a self-sustaining manner, heralding its transition out of nascency.

The growth stages, then, continue with increasing trends for both the number of firms (Gort & Klepper, 1982), variation in technical designs (Anderson & Tushman, 1990), and number of customers (Rogers, 1962), with the peak in firm entry preceding the peak in sales (Agarwal & Bayus, 2002). Subsequently, the shakeout stage ensues, with a decline in the number of firms due to firm exit and consolidation (Klepper, 1996; Lieberman, 1990). After shakeout, the industry's growing course comes to an end, with the ensuing final stages of mature industries having stable numbers of firms and sales, followed potentially by decline and obsolescence (Anand & Singh, 1997), or persistence of a re-emerged niche (Adner & Snow, 2010; Nelson, Anthony & Tripsas, 2023; Raffaelli, 2019).

Disciplinary Perspectives Explaining Industry Evolution

Evolutionary trends have been linked to uncertainty resolution across various conceptual lenses, each prioritizing different dimensions of uncertainty or focusing on different stages. Table 1 lists the factors privileged across conceptual lenses. Foundational studies appeared as early as the 1960s and took steam in the 1980s, with seminal articles within evolutionary economics (Gort & Klepper, 1982), marketing (Bass, 1969; Davies, 1979; Rogers, 1962), technology management and history (Abernathy

& Utterback, 1978; Dosi, 1982; Rosenberg, 1982), and population ecology (Hannan & Freeman, 1977).

Evolutionary economics scholars focused on explaining the probability of market entry by firms. Starting with an exogenous innovation shock instantiated through the first commercial product, firm and sales takeoff stems from firms' reliance on information sources external to the industry (Gort & Klepper, 1982) or economies of scale in R&D (Klepper, 1996). Industry emergence is tied to reducing technological uncertainty, including through diffusion of technologies from the initial set of firms to later entrants due to reduced costs of learning (Jovanovic & MacDonald, 1994) or appropriability of process R&D (Cohen & Klepper, 1996).

Marketing scholars sought to explain the probability of adoption of new products by customers, segmenting customers based on price and functional preferences across a continuum of innovators through laggards (Rogers, 1962). Starting with the willingness of early adopters to purchase the first commercial product, sales takeoff occurs when early majority, late majority, and laggard customer segments join. Industry emergence is tied to reducing demand uncertainty through social contagion processes (Bass, 1969) or manifestation of unique customer attributes (Davies, 1979).

Technology management and history scholars focused on technological design models based on choices in components, systems, and processes to explain design variety offered by firms and design selection made by customers (Abernathy & Utterback, 1978; Anderson & Tushman, 1990; Clark, 1985). Starting with the first feasible technical design with commercial desirability for customers, firms experiment with parallel products embodying different designs (Rosenberg, 1992). Customer selection across these alternatives reveals their preferences for a convergence around one dominant design. Industry emergence is accordingly tied to reducing both technological and demand uncertainties.

Population ecology scholars, with sociological roots, privileged ecological variation and selection mechanisms to explain evolutionary trends in a population offering a new product. Starting with the first commercial product, the increasing trends in the number of firms arise from population density's initial positive effects on legitimation and ensuing negative effects in terms of increased competition (Aldrich & Fiol, 1994; Hannan & Freeman, 1977; Rao, 1994). Industry emergence is tied to reducing institutional uncertainty, for which density and large population of firms prove beneficial.

Across these foundational perspectives, the focus was on explaining industry evolution over its entire lifecycle, of which nascent stages were but a subset. In the following decades, disciplinary scholars augmented seminal studies by delving deeper into evolutionary trends and mechanisms. Integrating these insights within management, several studies examined the ramifications of temporal processes for strategy, entrepreneurship, and organizations. Early management studies took industry stage and structure as deterministic inputs, to which firms must respond (McGahan & Porter, 1997) and viewed uncertainties as exogenous (Folta & O'Brien, 2004). Industry stage was modeled as a contingency factor for studying survival (Agarwal, Sarkar & Echambadi, 2002), entry timing (Suarez & Lanzolla, 2007), and vertical integration (Argyres & Bigelow, 2007).

Management Perspectives Examining Industry Creation and Emergence

Building upon the above disciplinary perspectives, management scholars have made significant advancements in the last three decades to highlight additional sources of uncertainty, focusing on the nascent stages of creation and emergence.

Ecosystem and value chain scholars focused on how firms evolve through entry and exit into related industries as they leverage and reconfigure their own capabilities (Adner & Kapoor, 2010; Mitchell, 1989; Teece, 1986). Starting with the first commercialization, innovators and value chain actors engage with the industry to create and capture value through collaboration or competition. Industry emergence is tied to ecosystem uncertainty resolution for the creation of stable supply chains.

Organizational theory scholars focused on collective action and non-market interactions by firm and non-firm actors that provide social legitimation and institutional structure (Kaplan & Tripsas, 2008; Lee, Struben & Bingham, 2018; Navis & Glynn, 2010). Starting with the first offerings of products, the socio-cognitive basis and institutional legitimation of new products and categories begin to take shape. These are tied to non-market interactions between stakeholders, including firms, non-profit organizations, regulators, and media to reduce institutional uncertainty.

Most recently, strategy and entrepreneurship scholars have identified knowledge development during industry incubation (Greenstein, 2015; Moeen & Agarwal, 2017) and focused on integrating the above perspectives. The holistic framework shows that starting with triggers of scientific

discoveries and recognition of unmet needs, heterogeneous actors engage in sequential and interdependent reduction of technological, demand, ecosystem and institutional uncertainties through knowledge generation and aggregation mechanisms, resulting in critical industry milestones (Moeen et al., 2020). These advances have questioned the deterministic assumption about industry stage and the exogeneity assumption about uncertainties, while also underscoring the generative role of diverse actors in industry creation and setting the stage for our review.

ACTORS AND THEIR ATTRIBUTES

Industries do not simply emerge; nor do uncertainties resolve themselves. Within and across the conceptual perspectives, a fundamental insight is that the starting point and the continuing thrust for industry creation come from actors who allocate economic efforts toward the industry. By economic efforts, we mean the investment of non-trivial resources, including the leverage of experiences, time, and attention towards the explicit focus of developing new solutions that cater to existing or unmet needs. In this section, we describe the types of actors highlighted in existing studies based on their organizational form. We then distill three distinct but interrelated sets of actors' attributes that are key to engaging in industry creation: endowments, identities, and inducements, summarized in Table 2.

Actors Who Engage in Industry Creation

A broad set of actors allocate their efforts toward a nascent industry, and in doing so, contribute to industry creation. Beyond firms and non-firm organizational forms, these include individuals who are often, but not always, embedded within organizations.

Firms. Firms are the ubiquitous organizational form. This is to be expected, as firms are the primary platform of internal organization of economic activity to transform resources and inputs within production processes embodying technological systems into goods and services offered to their customers. Beyond engaging with the industry with the aim of, or resulting in, offering of final products, firms may also engage in interim steps or functions that transform inputs to products.

Within this organizational form, scholars have distinguished three types, of which the first two

types represent established firms.³ Incumbents are existing firms that serve the focal customer purpose by offering products or technological systems within more mature, existing industries, relative to the nascent industry that uses one or more novel base principles within new technological systems. For example, at the time of inception of the digital typesetting industry, firms active in hot metal or analog typesetting were counted as incumbents (Tripsas, 1997). Moreover, in studies of new submarkets or subfields, incumbents are firms that offered technologies catering to the focal purpose in earlier submarkets as in laser (Klepper & Sleeper, 2005) and medical diagnostics (Mitchell, 1989, 1991).

Established firms in other industries, also known as diversifying firms, are existing firms in industries that serve a different focal purpose than what is served by the nascent industry. Diversifying firms often add aspects related to the nascent industry to their operations, although divestment out of existing businesses is another possibility. For example, among TV manufacturers, diversifying firms included firms with history in radio manufacturing (Klepper & Simons, 2000). Some nascent industries exhibit parallel engagement by diversifying firms from multiple industries. For example, studies have explored car producers that came from bicycle, engine, or carriage industries (Carroll et al., 1996), or camera producers that came from electronics or software industries (Benner & Tripsas, 2012).

Entrepreneurial startups are the third type of firms identified in the literature, representing firms founded within the nascent industry. These startups embody the use of novel base principles in technologies and production processes, or cater to unmet needs and opportunities. For example, startups helped create and diffuse the personal computer industry (Bayus & Agarwal, 2007). Similarly, startups were engines of innovation catering to unmet needs of sports enthusiasts in rodeo kayaking (Baldwin et al., 2006) and motorsports (Aversa, Furnari & Jenkins, 2022). In Indian art, Saffronart was the startup that set up auctions and exhibitions for the industry (Khair & Wadhvani, 2010).

Non-firm Organizational Forms. Beyond firms, scholars have identified other organizational forms

³ In the broader literature on industry evolution, we uncovered fuzzy and inconsistent boundaries in the distinction among established firms as incumbents or diversifying firms. The first definition of incumbency, and one we use here given our focus on industry emergence, is based on the “focal” vs. other purposes being served. The second definition of incumbency lumps all established firms entering in nascent industries as diversifying entrants (Chen, Williams & Agarwal, 2012; Klepper & Simons, 2000), defining incumbents only in later industry stages as firms who entered in prior earlier stages to distinguish them from firms who enter in later industry stages (Ganco & Agarwal, 2009; Gort & Klepper, 1982; Sosa, 2013).

that contribute to industry creation, mostly non-firm actors. These include universities and research agencies, user communities, industry associations, advocacy organizations, regulators, and media.

Universities and research agencies play an important role, especially when the trigger of industry incubation is a scientific discovery or when technological uncertainties involve deficiencies in basic science (Agarwal et al., 2017). Scientific inquiry as the basis of knowledge generation and dissemination is the historic mandate of universities, the outcomes of which can prove fruitful for a nascent industry. Other research agencies serve the same function. For example, public agencies (e.g., DARPA, NASA, CERN, Argonne National Lab) and non-governmental agencies (e.g., Howard Hughes Medical Institute, Max Planck Institutes) are common contributors to industry emergence (Agarwal, Kim & Moeen, 2021; Greenstein, 2015; Gross & Sampat, 2023; Roy, Lampert & Sarkar, 2019).

Communities, defined as groups of individuals or organizations that share common attributes and objectives, also contribute to industry creation. Depending on their composition, these include user communities, industry associations, professional communities, or advocacy groups.

User communities bring together lead users, enthusiasts, and tinkerers who share an interest in using the nascent industry's product and provide a dynamic forum for exchange of ideas (Franke & Shah, 2003). For example, user participation contributed to Linux's success as the fastest growing desktop operating system in the early computer industry by attending to its technological functionality and enabling adoption through user-funded advertisements and user-organized parties (Bagozzi & Dholakia, 2006). Some user communities are endorsed or sponsored by firms, as in computer-controlled music instruments where pioneering firms organized and monitored user communities, and designs by users resulted in enhanced product features (Jeppesen & Frederiksen, 2006).

Industry associations are organizing structures for assembly of firms or non-firm actors engaging with the industry and seek to identify and advance firms' mutual interests. For example, the National Solid Waste Association consisted of leaders of waste management firms, who set agenda for the scope of the nascent waste recycling industry (Lounsbury, Ventresca & Hirsch, 2003). The boundary of industry associations can be blurred with professional communities that encompass industry experts and professionals, who convene separately in their expert communities or in tandem with industry

associations. In the modern flight simulator industry, the community of technical experts was key in promoting full flight simulators over flight training devices (Rosenkopf & Tushman, 1998). Similarly, the Radiology Association led the digital integration of diagnostic imaging for the creation of the picture archiving & communication systems or PACS industry (Lim, Ranganathan & Agarwal, 2024).

Advocacy and non-profit organizations convene activists with a shared cause and concern that can be alleviated by the emergence of a nascent industry. For example, by viewing climate change and environmental pollution as their cause, organizations such as the Sierra Club and Friends of the Earth promoted the development of alternative renewable energy industries (Sine & Lee, 2009). These activist communities can overlap with trade associations, especially when mutual interests warrant a coalition. For example, the National Recycling Coalition was founded by activists to advocate for recycling, but broadly represented waste management firms (Lounsbury et al., 2003).

Regulatory and legislative bodies have only recently gained scholarly attention about their role in industry creation, despite the long-standing focus in institutional theory (North & Wallis, 1994). In some industries, these governmental organizations play a key role in shaping the legal frameworks for an industry and overseeing enforcement and compliance of experimentation and commercialization efforts. As examples of regulatory bodies in the United States, scholars have listed the Food and Drug Administration in personal genomics (Gao & McDonald, 2022) and dietary supplements (Ozcan & Gurses, 2018), the Federal Aviation Agency in commercial drones (Shermon & Moeen, 2022), and the Animal and Plant Health Inspection Services in agricultural biotechnology (Hiatt & Park, 2013).

Media organizations disseminate and interpret perceptions and opinions about an industry on a large scale (Rindova, Petkova & Kotha, 2007). In nascent industries, this information dissemination often increases awareness and shapes audiences' perceptions of an unknown new product (Kennedy, 2008). For example, positive media coverage contributed to the creation of the broadband internet industry in the 1990s (Schultz, Marin & Boal, 2014). Media can increase product adoption as in the case of consumer electronics industry (Goldenberg, Libai & Muller, 2002), and it can also encourage firm entry as in the case of the network equipment manufacturing industry (Lee & Paruchuri, 2008).

Individuals. Organizations do not make decisions, individuals do. While most studies focus on the

organization unit of analysis, a subset of studies dig deeper into the role of individuals embedded within organizational forms noted above. Of note, while many individuals begin within the knowledge contexts of the above organizations, they often leave to found firms or other organizational forms in their quest for creating nascent industries (Agarwal & Shah, 2014).

Scientists who engage in basic or applied research in corporate, university, or public laboratories play a role in creating new industries. Scientists within corporate or university labs are prominently discussed in several industry contexts including biotechnology (Stuart & Ding, 2006), semiconductors (Holbrook et al., 2000), and bionic prosthetics (Kim et al., 2024).

Users whose needs constitute the focal purpose may also be propelled to create new industries or niches when they find existing products and services to be inadequate in addressing their needs. Users have been shown to offer demand input, experiment, or introduce goods and services in sports (Aversa et al., 2022a; Baldwin et al., 2006), scientific instruments (Mody, 2006), commercial drones (Shermon & Moeen, 2022), and medical devices (Park et al., 2024).

Product champions are employees who marshal resources and create coalitions to constructively resolve conflict and overcome inertia within firms for the development of technologies and market opportunities. Product champions range in hierarchy from top management teams, as in firms in the Japanese cotton spinning industry (Agarwal, Braguinsky & Ohyama, 2019) and digital photography (Tripsas, 2009), to middle managers, as in firms that innovated within electronic computing (Taylor & Helfat, 2009). For example, after failed government efforts at creating a domestic cotton spinning industry in Japan during the late 19th century, Eiichi Shibusawa of Osaka Spinning Company shaped not only firm, but overall industry, growth by leveraging his own technical and managerial prowess and by enabling other engineers and managers in the process too (Braguinsky & Hounshell, 2016).

Mission champions and advocates are individuals who foster nascent industries by highlighting the impact and time urgency of their cause of interest. As part of non-profit organizations, mission champions launched HIV advocacy groups (Maguire, Hardy & Lawrence, 2004) or recycling coalitions (Lounsbury et al., 2003), thereby garnering financial and community support. As part of public agencies, mission champions orchestrated public-private partnership to seed antibiotics, radar, and

Internet industries (Agarwal et al., 2021). For example, scientist Howard Florey was a persistent advocate for the development of penicillin, enlisting government support, persuading pharmaceutical firms, and sustaining media and public attention for the miracle drug that saved wounded soldiers.

Endowments of Actors Who Engage in Industry Creation

Actors are rarely tabula rasa. Their endowments include knowledge, resources, and capabilities⁴ that may be leveraged in industry creation. Most studies differentiate actors' endowments based on their prior histories (Cattani, Fontana & Malerba, 2024; Helfat & Lieberman, 2002).

Scientific and Technical Expertise. Scientific and technical expertise are the requisite input for creating components using novel base principles and designing architectures that bring components together to serve the focal purpose (Helfat & Raubitschek, 2000; Henderson & Clark, 1990). Actors' experience in scientific or technical contexts often enables them to gain such expertise.

Established firms, incumbents in existing industries serving the focal purpose or diversifying firms serving alternative purposes, leverage their technological capabilities. For incumbents in existing industries serving the focal purpose, some of their technical capabilities may retain relevance for the nascent industry.⁵ For example, in bionic prosthetics, incumbents in mechanical prosthetics possessed several sub-technologies that were relevant to the new domain (Kim et al., 2024). In the global electric vehicles industry, a history of producing light and small gasoline-powered cars gave incumbent firms knowledge for designing electric cars in markets favoring that car type relative to heavier and larger cars (Dutta & Vasudeva, 2024). When the nascent biotechnology industry prompted incumbents to transition from cytotoxic into targeted agents in the development of anticancer drugs, they retained

⁴ Capabilities refer to “the capacity to perform an activity in a reliable and minimally satisfactory manner” (Helfat & Winter, 2011). Resources refer to “stocks of available factors that are owned and controlled” (Amit & Schoemaker, 1995). Knowledge refers to “that which is known” (Grant, 1996).

⁵ Kim et al., (2024) highlight the definitional circularity between radical technologies and incumbent technological obsolescence in most studies that start with first commercialization milestone: when examining industries embodying radical technological change, these studies have equated radical technologies as those introduced by entrants that create new price-performance parameters relative to existing technologies. This results in a definitional obsolescence of incumbent technological capabilities that requires them to adapt post technological shock (Eggers & Park, 2018) or requires additional categorization of competence enhancing radical technologies (vs. competence destroying ones) to accommodate radical technologies introduced by incumbents (Tushman & Anderson, 1986). Recent studies examining incubation and using the “technological systems serving a focal purpose” definition of technologies highlight the distribution of requisite technical expertise and component level knowledge across multiple actors, including incumbents.

scientific expertise in oncology, even as other non-biotechnology expertise lost value (Sosa, 2009).

For diversifying firms serving alternative purposes, the relatedness between the technology profile of their other industries and the nascent industry can provide them with relevant technical capabilities. For example, in bionic prosthetics, diversifying firms from related industries of robotics, automotives, and materials possessed technologies in mechanical controls, bionic controls, and materials (Kim et al., 2024). At the time of entry into the fiber optics communication industry, diversifying firms' research in fiber glass in the case of Corning or semiconductor in the case of Bell Laboratories provided them with different levels and types of technical capabilities (Cattani, 2005).

Finally, we note that to infer above technical capabilities, most studies distinguish firms into one or more of the three categories discussed above (Bayus & Agarwal, 2007; Carroll et al., 1996; Chen, Qian & Narayanan, 2017; Klepper & Simons, 2000; Moeen & Agarwal, 2017). When doing so, these studies have often validated their assumptions based on historical and context-specific information about the industry rather than an empirical measurement of the underlying resources. Other studies have substituted or appended to these firm type indicators by using patent-based measures of the underlying technologies (Cattani, 2005; Helfat, 1997; Moeen, 2017; Wu, 2013).

For scientists working in universities and research institutions, their knowledge context enables them to learn and generate novel base principles at the scientific frontier. Regardless of whether they stay in universities or found entrepreneurial startups, they can translate this experience into scientific capabilities. At times, this scientific expertise generates the trigger for incubation, such as the discovery of plant genetic modification at the outset of the agricultural biotechnology industry (Moeen & Agarwal, 2017). At other times, this scientific expertise can tackle ongoing deficiencies in technological design and product development that necessitate going back to basic and applied scientific principles. For example, scientific expertise in the MIT Lincoln Laboratory and NASA Jet Propulsion Laboratory resolved bottlenecks in the development of CCD image sensor (Roy et al., 2019). When scientists found new ventures, their academic startups transferred scientific knowledge to a nascent industry, for example, biotechnology (Stuart & Ding, 2006) and solid-state lighting (Sanderson & Simons, 2014).

Individuals who work for established firms gain technical expertise in their employment context,

which can be transferred to their employee entrepreneurship ventures. For example, individuals working for incumbent firms had technical knowledge across generational and submarket shifts in the disk drive (Franco et al., 2009) or laser industries (Klepper & Sleeper, 2005). Nearly half of the founders in the software encryption industry garnered technological expertise as employees of ICT firms (Giarratana, 2004). Former employees in the aviation industry had aerodynamics engineering expertise, which was suited to develop racing cars for the motorsport industry (Aversa et al., 2022b).

Demand Knowledge. Demand knowledge pertains to customers' implicit or explicit functional and price preferences across heterogeneous customer segments, which shapes their selection of whether and how much to pay for a combination of product features. Studies have noted that actors accumulate demand knowledge due to familiarity and interactions with the nascent industry's customers.

Established firms, incumbents in existing industries serving the focal purpose or diversifying firms from industries serving alternative purposes, can share the same customer base with a nascent industry, through which they typically learn customers' preferences. For instance, telecommunications incumbents that served early adopters of the 2G network had their demand knowledge about premium pricing, speed, coverage, and minutes of voice call usage when creating these industries in other countries (Eggers, Grajek & Kretschmer, 2019). Similarly, when telecommunication firms diversified into the global mobile money industry, they had demand knowledge and access to users, within and across countries (Wormald et al., 2021). In an alternative process of knowledge accumulation, instead of sharing the same customer base, diversifying firms' demand knowledge can arise from their own history or prospects of being a customer of a nascent industry. For example, in the computer numerical controls industry, established firms' demand knowledge stemmed from their internal work with machine tools and robotics, within a vertically integrated firm that was both the producer and user of the industry's products (Roy & Sarkar, 2016). Likewise, drone manufacturers diversifying from industries of agriculture, insurance, or land surveying had demand knowledge about how drones could be used and customized in their corresponding customer segment (Shermon & Moeen, 2022).

As an extension, individuals working for established firms in downstream industries also know about customers' unmet needs and preferences (Adams, Fontana & Malerba, 2016). For example,

when employees of a publisher formed a startup and initiated the photographic typesetter industry, they had knowledge about what their former employer as a customer of this device expected (Tripsas, 2008). Similarly, employees of healthcare firms who founded medical imaging startups had clinical expertise and could foresee other healthcare providers' needs (Park et al., 2024).

Studies have also noted demand knowledge available to individuals who are potential users of the nascent industry, as they are familiar with their personal needs. Their personal cues and insights can possibly generalize to the preferences and needs of other like-minded users (Gambardella, Raasch & von Hippel, 2017). Across different organizational forms that they pursue, i.e., create a user startup, participate in user communities, or independently share input, they infuse the nascent industry with demand knowledge. When they create startups, user entrepreneurs use their demand knowledge in the design of products and services that satisfy their unmet needs (Baldwin et al., 2006; Mody, 2006; Shah & Tripsas, 2007). For example, alpine sport climbers preferred to compete with consistent surfaces whose shape was created by human design rather than nature. In turn, their startups incorporated the demand for artificial walls in sport climbing (Aversa et al., 2022a). When they interact in a community of lead users, the aggregation across their individual and idiosyncratic preferences can refine and validate demand knowledge so that it reflects the broader demand (Franke & Shah, 2003; Jeppesen & Frederiksen, 2006). For example, in the rodeo kayak equipment industry, after sport enthusiasts created new kayaks, community members shared other design ideas and expressed interest in purchasing particular designs (Baldwin et al., 2006). In the PACS industry, health professionals and their associations leveraged their demand knowledge about the efficiency, image quality, and remote access enabled by a digital system for storing, retrieving, and sharing medical images (Lim et al., 2024).

Downstream and Complementary Assets. Complementary assets are downstream resources or value chain knowledge that enable product and value delivery to customers (Teece, 1986). Despite the uncertainty about the precise nature and composition of downstream assets needed for commercialization in early industry stages (Lampert, Kim & Polidoro, 2020; Moeen & Mitchell, 2020), actors may have developed resources in their prior contexts that can prove useful in a nascent industry. Although complementary assets in the form of manufacturing facilities, distribution channels, or

brand can be available in a wide range of established firms, studies have dominantly viewed incumbents in existing industries serving the focal purpose as the owners of complementary assets (Eggers, 2012; Moeen & Agarwal, 2017; Rothaermel, 2001; Wu, Wan & Levinthal, 2013). By gauging resources used for scalable downstream operations and product delivery to customers, some studies have directly assessed the presence and size of these resources. A notable aspect of these studies is the deep immersion of scholars in the context-specific history of each industry, so that they identify which resources count as complementary assets and how to empirically measure them. The examples range from distribution systems in medical diagnostic imaging (Mitchell, 1989), font libraries in typesetting (Tripsas, 1997), switching network equipment in telecommunications (Rothaermel & Hill, 2005), distributor partners in computer numerical control machines (Roy & Cohen, 2017), and protected plant varieties in agricultural biotechnology (Moeen, 2017).

In parallel to the extensive attribution of complementary assets to incumbents, a small set of recent studies show that former employees of incumbents can possess knowledge of complementary assets, enabling their ventures to configure downstream operations. For example, bioethanol entrepreneurs with work experience in ethanol value chain activities such as handling grains, managing feedstock, or storing fuels leveraged knowledge of these downstream activities (Qian, Agarwal & Hoetker, 2012). Similarly, startups founded by employees of pioneering car manufacturers utilized downstream knowledge of their former employers (Argyres & Mostafa, 2016).

Knowledge of Social and Legal Institutions. Knowledge of institutions includes actors' awareness about the extent to which the socio-cognitive interpretation of a nascent industry's product or service aligns with societal expectations of legitimacy and acceptance, plus actors' insights about the formal and legal frameworks that can effectively structure economic exchange. In discussing knowledge of institutions, most studies have considered them as endowments of non-firm organizational forms.

Because mission champions, advocacy groups, and non-profit organizations often arise to reflect a collective cause or concern, they are associated with the recognition of the corresponding societal issues. In turn, studies have noted that these mission champions and advocates, along with the organizations that they form or join, represent knowledge of social institutions. Their knowledge can

embody various trends and values, including environmental (Sine & Lee, 2009; Weber, Heinze & DeSoucey, 2008), humanitarian (Maguire et al., 2004), or religious (Hiatt, Sine & Tolbert, 2009). For instance, in building the sustainable coffee value chain, the Rainforest Alliance and Bird Friendly recognized the societal interest in consuming coffee that was sustainably sourced (Levy, Reinecke & Manning, 2016). In advocating for bean-to-bar chocolates, passionate entrepreneurs leveraged their knowledge that some societal segments valued improving human rights and environmental conditions of cocoa production (Woolley, Pozner & DeSoucey, 2022).

Journalists and media organizations bring knowledge of social institutions. Due to connection to diverse audiences, journalists and media are often positioned to not only broadcast, but also recognize and assimilate societal trends and values. In transforming yoga from a spiritual practice to an industry, Yoga magazine leveraged its knowledge of what Western society could find an acceptable blend of self-reflection, leisure, and exercise (Munir, Ansari & Brown, 2021). In the early electric vehicle industry, before its century-long stall, Horseless Age magazine's interactions with drivers and readers provided it with the knowledge of societal trends favoring or opposing electric vehicles (Kirsch, 2000).

Regulatory and legislative bodies possess knowledge of social and legal institutions. Due to interactions with and representation of their constituents, regulators typically know about societal trends. Further, because of their responsibilities, regulatory bodies have expertise in the rule-making process and the existing legislation. For example, interactions with voting citizens informed regulators' about social acceptance of the ride hailing industry (Paik, Kang & Seamans, 2019). Likewise, interactions with farmers interest groups led to regulators' knowledge about the duality in social acceptance and opposition to agricultural biotechnology (Hiatt & Park, 2013). This institutional knowledge is often pronounced for state-level, rather than national-level, legislators due to their closer connection to local conditions (Armanios, Lanahan & Yu, 2020; Bao & Zhang, 2024).

Dynamic and Managerial Capabilities. Dynamic capabilities are capabilities for sensing and seizing opportunities, through actors' ability to integrate, build, and reconfigure resources and processes (Teece, Pisano & Shuen, 1997). Dynamic capabilities can operate as firm-level routines (Zollo & Winter, 2002) and individual-level managerial skills (Adner & Helfat, 2003; Helfat & Peteraf, 2015).

Among the various dynamic capabilities, the most studied in industry emergence contexts are integrative capabilities, which relate to assembly of components, resources, and activities within and across value chains (Helfat & Raubitschek, 2000). The importance of these capabilities arises because related resources and knowledge in existing portfolios of firms are rarely an exact match for the nascent industry, and integrative capabilities enable the requisite combination and reconfiguration of resources. Integrative capabilities of established firms are associated with the development of resources for creating and entering bioethanol (Qian et al., 2012), agricultural biotechnology (Moeen, 2017), and mobile money industries (Wormald et al., 2023). The presence of integrative capabilities extends to employee entrepreneurs who garner relevant routines in their former employment. These capabilities can then apply to the integration of activities toward product or geographic expansion, as shown in solar panels (Furr, 2019) and telecommunications (Jahanbakht, Mostafa & Veloso, 2022).

Further, managerial capabilities manifest in studies of champions and advocates. Steve Jobs' unique leadership shaped the wireless phone industry away from phone functionality and barebones enterprise communication and towards aesthetic appeal and easy-to-use interface (Gavetti, Helfat & Marengo, 2017). Mission champions and advocates' mobilization efforts likewise hinge on their ability to coordinate and integrate across numerous other actors. Similarly, the strength of non-profit organization often resides in their leaders' professional expertise and history of advocacy (Maguire et al., 2004) and ability to attract like-minded participants to mobilize resources (Sine & Lee, 2009).

Identities and Cognitive Frames of Actors who Engage in Industry Creation

While endowments have received most of the attention, a second attribute, identity and cognitive frames include how actors perceive themselves and interpret the environment of the nascent industry (Gavetti & Levinthal, 2000). Organizational identity refers to the shared beliefs among members of the organization regarding who they are as an organization, and what is the distinguishing feature of their organization (Albert & Whetten, 1985).

For established firms, prior histories and industries of origin interact with identities and cognitive frames. Because of the stability in perceptions of members about their organization (Gioia, Schultz & Corley, 2000), the industry of origin in established firms often results in self-perception and vantage

points that carry over from their prior industry to a nascent industry. For example, smart city projects have attracted established firms from the real estate development, artistic architecture, and technology industries. Rather than adopting a unified concept of what constituted a smart city, each firm exhibited identities that mapped onto their past work in construction, art, and technology (Zuzul, 2019). In the digital camera industry, established firms from photography, consumer electronics, and computing industries held different identities, corresponding to their prior industry (Benner & Tripsas, 2012).

The interrelation between identities and prior histories is especially salient for incumbents in existing industries serving the focal purpose, as their identity can be tied to existing resources, business models, routines, and customers that directly conflict or overlap with the nascent industry. Thus, their interpretation of their position in a nascent industry often interacts with their financial and resource redeployment considerations associated with the existing industry. Scholars have mostly documented instances of inertial identities that are tied to incumbents' existing industries, which in turn correspond to negatively perceiving a nascent industry as a cannibalization threat to existing revenue streams and customer bases (Chandy & Tellis, 2000; Christensen & Bower, 1996). Several examples of incumbents' impaired attention to nascent industries are associated with their inertial identity, as in digital photography (Tripsas & Gavetti, 2000), personal computers (Danneels, 2011), and semiconductors (Henderson, 1993). Nonetheless, there are cases of incumbents whose identity is not restricted to their past industry. Instead, they are growth-oriented, seeking to diversify revenue streams and apply their resources in new directions. For example, communications incumbents varied in how closely they tied their identity to their existing industry, but those with a broader forward-looking identity paid attention and pursued opportunities in fiber optics (Eggers & Kaplan, 2009).

Founder identities and cognitive frames are also present in startups. Because startups are founded in the nascent industry, their identities are often tied to the industry. Studies have noted authenticity and agility as pervasive identities among entrepreneurs in nascent industries (Khessina & Carroll, 2008; Santos & Eisenhardt, 2009). In other contexts, studies note that entrepreneurs' identities can arise from their distinct visions for the trajectory of an industry. For example, in the air taxi industry, entrepreneurs viewed themselves as either revolutionaries or discoverers (Zuzul & Tripsas, 2020).

Across different organizational forms, studies have singled out other individual-level identities that define the individual actor or may aggregate to define the organizational form embodying them. For scientists designing the first cochlear implants, distinct identities distinguished safety-oriented scientists with a focus on reducing neuro-physiological damage from efficacy-oriented scientists with a focus on increasing speech recognition (Garud & Rappa, 1994). For users of commercial drones, photographers versus engineers viewed themselves as developers of flying cameras versus developers of flying robots (Shermon & Moeen, 2022). Mission champions perceived their identity as imaginaries who show resilience in the face of uncertainties in geoengineering (Augustine et al., 2019).

Of note is the variation in how scholars describe identities, often arising from the specific empirical context of their study. Unlike endowments for which higher-order themes and types could emerge from our literature synthesis, the discussion of identities in the literature seems to be context-specific and dispersed, especially with scarce attention to non-firm actors.

Inducements of Actors who Engage in Industry Creation

Inducements include reasons why actors engage with the nascent industry spanning across financial (profit motive) and non-financial (e.g., passion, desire for creating novel problem-solution nexus, status, impact) factors.

Financial Inducements. Financial inducements are either explicitly modeled or implicitly assumed to be key within evolutionary economic models for why firms, established and startups alike, engage in creating new industries (Gort & Klepper, 1982; Jovanovic & MacDonald, 1994; Klepper, 1996; Rosenberg, 1969). The same is true in several studies within management using the conceptual lenses of organizational theory, strategy, and entrepreneurship (de Figueiredo & Silverman, 2009; Engler, Cattani & Porac, 2020; Mitchell & Singh, 1992; York & Lenox, 2014). Moreover, when using the resource-based view and capability reconfiguration lens, scholars assume financial inducements when discussing the role of resource complementarities and fit in diversification efforts of established firms (Helfat, 1997; Silverman, 1999), including the leverage of complementary assets in the choice to enter nascent industries (Mitchell, 1989; Rothaermel, 2001; Tripsas, 1997). Within the pharmaceutical industry, for example, when incumbents developed products utilizing monoclonal antibodies than

gene therapy, the former conformed to their existing profitability calculus (Kapoor & Klueter, 2015). When firms convene within industry associations, these financial inducements similarly hold.

Non-financial Inducements. A small set of studies explicitly refer to non-financial inducements for firms. During WWII, firms' investments in antibiotics and radar were driven by national pride and mission to save lives (Agarwal et al., 2021). Firms' pharmaceutical projects commonly seek to treat neglected diseases and increase well-being of low-income patients (Vakili & McGahan, 2016).

Non-financial inducements are noted in references to individuals, which also extends to the inducements of firms or communities that they initiate or join. Scientists are often motivated by the quest for scientific inquiry (Stern, 2004), although their desire for status and financial rewards is present in parallel (Sauermann & Stephan, 2013). When academic scientists create startups for the development or commercialization of their scientific findings, their inducements expand to the dissemination of and public access to products based on their science (Bercovitz & Feldman, 2008). For example, academic entrepreneurs in life sciences gravitated to the societal impact of health and wellbeing through availability of modern medicine (Cohen, Sauermann & Stephan, 2020).

For users and user entrepreneurs, studies have singled out inducements of unmet personal needs (Shah & Tripsas, 2007) and passion (Aversa et al., 2022b; Baldwin et al., 2006). For example, in the motorsport industry, founders were driven by their collective passion for the sport (Aversa et al., 2022b). In bionic prosthetics, amputees pursued scientific degrees and academic positions to develop products addressing their medical needs (Kim et al., 2024). Users' participation in some communities happens without financial remuneration, with the desire to address their unmet needs. In addition, scholars have noted an intrinsic belonging to community members (Bagozzi & Dholakia, 2006), which reinforces their motivation for dissemination of solutions for the benefit of a larger number of users (Jeppesen & Frederiksen, 2006). Despite lack of financial remuneration, some users seek peer recognition and status, which can improve their recruitment opportunities (Lakhani & Wolf, 2005).

The inducement for product champions who found their efforts thwarted within firms can be the desire to see their ideas succeed that prompts them to venture out on their own. This has occurred in the early automobile, semiconductor, and laser industries (Klepper & Thompson, 2010) and in

successive generations and submarkets of the disk drive industry (Shah, Agarwal & Echambadi, 2019).

Mission champions, too, have non-financial inducements, often corresponding to finding a quick solution to the challenge behind their mission. Like-minded members of non-profit organizations and advocacy groups also share the mission as their inducement. For example, champions for the grass-fed meat industry were motivated to reduce the adverse impact of industrial agriculture procedures for corn-fed or grain-fed meat on rural communities (Weber et al., 2008). Nanotechnology champions were motivated to accelerate the next industrial revolution (Grodal & O'Mahony, 2017).

For regulatory bodies, studies note the dual inducements of protecting public interest by defining the industry's legal boundaries (Bao & Zhang, 2024; Gao & McDonald, 2022; Lounsbury et al., 2003; Wormald, 2024) and creating national competitiveness and economic growth by aiding industry creation (Agarwal et al., 2021; Georgallis, Dowell & Durand, 2019; Murmann, 2003).

WHEN TO ENGAGE IN A NASCENT INDUSTRY

Uncertainties in envisioned industries are resolved, if at all, by purposeful actions. A key decision is when to engage in a nascent industry. Salient in this theme is the match between actors' attributes (endowments, identities, inducements) and the interplay of the industry's nascent state (uncertainty dimensions) and temporal stage (incubation, firm takeoff, sales takeoff). Figure 1 provides the timing of engagement of various actors, as discerned by their role and intensity of investment.

Engagement to Initiate the Incubation Trigger

Depending on the trigger for industry incubation, the set of actors initiating that trigger are among the earliest engaging with the nascent industry. When scientific discoveries are triggers for incubation, studies note the early engagement of scientists, universities, and research agencies. Examples include the incubation stage of biotechnology (Moeen & Agarwal, 2017; Zucker, Darby & Brewer, 1998), nanotechnology (Rothaermel & Thursby, 2007), and solid-state lighting (Sanderson & Simons, 2014). When unmet needs initiate actions, users who seek solutions to their unmet needs are among the early actors engaging with industry. For instance, the early engagement of users was consistent with the demand-side trigger for the development of rodeo kayaking (Baldwin et al., 2006), probe microscopy (Mody, 2006), motorsports (Aversa et al., 2022b), and the Machinima technology and movie genre

(Haeffliger, Jäger & Von Krogh, 2010). When industries are created in response to grand challenges arising from public sector needs, public agencies engage early to articulate the mission and drive participation by other actors. For example, due to time urgent, wartime needs, the Department of Defense was the early actor seeking penicillin to treat infections in wounded soldiers or radar to detect objects (Agarwal et al., 2021; Gross & Sampat, 2023).

Engagement in Incubation Stage with Pervasive Uncertainty

Pervasive technological and demand uncertainties during incubation stage invite actors whose endowments, identities, and inducements can contribute to the reduction in these uncertainties, while not being averse of constraints from the lack of immediate revenue potential at this stage.

The timing of actors' engagement is contingent on their judgment about a match between their endowments and inducements and the state of industry knowledge. Technological and demand uncertainties during incubation imply that actors with scientific and technical expertise join forces with actors with demand knowledge and passion. Established firms' investments during incubation are induced by leveraging a potential match in their related technological capabilities, demand knowledge, and identities, rather than immediate profit and revenue (Engler et al., 2020; Moeen, 2017). Academic and user startups with frontier technical expertise and demand knowledge engage this early, as do private enterprises whose expertise is vital for the public sector's pursuit of a grand challenge.

At the same time, the uncertain state implies that a potential for profitability is by no means assured. Accordingly, some actors' engagement during incubation stems from their non-financial inducements, leading to early venture creation by a few scientists who seek to realize their envisioned solutions, or a few users who aim to satisfy their unmet needs and passion. This also holds for established firms. For example, established firms in mechanical prosthetics (e.g., Össur, Ottobock) and related industries (e.g., Kobe Steel, Liberty Mutual) invested in incubation of bionic prosthetics with the purpose of providing superior value propositions for amputees (Kim et al., 2024).

The absence of immediate profit and revenue during incubation, however, can discourage some actors. They hesitate to engage due to their own perceptions or external pressures. For example, despite having the prerequisite technological knowledge, short-term focus on the profitability of

existing products and inadequate approaches for understanding embryonic markets resulted in IBM's lack of engagement in the incubation of numerous new technologies. Some of these technologies, such as speech recognition, web performance, and RFID, subsequently became viable industries (O'Reilly, Harreld & Tushman, 2009). In another case, despite Monsanto's investment during the incubation of agricultural biotechnology to leverage its chemical and plant sciences knowledge for diversification (Moeen, 2017), the long duration of incubation stage, with no certain timeline for achieving commercial success, led to doubts and attempts to withdraw investments (Charles, 2001). In photography and wireline telecommunications, financial analysts' negative reactions to incumbents' pursuit of nascent technologies led to hesitations against investment during incubation (Benner, 2010).

Engagement After First Commercialization Heralds Product Market Opportunities

If and when industries move past incubation, the first commercial sale stems from technological uncertainty being sufficiently addressed for the first set of products and services to convince the early segment in customer populations to purchase them (Moeen et al., 2020). At this stage, technological and demand uncertainties and their interdependence remain the focus of actors, whereas ecosystem and institutional uncertainties begin to gain salience. The timing of engagement with the nascent industry during the post-commercial pre-takeoff stage corresponds to this uncertain state.

To resolve the remaining technological and demand uncertainties, established firms, startups, scientists, and users whose technological expertise and demand knowledge can potentially address these uncertainties engage with the industry, driven by financial or non-financial inducements. Some individuals who started their investment during incubation, for example, to advance the science base or to explore unmet needs may found firms and transition to organizational forms.

The shift to addressing ecosystem uncertainty highlights opportunities for firms whose judgment points to a match between their downstream and complementary assets and those valued in this industry stage, thereby prompting them to engage. In bionic prosthetics, for example, incumbent firms in mechanical prosthetics were the first to enter, as their complementary assets could initiate ecosystem formation (Kim et al., 2024). Further, visible exchanges in the product market can bring to surface the formal and social aspects of institutional uncertainty, attracting the attention and engagement of

regulators (Lounsbury et al., 2003; Rao, 1994) and media (Kennedy, 2008; Rindova et al., 2007).

Additionally, the first commercialization and product market exchanges signal the opportunity to other actors. Thus, this is the time window of engagement by established firms, startups, and individuals with relevant attributes who were hesitant during incubation. In parallel, as the indirect consequence of engagement by regulators and media, some other actors' reluctance to engage is partially addressed. When regulators offer financial incentives or clarify the institutional framework, financial and institutional incentives can prompt new firm entry. For example, incumbent firms in the construction industry were reluctant to enter the green building industry until state regulations introduced tax credits or financial support (York & Lenox, 2014). Similarly, a wave of entry into the solar panel industry came from national regulations that provided financial subsidies or created legal mandates (Georgallis et al., 2019; Guerra & Agarwal, 2024). Moreover, by amplifying the industry's position, media and journalists can alert actors to the opportunities, as observed in the increased engagement of firms from related industries to computer networking after media releases (Lee & Paruchuri, 2008). Finally, the external pressure from financial analysts can ease from an initial negative perspective based on income metrics to a positive perspective based on growth metrics, thereby endorsing firm entry (Benner & Ranganathan, 2017).

Nonetheless, the lack of widespread industry profile, particularly compared to existing products and services with robust ecosystems, creates variation in whether and when actors perceive the nascent industry as worthy of engagement. Some established firms and incumbents may continue to fear cannibalization and not engage with the industry (Christensen & Bower, 1996).

Engagement After Firm Take-Off for Realization of Scaling Potential

Sequentially, if and when industries move past firm takeoff due to reduction in interdependencies in technological and demand uncertainty, actors' attention shifts to building ecosystems and garnering institutional legitimacy so that industries can scale (Moeen et al., 2020). The timing of additional actors' engagement in the nascent industry at pre-sales takeoff stage depends on this uncertain state.

To resolve the remaining uncertainty dimensions and the interactions among them, additional actors that engage with the industry at this stage include established firms, startups, scientists, and

users with technological, demand, and complementary ecosystem knowledge. As the industry gains traction, some firms that exercised an option to wait are induced to enter and take advantage of an increased likelihood of profits, whereas other firms may only begin to sense the relevance of their endowments for the nascent industry and enter (Mitchell, 1989). At this stage, actors who entered early in the preceding stages also become a source of new entrants, often spawning within-industry employee entrepreneurs (Agarwal & Shah, 2014). These latter individuals are endowed with technical, market, and operational knowledge to capitalize on opportunities within the new industry. Individuals previously employed at IBM engaged with the Internet industry (Greenstein, 2015), as were employees of Shockley and Fairchild in the semiconductor industry (Moore & Davis, 2004).

Because scaling involves expanding capacity, enhancing efficiency, and streamlining processes relating to value chains and ecosystems, additional firms that perceive their attributes to match the needs of a nascent industry respond to these financial inducements by offering their downstream and complementary assets. Firms' development of both supply and demand side ecosystems has been notable in studies about semiconductor lithography equipment (Adner & Kapoor, 2010), solar (Furr & Szerb, 2024; Guerra & Agarwal, 2024) and mobile money industries (Wormald et al., 2023). Further, the potential interdependencies between ecosystem and institutional development entices some actors to engage at this stage. In the solar industry, silicon suppliers who diversified from semiconductors engaged at this stage to contribute to the scaling of silicon-based technologies, whereas utility firms who had to comply with regulatory mandates to favor silicon over thin film engaged at this stage to leverage the assurance of reliable and robust supply chains (Guerra & Agarwal, 2024).

At this stage, there is an increased rate at which regulators engage with the industry, in terms of various national and state regulators, and in the legislations and policies that refine the institutional framework. This timing is interdependent with emerging industry associations and non-profit organizations, who also commonly form at this stage due to the critical mass for firms that can convene in such organizational forms. For example, the California Certified Organic Farmers started to represent organic farmers and their interest in certification, only after a sizeable number of organic growers were already active (Lee, Hiatt & Lounsbury, 2017). In turn, these industry associations can

spearhead regulatory agendas, giving rise to the concurrent temporal attention by regulators and industry association. In synthetic dyes, German firms' collective lobbying and educational agenda resulted in the drafting of a robust patent law that fostered innovation, while the lack of coordinated efforts among British firms left a vacuum in the country's patent law (Murmann, 2003).

CAPABILITY PORTFOLIO DEVELOPMENT AND RECONFIGURATION

As the two previous themes show, actors leverage their initial capabilities to correspond to the knowledge state of a nascent industry at each time juncture. Still, these initial capabilities⁶ are rarely adequate for and aligned with the requirements of a nascent industry. Building on the strategic management literature on capability sourcing and reconfiguration in established contexts (Arora, Fosfuri & Gambardella, 2004; Capron & Mitchell, 2012; Karim & Mitchell, 2000; Katila & Ahuja, 2002), scholars have highlighted the process of achieving a suitable capability portfolio in nascent industries. The formative actions of internal capability generation and reconfiguration, which are augmented by the reliance on external sources of capabilities in markets for technology and markets for value chain activities, help actors build a capability portfolio for operating in the nascent industry.

Internal Capability Generation and Reconfiguration

Given the uncertainties pervading a nascent industry, not only is each actor's capability portfolio inadequate in addressing knowledge gaps, but there is a lack of external sources with requisite knowledge for off-the-shelf exchanges (Moeen & Mitchell, 2020). Thus, internal organization through actors' capability generation, integration, and reconfiguration becomes key.

Two precursors influence capability generation and reconfiguration. First, these efforts hinge on mobilizing financial resources to incur the associated expenses. Despite the widespread and critical role of private capital, studies have instead largely noted public financial sources. For example, firms in the solar industry relied on the supportive tariffs enacted by the European governments (Georgallis et al., 2019). Mission-oriented projects received funding from the US government agencies (Agarwal et al., 2021). Airplane innovators had guaranteed purchase contracts from the US Postal Service as

⁶ In this section, we use "capabilities" as a general term, encompassing resources and knowledge. Our premise is that capabilities act upon resources and knowledge. Similarly, we take the broad definition of "reconfiguration," as firms change their capability portfolio by adding, removing, and recombining (Capron & Karim, 2016).

lead user of airmail (Sohn, Seamans & Sands, 2023).

Second, because of the interplay between capabilities and identities, studies have highlighted that changes in an actor's capability portfolio are often accompanied by changes in its identity. A congruent identity often underpins heuristics and interpretive schema for the development of capabilities and attention to relevant routines as building blocks (Bingham, Eisenhardt & Furr, 2007; Eggers & Kaplan, 2013). This transformation applies to established firms and startups (Dutt & Joseph, 2019; Lavie, 2006; Rindova & Kotha, 2001). For example, in biotechnology, shifts in identity were intertwined with investments in technological capabilities (Kaplan, Murray & Henderson, 2003). Similarly, a pioneering firm in the flash card memory industry succeeded in capability adaptation after it discarded its old identity, explored a period of identity ambiguity, and eventually adopted a new identity (Tripsas, 2009).

Primed with adequate funding and a congruent identity, actors can undertake various approaches for capability generation. Scholars have largely studied the generation of technological capabilities, demand knowledge, and complementary assets, while noting how dynamic capabilities emerge or fulfill capability integration and reconfiguration.

To tackle technological uncertainty and gain technological capabilities, a long standing perspective focuses on firms' internal R&D (Chandler, 1977). To pursue scientific and technical endeavors, firms often set up specialized divisions, laboratories, or cross-functional units, staffed with scientists, engineers, and researchers. Through an iterative process of idea generation and experimentation, these efforts can lead to invention of scientific principles or development of technical designs. Firms' direction of new R&D can often arise from past endowments, as in Corning's path-dependent investment in fiberoptics (Cattani, 2006) or petroleum firms' in alternative fuels technologies (Helfat, 1997). However, these endowments may also generate inertia, as in medical lithotripsy producers' focus only on incremental technology development (Nagarajan & Mitchell, 1998). In addition to firms' endowments, technology spillovers facilitate the knowledge flow that can be incorporated as input in the R&D process. Scholars have noted that the strength of technology spillovers in a nascent industry may depend on the attributes of source and recipient (Polidoro & Jacobs, 2024), availability of university scientific publications (Sanderson & Simons, 2014), and geographic proximity among actors

(Aversa et al., 2022b; Sohn, 2021). A notable aspect of R&D is its setbacks and failed trajectories, which require firms to pivot their projects and technological solutions. Some technological setbacks have industry-wide repercussions such as the case of the Virgin Galactic test flight crash for the entire space tourism industry (Chai, Doshi & Silvestri, 2019), whereas other setbacks apply to missteps in firms against the evolving technological trajectory (Eggers, 2012, 2014; Kapoor & Klueter, 2020).

To address demand uncertainty and learn about customers' implicit preferences, product market interactions, as we discuss in the next section, often provide demand knowledge. Firms introduce alternative products to gather knowledge about customers (Pillai, Goldfarb & Kirsch, 2020), spread rumors and experimental ideas to assess reactions (Seidel, Hannigan & Phillips, 2020), or conduct interviews and prototype tests with prospective customers (Seidel & O'Mahony, 2014). Community exchanges with users are also useful (Aversa et al., 2022b; Greenstein, 2015; Mody, 2006).

To overcome ecosystem uncertainty and obtain resources for value delivery and capture in ecosystems and value chains, scholars have highlighted internal efforts in redeploying and reallocating complementary assets across units within a firm. For example, firms could redeploy complementary assets from their existing x-ray radiography unit to the ultrasound or magnetic resonance imaging industries (Mitchell, 1989), from their obsolescing analog phototypesetter unit to the laser imagesetter industry (Tripsas, 1997), from grain handling and feedstock management units to the bioethanol industry (Qian et al., 2012), and from mechanically controlled machine tools unit to the computer numerical control machines industry (Roy & Cohen, 2017). Passive redeployment of complementary assets is, however, not sufficient. Firms need to consider the uncertain nature of complementary assets (Lampert et al., 2020; Moeen & Mitchell, 2020) and integrate complementary assets within a firm's activities in a nascent industry (Helfat & Raubitschek, 2000), as observed in the global mobile money industry where telecommunication firms reconfigured upstream and downstream capabilities to facilitate mobile money platforms (Wormald et al., 2023). To this end, scholars have described the accumulation of additional complementary assets, plus the extensive specialization and integration across resources and activities. Effective coordination between middle managers (Taylor & Helfat, 2009) and the use of integrative capabilities (Moeen, 2017) are crucial for this integration.

While internal efforts gradually shape a firm's capability portfolio for a nascent industry, external capability sources are also crucial in filling a firm's capability shortcomings. At times, firms' capability endowments or organizational attributes are not adequate or effective in developing every capability. At other times, the uncertain environment limits the development of all possible capability combinations. This makes markets for technology and value chain activities essential.

Participation in Markets for Technology

To illuminate how actors supplement their internal R&D, studies have noted the reliance on external sources in markets for technology. Although inter-firm collaboration and exchange are the most studied, technology sources are not limited to firms. Universities and scientists are key external sources of science and technology. For example, patents from MIT and Stanford were among the top-cited and licensed in the software encryption industry (Giarratana, 2004). Similarly, scientists in geographic proximity to the emerging industrial regions in agricultural biotechnology aligned their scientific projects to the interests of firms (Sohn, 2021). To foster the supply of scientific knowledge, firms can advocate for the creation of academic departments aligned with cutting-edge science in their industry, a practice employed by synthetic dye firms to strengthen organic chemistry departments in German universities (Murmann, 2003). Science-based collaborations are, however, prevalent in earlier stages, as the comparison between science-based alliances involving universities and technology-based alliances involving firms in the example of deep ultraviolet manufacturing in semiconductors illustrates (Kapoor & McGrath, 2014). Further, as another external technology source, public agencies and non-profit organizations in public-private partnerships can co-develop technologies with firms (Agarwal et al., 2021; Gross & Sampat, 2023; Rathje & Katila, 2021; Roy et al., 2019). However, the innovative outcome of public-private partnerships may be less effective than private collaborations, as in the example of antimicrobial drug development (Arslan, Vasudeva & Hirsch, 2024).

When markets for technology involve firms, licensing agreements, alliances, or acquisitions enable access to technological knowledge on the buyer's side. For example, when entering the biotechnology industry, established firms licensed patents from pioneering startups (Rothaermel & Boeker, 2008). When entering the networking switch industry, alliance portfolios that included repeated ties and

frequent changes provided firms with in-depth and diverse technologies (Lee, 2007). When entering the digital camera industry, alliances and acquisitions focused on product features, such as Kodak's acquisition to gain digital zoom technology or Polaroid's alliance to gain LCD screen technology, enabled firms to align products with the technology frontier (Chaturvedi & Prescott, 2020).

Even as the above examples show how actors add the requisite technological capabilities to their portfolio, vibrant markets for technology hinge on availability of sellers and supportive structures. By selling technology rather than final products to customers, firms who are sellers in markets for technology can capture economic value and contribute to the technology base of a nascent industry (Moeen & Agarwal, 2017). Such sellers leverage their attributes to serve as providers of component or process technologies (Rothaermel & Boeker, 2008; Wormald et al., 2021). These transactions require intellectual property rights protection and enforcement, plus effective technology evaluation and transfer mechanisms. Organizing structures for technology transfer and diffusion enable two or more-sided matching between technology partners. Examples include technology exchange and licensing structures in DARPA and NSF for the commercial Internet (Agarwal et al., 2021; Greenstein, 2015), in advocacy groups for HIV treatments (Maguire et al., 2004), in standard setting for optical disks (Joshi & Nerkar, 2011), and in digital medical diagnostic imaging (Lim et al., 2024).

Participation in Markets for Value Chain Activities

To illuminate how actors gain access to downstream and complementary assets from external sources, studies have noted the reliance on markets for value chain activities. The external sources often reside in adjacent industries that share similar value chain or ecosystem activities with a nascent industry. Some external sources can be component suppliers, as in the example of monitor display suppliers for the laptop manufacturing industry (Hoetker, 2005) or financial software providers in mobile money (Wormald et al., 2021), whereas other external sources can occupy downstream or complementary positions in the value chain and ecosystem, as in the example of brand owners of board games for the wireless gaming industry (Ozcan & Eisenhardt, 2009).

By forming alliances or pursuing an acquisition, firms often obtain downstream and ecosystem capabilities. For instance, in the medical imaging diagnostics industry, distribution agreements enabled

established firms to sell their innovative devices (Mitchell & Singh, 1992). In both software encryption and mobile money, commercial alliances enabled cross-country geographic expansion (Giarratana, 2004; Wormald et al., 2021). In agricultural biotechnology, acquisitions of seed breeders provided access to elite germplasm (Moeen & Mitchell, 2020). For startups seeking complementary assets, corporate venture capital investment can be a useful pathway (Alvarez-Garrido & Dushnitsky, 2016).

A notable aspect of markets for value chain activities is the co-specialization between the focal technology and the requisite complementary assets, the nature of which is often in flux due to ecosystem uncertainty in a nascent industry (Moeen et al., 2020). In turn, the supply of external capable sources at the outset for off-the-shelf purchases is limited. Coordination between firms and external sources then becomes key. Suppliers of power convertors for wind turbines regularly contacted turbine manufacturers to inquire about the specifications of turbine behavior and control algorithm, plus to inform them about constraints and suggest turbine design revisions (Malhotra, Schmidt & Huenteler, 2019). In the lithium-ion battery industry, suppliers of advanced material needed to consider the type of cathode coating processes used by lithium-ion battery cell and pack manufacturers before preparing and supplying cathode material (Malhotra et al., 2019).

Firms on the buyer's side of markets for value chain activities often interact with multiple external sources on the seller's side, thereby unveiling the need for a portfolio approach. There are benefits to maintaining a dynamic vertical scope in an uncertain nascent industry. This involves gradually strengthening the network of suppliers in the nascent industry and weakening it in the declining one, as effective supplier management in the reduced instruction set workstations industry illustrates (Afuah, 2001). Further, given the need for multiple types of value chain and ecosystem resources, firms can deliberately sequence their focus. For example, residential solar panel manufacturers noticed finance and installation as two ecosystem activities but waited to tackle each only after they became a bottleneck (Hannah & Eisenhardt, 2018). In other cases, firms can jointly consider their technological trajectory, when contemplating about markets for value chain activities. Agricultural biotechnology firms started with minimal alliances and licensing agreements to obtain elite germplasm during the early years of incubation stage. However, after they reached their desired technical milestones, they

subsequently intensified their efforts through numerous acquisitions of owners of elite germplasm during the later years of incubation stage (Moeen & Mitchell, 2020).

MODES OF PRODUCT MARKET AND NON-MARKET INTERACTIONS

In addition to the above leverage of markets for technology and value chain activities for capability reconfiguration, actors who seek to achieve their desired position in a nascent industry engage in product market interactions, non-market interactions, and market intermediation.

Modes of Product Market Interactions

Consistent with the long-standing focus of industry evolution studies, scholars have focused on product market interactions with customers. These studies have mostly considered firms, presumably, because endowments and inducements of firms prepare and motivate them for product markets.

Before firms can consider a mode of product market interaction, a prerequisite is the implicit step of product market entry, which entails reaching a resource portfolio that enables the development, delivery, and sales of a product to customers through the above efforts at internal development and participation in markets for technology and value chain activities. Accordingly, modes of product market interaction are linked to actors' attributes, as endowments differently influence each actor's capability generation and reconfiguration costs, thereby facilitating the pursuit of some product markets over others (Helfat, 1997). Product market interactions are also linked to how identities differently situate each actor's cognitive interpretation, thereby directing their attention to some product markets (Gavetti & Levinthal, 2000). Conditional on product market entry, scholars' analysis of product market interactions accounts for the uncertain environment. Unlike established industries, wherein exchanges in the product market can benefit from known technologies and product designs that are aligned with known customers' preferences, the nascent state of an industry with its technological and demand uncertainties poses challenges for product market interactions.

Technological uncertainty affects modes of product market interaction because firms commonly have to consider multiple (competing) trajectories, some of which may be created and envisioned by their own entrepreneurial endeavors. Studies examining a firm's technological design choices have mainly taken two approaches. The first, a focus on dominant design, takes the technology management

perspective that an initial proliferation in technical designs ends with a convergence in features and architecture in a dominant design (Anderson & Tushman, 1990; Murmann & Frenken, 2006). In doing so, these studies have assessed the adherence of a firm's technical design choices to the ex-post dominant design (Bayus & Agarwal, 2007; Eggers, 2016; Garud & Rappa, 1994; Rosenbloom & Cusumano, 1987; Roy et al., 2019; Vincenti, 1994). In the personal computer industry, firms' product portfolios embodied the contemporary dominant design of Intel x86 or deviated from the standard with the most recent microprocessors. This was associated with differences in technical expertise, captured with the dichotomy of startups versus established firms (Bayus & Agarwal, 2007). In the flat panel display industry, before and after liquid crystal displays (LCD) became the dominant design, firms' products could switch between LCD and the alternative plasma display design (Eggers, 2016).

The second approach, a focus on contextualization, takes a broader and unrestricted view in examining a firm's product choices by leveraging context-specific knowledge of a product's attributes to examine variation in the technical features. For example, in the magnetic resonance imaging equipment industry, as firms spent an average of 5 years and \$150 million for designing a new product, their products varied in embodied permanent, resistive, or superconductive magnet types combined with low, medium, high field strength (Martin & Mitchell, 1998). Digital camera offerings varied in optical or digital zoom, movie clips, and removable storage chips (Benner & Tripsas, 2012), and endurance race cars included different types of engines, flywheel, battery, or supercapacitor (Aversa & Guillotin, 2018). Each combination of product features sheds light on how firms can interact with customers in the product market, via different resultant functional tradeoffs.

Shifting to demand uncertainty's role in product market interactions, the dual assumptions of demand heterogeneity and uncertainty imply that customers' diverse functional and price preferences separate them into customer segments (Adner & Levinthal, 2001; Rogers, 1962), but both types of customer segments and specific customer preferences are not yet fully known (von Hippel, 1986). Product market interactions hinge on two choices. The first choice is the sequence with which to target alternative segments. As an illustration, in the solid-state lighting industry, the early customer segments included calculators, wristwatches, car tailgates, and traffic lights, each requiring different

light colors and intensities. Instead of targeting each segment simultaneously, firms started with calculators and wristwatches which served as a stepping stone to other complicated customer segments (Sanderson & Simons, 2014). Likewise, in the legalized cannabis industry that spanned across medical and recreational use, firms' focused on the medical segment to learn from customers' reactions (Hsu, Kovacs & Kocak, 2019) and built legitimacy before engaging in the contested recreational segment (Lashley & Pollock, 2020). The second choice is the breadth and number of targeted customer segments. In the commercial drones industry, wherein drones are used by distinct customer segments in photography, inspection, surveying, agriculture, and supply chain, firms varied in the choice of targeting singular customer segments with customized products or multiple segments with a generic product, which in turn stemmed from firms' differences in user experience and demand knowledge of customer segments (Shermon & Moeen, 2022).

The combined implications of technological and demand uncertainties have been incorporated in studies of how firms adapt through their product market interactions. The sequential evolution of firms' portfolio of products embodies how a number of distinct features and their changes over time represent their experimentation in light of uncertainty, as documented in the early car industry (Pillai et al., 2020). The speed of such change in features across a firm's products over time is another dimension of product market interactions, as in optical disk drives (Khessina & Carroll, 2008), solar panels (Furr, 2019), and LED light bulbs industries (Lu, Lee & Coles, 2023). Moreover, such speed of product adaptation is related to the underlying endowments and identities of firms. Not only was firms' use of crystalline versus amorphous silicon in solar panels associated with differences in access to complementary assets (Kapoor & Furr, 2015), the greater speed and scale of firms using silicon technology relative to thin-film technology resulted from their prior knowledge and adaptability when leveraging demand and supply synergies (Guerra & Agarwal, 2024). In optical disk drives, speed was associated with differences in agile and authentic identities, captured with the dichotomy of startups versus established firms (Khessina & Carroll, 2008).

Overall, at the intersection of each new technical design and customer segment, a product market interaction is an economic experiment that reveals knowledge about technological feasibility and

customer desirability in the nascent industry (Moeen et al., 2020; Rosenberg, 1992).

Modes of Non-Market Interactions

Using sociology and organizational theory lenses, scholars have focused on non-market interactions, involving both firm and non-firm actors. Further, non-market interactions have primarily been highlighted to create social legitimacy to address the intersection of demand and institutional uncertainties and fill regulatory voids to address institutional uncertainty. Taken together, non-market interactions have important consequences for market structures in emerging industries.

Non-Market Interactions to Address Social Legitimacy. Non-market interactions for social legitimization commonly consist of two approaches: discursive interactions and collective action.

Discursive interactions involve conveying a product's meaning to customers and audiences to create shared socio-cognitive interpretations and labels as the basis for product market exchange (Granqvist, Grodal, & Woolley, 2013; Wry, Lounsbury & Glynn, 2011).⁷ Firms utilize discursive interactions about a product's meaning through linguistic features and images. For example, to increase social legitimacy of the nascent roll-film cameras, Kodak consistently used messages and visuals about "picture ahead" and "a holiday without a Kodak is a holiday wasted" near vacation spots. Over time, these discursive interactions could position photography as an everyday activity for which a portable amateur camera was essential and also changed socio-cultural behaviors toward seeking "Kodak moments" (Munir & Phillips, 2005). Further, the use of analogies tied to familiar references is a common discursive interaction, as affiliation with known labels and functionalities can make the unknown nascent industry familiar and acceptable (Rindova & Petkova, 2007). For instance, an online shopping startup used "shopping cart" from the offline shopping context (Santos & Eisenhardt, 2009), while ride hailing platforms used "taxi" to induce familiarity (Aversa, Huyghe, & Bonadio, 2021). This discursive strategy, however, is contingent on the power and social legitimacy of the familiar analogy. For example, firms used "e-cigarette" to induce familiarity and show the new product as a virtuous alternative to cigarettes. Instead of the intended discursive outcome, the label invoked the stigma

⁷ The variety of labels for discursive interactions across scholarly conversations include cultural entrepreneurship and narratives (Wry et al., 2011), category innovation (Pontikes, 2022), or rhetorical strategy (Suddaby & Greenwood, 2005).

affiliated with cigarettes (Hsu & Grodal, 2021). In turn, to account for the diverse and evolving reactions of different audiences, other studies have noted discursive interactions that use lenient labels and fuzzy descriptions (Pontikes, 2022) or experimental labels (Younger & Fisher, 2020).

Additionally, non-firm actors also play an important role in discursive interactions. Industry associations or an informal group of industry firms can explicitly or implicitly advance a collective label for the nascent industry, as was signified in the case of two early satellite radio entrants (Navis & Glynn, 2010). Further, users and user communities can suggest analogies and labels. In the example of business computers, “machine” or “brain” as alternate analogies in IBM’s discursive strategy stemmed from descriptions by employees in insurance companies who were computer users (Bingham & Kahl, 2013). In the legalized cannabis industry, activists and advocates joined dispensary owners to use discursive interactions that linked cannabis to healing and reduced the stigma (Lashley & Pollock, 2020). Of note is the role of media in discursive interactions (Rindova et al., 2007). Not only does media’s positive and repeated coverage increase social acceptance of products (Kennedy, 2008; Lee & Paruchuri, 2008; Schultz et al., 2014), but also media’s active interpretive role matters. For example, when a new culinary science-based style appeared, media took cues from this style’s connection to science, unusual cooking equipment, and atypical ingredients. In turn, against the opposition of chefs, media’s discursive interaction elevated “molecular gastronomy” as the label (Slavich et al., 2020).

Collective action, the second approach for social legitimization, involves a mobilizing structure that leverages dispersed participants towards a common goal, often within a social movement (Pacheco, York & Hargrave, 2014; Lee et al., 2018). While they may not always have formal leadership, collective action generally has an initial organizer and subsequent coordinators. Studies have identified mission champions (Maguire et al., 2004), industry associations (Lounsbury et al., 2003), and non-profit organizations and advocacy groups (Hiatt et al., 2009; Levy et al., 2006; Weber et al., 2008) that assume the founding or leadership role in a social movement. Further, the legitimizing scope of non-market interactions via social movements spans to all actors in a nascent industry. The interactions can target customers to gain support and popularity (Hiatt et al., 2009; Weber et al., 2008), firms to entice investment and commitment (Durand & Georgallis, 2018; Sine & Lee, 2009), and scientific

communities to tackle knowledge gaps (Maguire et al., 2004; Pacheco et al., 2014).

Non-Market Interactions to Garner Regulatory Support. Nascent states exhibit regulatory voids and incipient industry-specific institutional structures. Within this context, non-interaction is one possibility, as firms in the incubation stage and in the absence of visible commercial products may well try to remain unnoticed and circumvent regulations. In fact, a few firms in the personal genomics industry operated covertly and out of sight of regulatory bodies for as long as possible, while others lobbied for regulations (Gao & McDonald, 2022). As industries move past commercialization, non-market interactions gain importance in shaping or navigating legal frameworks (Aversa & Guillotin, 2018). Moreover, firms can contribute to the co-creation of regulatory frameworks with public agencies. For example, mobile money platform providers often worked with regulators across different countries to create industry-specific policies that enabled these ecosystems to develop (Wormald, 2024), and firms in the dietary supplement and cell-cultivated meat industries enlisted a favorable legal authority (Gao, DeSantola & Gheihman, 2024; Ozcan & Gurses, 2018).

Other non-firm actors also engage in non-market interactions with regulators, as channels for mobilizing supportive coalitions of users, industry associations, and social movements. Firms and communities of users can work together to put pressure on legislators, as in the case of ridesharing where firms engaged constituents to help create favored legal frameworks in cities where mayoral election candidates vied against each other as they sought voters' support (Paik et al., 2018). To endorse regulatory compliance in agricultural biotechnology, firms often garnered third-party support of farmers' industry associations (Hiatt & Park, 2013). Social movements also advance their regulatory interests. In solar energy, fueled by societal concerns regarding climate change, such environmental coalitions lobbied for technology grants and policies (Guerra & Agarwal, 2024), whereas other environmental activists initiated lawsuits to resolve legal boundaries (Durand & Georgallis, 2018).

In turn, regulators themselves, due to either their inducements or pressure from above non-market interactions, create policies that speed up or slow down industry emergence. Although at face value, their enacted regulations address institutional uncertainty, it is the interdependent enabling or stifling effect on the resolution of technological, demand, and ecosystem uncertainties that turns

crucial. For example, in renewable energy, regulatory mandates and provision of grants to stimulate technological investment have been key for addressing technological and ecosystem uncertainties in solar (Guerra & Agarwal, 2024), whereas regulatory mandates through the creation of the Renewable Portfolio Standards have been crucial for tackling demand uncertainty and redirecting electricity generation and consumption (Dutt & Joseph, 2019). In contrast, restrictive regulations for product approval and compliance, despite clarifying the institutional environment, can create a mixed effect and hinder investments for reducing other uncertainties. For instance, regulations of autonomous vehicles intended to increase road safety and cyber security risks through mandating testing permits, driver monitoring systems, and limited driving zones. The state-level variation in restrictiveness of these regulations influenced the extent to which firms invested in experimental autonomous technologies and local actors built ecosystems (Bao & Zhang, 2024).

Modes of Market Intermediation

Market intermediation interactions act as interfaces for facilitating exchange and involve the collection, assimilation, and provision of information about a nascent industry and its product (Sharkey, Kovacs & Hsu, 2023). Studies have focused on three aspects of market intermediation to mitigate information asymmetry across different audiences with incomplete and divergent information and expertise for assessing and interacting with a new product.

The first market intermediation focuses on setting evaluation criteria and measurement systems for sensemaking and assessing a new product. Evaluation criteria can guide customers' purchase of an unfamiliar product and also provide heuristics for adherence by firms. For example, in the absence of metrics and sources to evaluate Indian art, Saffronart and other auction houses collaborated with art museums, critics, and magazines to develop a shared measure of art originality (Khair & Wadhvani, 2010). Other evaluation criteria relate to a firm's interactions with its financial resource providers. Similar to customers, prospective shareholders do not always know about technological or demand trends. Further, because of limited revenue and extreme uncertainty in nascent states, financial stakeholders (shareholders, analysts, venture capitalists) cannot rely on conventional financial metrics. Financial evaluation criteria are often created or conveyed by security analysts, who publish recurrent

reports, offer recommendations, and articulate their rationale (Benner, 2010). Although the evaluation criteria may initially reflect a resistance as they are rooted in the visible revenue and familiar processes of an established or obsolescing industry, securities analysts subsequently develop and adapt industry-specific criteria according to the emerging trajectory of the focal nascent industry. For example, the evaluation criteria of access line performance or number of subscribers commonly applied to copper wireline telecommunication industry, but not to the nascent fiber optics telecommunications industry. Thus, securities analysts developed new evaluation criteria including growth in high-speed internet, voice-over-IP services, or pay-per-view video (Benner & Ranganathan, 2017).

The second market intermediation focuses on certification. Often in tandem with establishing evaluation criteria for an industry, actors can certify the adherence and compliance of products to the criteria. Third-party certification often comes into play, particularly when the evaluation criteria are unobservable or non-measurable by stakeholders, or when independent recurrent evaluation is too costly. For example, the California Certified Organic Farmers assessed producers' adherence to manufacturing practices in the organic food industry. For firms, it credibly clarified what it required to produce organic food, and for customers, it provided the desired assurances for their purchase (Lee et al., 2017). Similarly, the LEED certification process enabled construction firms, real estate agents, and homebuyers to have a unified recognition of green buildings (York, Vedula & Lenox, 2018).

Finally, market intermediation also consists of technology standard setting. In a nascent industry, technological uncertainty implies a system of unknown and changing technologies. Technology standards often provide a unified guideline about how components of a technology system interact (Leiponen, 2008). Standard setting bodies, involving a combination of firms, user communities, industry associations, non-profit organizations, and regulatory bodies, facilitate and enforce the interactions for agreeing upon one standard, and the concomitant legal or intellectual property requisites (Simcoe, 2012). This intermediation promotes technologies with interoperability and compatibility, so that firms can accelerate their technology and product development along less uncertain trajectories and customer can easier adopt products. Standard setting can facilitate production and upstream technology partnerships for growth of each nascent industry, as in keyboards

(David, 1985), flight simulators (Rosenkopf & Tushman, 1998), computing (Ranganathan & Rosenkopf, 2014), Internet (Greenstein, 2015), and communications equipment (Toh & Miller, 2017). Moreover, such intermediation can result in ecosystem innovation for platforms that help reorganize and reconfigure interactions between erstwhile technology vendors, product manufacturers, and end customers to take advantage of digitization, as in the medical diagnostics industry (Lim et al., 2024).

A key aspect of market intermediation interactions across these studies is the process of reaching a consensus about the evaluation criteria and standard, which is described as a multi-stage, multi-actor process. For example, despite securities analysts' role in conveying evaluation criteria, firms could influence the criteria. In the early days of the Internet, securities analysts and shareholders were subject to recurrent references to online engagement metrics such as website traffic, visitors, and users in firms' financial prospectus statements, in conjunction with explanations for why they predict future revenue potential (Harmon, Rhee & Cho, 2023). Diverse firms that explore a nascent industry can also contest a single evaluation criterion. In the nascent online retail industry, incumbents from brick-and-mortar retail versus diversifying firms from information technology advocated revenue- versus growth-based criteria (Benner & Ranganathan, 2013). A similar trend holds in the certification process. In the sustainable coffee industry, different firms, non-profit organizations, and advocacy groups started with the aim of achieving a certification process that navigates both environmental sustainability and ethical labor practices. However, over time, the negotiation and contestation process led to a change in involved actors and the resultant standard (Levy et al., 2006). The same holds for technological standards, wherein due to the interplay of cooperation and competition, involved actors often balance their private interest with the industry's needs (Dokko & Rosenkopf, 2010; Simcoe, 2012; Toh & Miller, 2017). In the computing industry, voting patterns in the International Committee for Information Technology Standards stemmed from each firm's position in the technology versus commercialization networks, when semiconductor firms, hard disk manufacturers, and software developers opposed and delayed standards against their interests (Ranganathan & Rosenkopf, 2014). Similarly, in the medical diagnostics industry, early reluctance by the manufacturing firm to create interoperability was overcome by the Radiology Association's insistence for a common standard and

invoking of governmental mandates as a credible threat (Lim et al., 2024).

OUTCOMES

The engagement of heterogeneous actors and the iterative steps that they undertake result in industry-level outcomes for industry creation, which can also have heterogeneous implications for actor-level outcomes for different actors, and society-level outcomes for different stakeholders.

Industry-level Outcomes

Almost all studies in our review have covered successes rather than failures at this level of analysis: the very use of the label “industry” denotes that these industries have successfully emerged to an ultimate stable state and thus merit the label. Indeed, it may well be that their stable existence and visibility induced scholars to consider them as subjects of research investigations, and their transition out of a nascent state enabled inference of trends and processes of industry creation from them.

Yet, industry creation does not manifest as a dichotomous outcome. A simultaneous look at different studies reveals variations in the time and place of each industry’s emergence or lack thereof. For example, despite nearly 30,000 registered electric cars in the United States in the 1910s, their production and consumption remained slow and scarce for over a century (Kirsch, 2000), even as gasoline powered cars took off. Only in the 2010s did the electric cars industry grow to at least 68 countries (Dutta & Vasudeva, 2024) with 50% of the adoption in China (Helveston et al., 2019). In mobile money, the lack of consensus among global banks and mobile operators between 2006 and 2011 resulted in non-emergence of chip-based payments (Ozcan & Santos, 2015). Meanwhile, mobile money platforms based on software rather than chips became a viable industry with nearly 30 digital platforms in at least 91 countries, including in Africa, central and south Asia, and Latin America by 2017 (Wormald et al., 2021, 2023). Although two smart city projects in the early 2010s in the United States were abandoned (Zuzul, 2019), the Smart Nation Initiative launched in 2014 succeeded in revolutionizing Singapore to a smart city (Cinar et al., 2024). Thus, the specific time window and geographic region of interest can matter for analyzing industry-level outcomes.

Further, the commercial viability of industries is linked to the twin outcomes of the temporal milestone of sales takeoff and the knowledge milestone of sufficient reduction in uncertainties (Moeen

et al., 2020). In turn, some studies have assessed industry-level outcomes as the onset of each milestone and duration of industry stages. For example, in light of the average incubation duration as 26 years, the time between the first concept to commercial products in laser printers, automatic teller machines, and cellphones was seven, 10, and 11 years, respectively (Golder, Shacham & Mitra, 2009). The shorter duration can reflect the quicker resolution of uncertainties, in turn favorable outcomes.

For industries that emerge, another set of outcomes pertain to industry-level structural features such as technology profile, downstream applications, and geographic scope. For technology profiles, studies have highlighted dominance. For example, as flat panel displays became a viable industry, liquid crystals prevailed over gas plasma as the focal technology (Eggers, 2014). In solar energy, silicon dominated over thin film technology (Guerra & Agarwal, 2024). Studies have also focused on pertinent downstream applications. For instance, plant genetic modification succeeded in attracting farmers to increase agricultural productivity, instead of food producers to enhance nutritional content (Kirsch, Moeen & Wadhwani, 2014). In terms of geographic scope, many studies note regional agglomeration effects. For instance, car manufacturing was concentrated in Detroit (Klepper, 2007), information and communication technologies in Virginia (Feldman, Francis & Bercovitz, 2005), dialysis equipment in central Italy (Ferriani, Lazerson & Lorenzoni, 2020), semiconductors in California and Massachusetts (Kim, Shaver & Funk, 2022), motorsports in Oxfordshire, England (Aversa et al., 2022b), and ready-to-wear designer clothes in Milan (Pillai & Giacomini, 2024).

Actor-level Outcomes

Although the nascent industry provides the context for actors to fulfil their financial and non-financial inducements, actors within the same industry can vary in actor-level outcomes. In studying actor-level outcomes, the focus has been on firms. Several studies examining the survival-dissolution dichotomy in a variety of contexts have underscored that not all firms stay long in the industry, even when the industry reaches commercial viability (Bayus & Agarwal, 2007; Carroll et al., 1996; Dobrev & Gotsopoulos, 2010; Klepper & Simons, 2000; Pillai et al., 2020). Among the dissolved firms, studies have noted that some firms capture economic value in markets for technology and corporate control (Arora & Nandkumar, 2011; Furr & Kapoor, 2018; Moeen & Agarwal, 2017), an important value

capture mode for scientists and users who dedicate themselves to novel problem-solution nexus (Agarwal & Shah, 2014). Among the surviving firms, value capture in markets for product can result in outcomes such as market share (Chen et al., 2012; Eggers et al., 2020; Mitchell, 1991; Tripsas, 1997) and financial return (Rothaermel & Hill, 2005). Moreover, evolving with new technologies and industries enables strategic renewal and continued relevance (Agarwal & Helfat, 2009). For firms within industry associations and expert committees, outcomes can be the alignment between their financial interests and the industry's direction (Ranganathan & Rosenkopf, 2014; Schilling, 2002).

Based on the few studies that have examined outcomes for non-firm actors, success aligns with the extent to which their non-financial inducements were realized, and their actions created the desired novel solutions. For universities and scientists within them, outcomes include the application of novel principles that were discovered to satisfy a key mission (Mowery & Rosenberg, 1991), as illustrated in many of studies included in our review (e.g., Sanderson & Simons, 2014; Sohn, 2021). For pioneering users and their communities, outcomes include creation of products and services that tend to their unmet needs (Aversa et al., 2022a; Baldwin et al., 2006; Mody, 2006). Outcomes for mission champions, advocacy groups, and non-profit organizations similarly relate to the fruition of their cause and values through a desired industry trajectory (Lounsbury et al., 2003; Sine & Lee, 2009).

Society-level Outcomes

The emergence of industries, the resultant products and new structure of market exchange has broader society-level outcomes. Beyond specialization and gains from trade through which established industries benefit society, industry creation leverages the process of Schumpeterian growth, wherein the application of information and the increase in human knowledge enable technological progress, expand socio-economic opportunities, and result in institutional changes (Rosenberg, 1982; Mokyr, 1992). Within the process of technology-induced endogenous economic growth (Romer, 1990), individuals and organizations are the engines for creative construction (Agarwal, Audretsch & Sarkar, 2007). Such entrepreneurial activity often improves upward mobility (Quadrini, 2000), leveraging markets as engines for poverty alleviation and wealth generation (Stephan et al., 2016; Sutter, Bruton & Chen, 2019). Further, job creation and spillover to other sectors can lay the groundwork for national

or regional competitiveness (Malerba, 2002; Mowery & Rosenberg, 1991).

Specific to nascent industries studied by scholars in our review, each has played a vital role in enhancing quality of life, as they have fulfilled the respective societal needs of their time. For example, societal impact manifests in studies of leisure activities such as art (Anthony, Nelson & Tripsas, 2016; Khaire & Wadhwani, 2010), sport (Aversa et al., 2022a; Baldwin et al., 2006; Munir et al., 2021), and entertainment (Klepper & Simons, 2000; Ozcan & Eisenhardt, 2009). Medical advancements that increase life expectancy appear in studies of diagnostics (Gao & McDonald, 2022; Mitchell, 1989, 1991), medical devices (Garud & Rappa, 1994; Ferriani et al., 2020), and pharmaceuticals (Arslan et al., 2024; Maguire et al., 2004; Sosa, 2009; Vakili & McGahan, 2016). Affordable energy has provided access to essential services, enabled comfort, and sparked productivity, which has been the subject of studies about electrification (Hargadon & Douglas, 2001), petroleum (Helfat, 1997), solar energy (Furr, 2019; Georgallis et al., 2019; Guerra & Agarwal, 2024), wind energy (Sine & Lee, 2009), biofuels (Qian et al., 2012), and conservation practices (Lu et al., 2023; York & Lenox, 2014). Other studies have focused on a stable and nutrient-rich food supply, by increasing agricultural productivity (Moeen & Agarwal, 2017) or catering to diverse culinary preferences (Slavich et al., 2020; Weber et al., 2008; Woolley et al., 2022). The increase in connectivity and mobility has increased financial inclusion in developing countries (Wormald et al., 2021), unlocked the flow of information, people, and goods worldwide, as captured in studies of telecommunications (Benner & Ranganathan, 2017; Cattani, 2005; Eggers & Kaplan, 2009; Lee, 2007) and transportation (Argyres & Mostafa, 2016; Carroll et al., 1996; Engler et al., 2020). National security innovations safeguarding citizens and upholding peace have appeared in studies of radar (Agarwal et al., 2021; Gross & Sampat, 2023).

Although studies highlight positive outcomes, we note reasons for negative impact. First, for stakeholders whose capabilities and investments become obsolete, the transition from an obsolescing to a nascent industry is neither guaranteed nor free of adversities. Second, despite the positive inducements of industry creators, the societal benefits of an industry hinge on how individuals choose to utilize its products and services. For example, drones can be exploited for illicit activities such as weapon delivery to prisons for harm, even as they play a vital role in saving lives and delivering blood

and medical supplies to remote areas for positive societal impact. Third, no single industry can concurrently tackle multiple competing unmet needs, nor can it fully avoid unintended consequences at the outset. For instance, the nascent carbon capture industry seeks to mitigate air pollution from the industrial and transportation sectors, whereas the industry's storage of captured carbon in oceans and geologic layers can lead to groundwater contamination, marine life disruption, and seismic risks. Nonetheless, the recurring creative cycles of emergence across industries imply that as unintended negative aspects of one industry are revealed over time, society's awareness of the drawbacks often fuels the next cycle of discovery and creation aimed at finding solutions. This process ultimately propels society forward while mitigating long-term negative impacts.

A CONCEPTUAL FRAMEWORK FOR THE GENERATIVE ROLE OF ACTORS

We offer an integrative view of industry creation, building on the above in-depth discussion of each theme. Insights from studies in our review have informed different pieces about who engages in a nascent industry, why and when they do so, what they bring and add to the industry, and how they interact. In conjunction with Figure 1 that shows sequential engagement of diverse actors, our integrative framework, depicted in Figure 2, highlights the simultaneous linkages across themes within any one nascent stage. Together, these enable the inference of the iterative engagement of diverse actors in the process that results in industry creation and emergence.

The framework builds on the premise in foundational studies that at the outset, a nascent industry as heralded by its incubation trigger exhibits the highest level of uncertainty related to the dimensions of technology, demand, ecosystem, and institutions. Left unresolved, it is fallow ground. An industry can progress over its early life cycle only if and when reduction in uncertainties enables its commercial viability, and subsequently, its scale. The core insight of our framework is that the starting point for industry creation, and its continuing impetus, stems from actors who engage with a nascent industry.

The Actor-level Iterative Process

From the perspective of a single actor, whether and when each actor engages with the industry and allocates their economic effort hinges on the match between their attributes and the industry's uncertain state. This results from each actor's judgment about the extent to which their endowments

and identities can contribute to the reduction in pertinent uncertainties, and their inducements can be realized in the course of the industry creation.

In terms of the undertaken actions, an actor's endowments, identities, and inducements shape the distinct direction and nature of the initial actions, often due to the unique capability fit or cognitive attention. Thus, rather than each actor engaging in all actions within the entire menu required for addressing the various dimensions of uncertainty, there is selective effort by each actor. Our synthesis reveals that, much like different perceptions of the proverbial elephant based on unique vantage points, each actor undertakes a different set of actions, and in so doing, gains useful knowledge and contributes to the reduction of a distinct uncertainty.

While the reviewed studies often examine each action depicted in Figure 2 separately, our synthesis points to the interdependent nature of these actions. We posit that the choice and direction of product market, non-market, and intermediation interactions guide subsequent reconfiguration of suitable capabilities needed to undertake those actions. At the same time, we conclude that the choice and path of capability reconfiguration reveal what product market, non-market, and intermediation interactions are feasible and worthwhile. Thus, from the perspective of each actor, reconfiguration actions become either preparative for initiating another mode of interaction, or reactive for tackling an obstacle in continuing an existing mode of interaction.

Taking a perspective of each separate actor and as a whole, Table 3 integrates across studies and themes in the preceding sections. This illustrates how in addition to actors' efforts enabling them to develop their own knowledge base, the efforts reduce uncertainty at the industry level in the dimension they focus upon. For example, when the focal actor complements internal efforts for capability generation with market-based interactions (product, technology and value-chain) for evolution and reconfiguration of their capabilities, these actions also reduce industry level uncertainty in technology, demand, and ecosystem dimensions. When the focal actor invests effort on non-market interactions, these interactions enable addressing demand and institutional uncertainties. Similarly, efforts at market intermediation help address all four dimensions.

Regardless of whether these actions represent market or non-market interactions, or whether

these actions involve markets of product, technology, or value chain activities, they build the foundation for subsequent economic value capture and the realization of actors' inducements. The process model depicted in Figure 2 implies a dynamic feedback loop that updates the industry state and sets in motion the process for the subsequent stages. The processes in play within each antecedent stage depicted in Figure 1 affect the subsequent stages at the actor level in two distinct ways. First, at the onset of each stage, each actor reassesses whether to maintain their engagement within the nascent industry. Second, the collective efforts of the various actors build the industry state of knowledge across various dimensions to determine a new set of actions for each actor, based on the extent to which the updated state aligns with their reconfigured endowments, identities, and inducements.

The Multi-Actor and Multi-Stage Process

While the above steps focused on the process from the perspective of a focal actor and their implications at actor and industry level, corollary insights emerge for the multi-actor industry level process. Referring once again to the proverbial elephant, the immense and multi-dimensional uncertainty renders it almost impossible for a single actor to be the sole omniscient industry creator, regardless of their limitless power and resources. Indeed, industry creation and emergence is predicated on a broad set of firms and non-firm actors engaging within and across different points of time, empowered by diverse endowments and identities and motivated by their inducements. Accordingly, our conceptual framework infers industry creation as an iterative process wherein numerous diverse actors engage in it in parallel or in sequence, invest effort in different actions and resolve different uncertainties. When doing so in each stage depicted in Figure 1, each actor directly or indirectly draws on what other actors before them have achieved in the preceding stage, and each actor contributes to what other actors after them can draw on in subsequent stages.

This multi-actor emergent division of labor is both necessary and efficient. Because actors vary in their attributes, different sets of actors with unique endowments and inducements enter at different times, often separated along early industry stages of incubation, firm takeoff, and sales takeoff, each with different uncertain states. At each point in time, the nascent state of an industry represents the available knowledge related to the dimensions of technology, demand, ecosystem, and institutions;

this also implies remaining knowledge gaps and uncertainties in these dimensions. In turn, different actors face different levels and types of uncertainty, deserving of actors' reliance on a different set of endowments and inducements. These endowments and inducements also shape actors' choices of mode of interaction suggesting that different actors will face different opportunities for industry-level value creation and actor-level value capture. For example, an academic startup endowed with scientific expertise and induced by curiosity can find tackling technological uncertainty during incubation stage fruitful for selling patents in markets for technology. Although this path may not apply to an incumbent with complementary assets, an incumbent firm can instead find tackling ecosystem uncertainty during sales takeoff stage fruitful for building scalable value chains and transactions in markets for product. Here, in addition to their initial attributes since the time of first engagement, the evolving capabilities of actors based on internal capability development and participation in markets for technology and value chain activities also influence the direction of their actions. Further, despite the wide range of possible actions, not all actors are equally likely to undertake them, largely because they are informed and impacted by their initial and evolving attributes. For example, although the institutional knowledge of industry associations and media may position them to mitigate social legitimacy concerns, the demand knowledge of users and user communities may position them to identify new use applications. Overall, diverse combinations of endowments and inducements position different actors for different actions.

This is how and why the diversity in the attributes of actors who engage with the nascent industry is critical for our conceptual framework. In an uncertain context, the ultimate direction of an industry and the precise actions needed for its realization cannot be known ex-ante. Each actor's endowments, identity, and inducements set in motion a unique direction in the uncertain industry, each acting as an economic experiment, whose validation or refutation provide valuable information. In turn, this diversity in attributes and the resultant creative diversity in actions enable actors to collectively advance and experiment a wider set of imagined opportunities, for the creation and progression of a nascent industry. The impactful diversity for such collective experimentation stems from the diversity in actors' attributes, which serves as the principal insight of our conceptual framework.

When these actions culminate in sufficient knowledge generation and uncertainty reduction, the nascent industry often reaches commercial viability. This creates a context where actors can achieve their desired outcomes consistent with their financial and non-financial inducements, while also supporting broader society-level outcomes for prosperity, growth, and enhanced quality of life.

RESEARCH OPPORTUNITIES AND DIRECTIONS

We next elaborate on research opportunities, corresponding to each theme arising in our review.

The Incubation Stage of Industries

While our review could rely on hundreds of studies examining an impressive range of industries to develop insights on post commercialization stages, we gleaned the insights on industry incubation only from the relatively few that made this stage the explicit focus of their investigation. Additional research, including replications and extensions, can inform our knowledge base about this formative stage, including which findings are generalizable principles, and which findings are contingent on the contextual factors of each industry. Investigation of the temporal duration, intensity and nature of investments, interactions between firms and non-firm organizational forms, and actions for resolving uncertain dimensions are among understudied areas. Such focus can reveal interim milestones within the incubation stage and alternative pathways across industries.

To the extent that new scientific principles may underpin several industries (e.g., biotechnology principles applied in medicine, food, or agriculture related industries), future studies could examine the simultaneity or sequencing of incubation of multiple industries drawing on these principles. Instead of looking at these applications in isolation, doing so would shed light on how and why some industries are incubated before others, or how industries incubated later draw upon the knowledge of antecedent industries drawing upon the same base principles. Moreover, given the formative role of actors who engage in the incubation period, future research can examine how sequential incubation is informed by actor-level sources of heterogeneity and how efforts to develop application-specific knowledge are constrained or enabled as carriers across industries. This potential for interdependence across industries can explain what factors accelerate or slow down their creation and emergence.

Current incubation studies start with singular triggers of scientific or unmet need. Future research

can explore mixed-trigger contexts where both are at play. Such studies can uncover the processes where scientific and use-driven principles jointly shape the industry. In doing so, future research can relax the assumption that links specific triggers to a subset of actors with congruent endowments and inducements. Studies about triggers of scientific discovery tend to focus on the technical expertise of actors who seek to apply their inventions, whereas studies about triggers of unmet needs tend to focus on the demand knowledge of actors who seek to satisfy their needs. Instead, future studies can emphasize the whole range of actors whose endowments are not restricted to the initial trigger.

Future research can incorporate the incubation stage into its path-dependent explanations about industries' later stages. The structure of organizations, value chains, and ecosystems may have been formed during incubation, calling to question some inferences drawn from post-commercialization observations. For example, research on incubation reveals that technologies are not monolithic, but represent an integration of component knowledge within systems, and the heterogeneity among actors reflects a distribution of requisite prior knowledge of these components across actors. By ignoring the incubation stage, scholars may have discounted these early actors, their technology, market, and non-market interactions. Future research can assess the extent of a potential overestimation of the role of post-commercialization actors and value creation and capture choices.

Heterogeneity in Actors and Their Attributes

Our framework suggests that the locus of industry creation is dispersed across actors, as each actor's unique attributes unleash variations in actions for tackling uncertainties. Rather than focusing on one actor at a time, future studies can consider the multiplicity and interdependency of actors. To begin with, it is valuable to document what types of actors, with what agency, intensity, and roles, are present and absent from the nascent stages. This can enable interpreting whether single-actor studies truly represent the absence of other influential actors from the industry creation process versus the omission of other actors from the study's research design. For conceptual lenses that prioritize firms as principal actors, considering non-firm organizations can be valuable. Similarly, for those that privilege the social and public sectors, emphasizing private enterprises can provide a fuller picture.

The imbalances in the scholarly attention to different attributes of actors point to opportunities

for systematic mapping of all actors' endowments, identities, and inducements. In contrast to the enduring insights about firms' resources and capabilities, questions remain regarding non-firm actors' endowments. Future studies can examine which capabilities non-firm actors bring to the industry, so that we can also investigate how these endowments direct their capability reconfiguration, plus market and non-market interactions. Further, in the absence of explicit attention to all actors' inducements, an unsubstantiated assumption separates inducements of firms and non-firm actors along private versus public interests. To challenge this assumption, another research opportunity relates to non-financial inducements that attract firms to new industries, for example, what these inducements are, how they interact with financial inducements, and how they impact firm outcomes, engagement with other actors, and the overall trajectory of the industry. Likewise, to assess the alternate facet, future studies can explore private benefits, financial or otherwise, that draw non-firm actors to an industry.

Actors' engagement may also be nested within different levels of analysis. For instance, firms act on their own but may also join industry associations and social movements to act as part of a collective. Similarly, individuals may create firms, or they may operate as scientists within universities, as champions within firms and social movements. Whether actors decide to act alone or within collective organizational forms may reveal contrasting market and non-market strategies at different levels of analysis. Future studies can examine the antecedents of the decision to engage with the new industry alone, within a collective, or in both ways. For example, identity and inducements may imply a preference for occupying a role, while capabilities may impose constraints on this choice.

Co-evolution of Actors' Capabilities and Interactions

Although actors' endowments often come as their capability inheritance from prior contexts, our review underscores their continued dynamic adjustment to the evolving context. Focusing on firms, future studies can investigate capability reconfiguration modes that not only go beyond internal development, alliances, or acquisitions, but also showcase complementarities and substitutions among them. For example, human capital internal investment, within-firm redeployment, and inter-firm mobility can help the reconfiguration of capabilities embodied in individuals. Further, studies can shed light on the mobilization and reconfiguration of capabilities other than technology and value chain

activities. For example, for financial resources, access to private venture capital is an understudied area, given that the entrepreneurial finance literature does not disentangle high technology from nascent industries, often assuming private venture capital is unavailable in nascent industries due to their uncertainty and long payback periods. Focusing on non-firm actors, there is a notable scarcity of studies about capability generation and reconfiguration, which offers a promising area of future inquiry. These include whether non-firm actors leverage reconfiguration modes that are common among firms, such as alliances or acquisitions, as opposed to pursuing other understudied modes.

Our review indicates how modes of market, non-market, and intermediation interactions reduce the uncertain state of nascent industry. Future studies can identify other interactions that contribute to the value proposition of the nascent industry. Further, analyzing market and non-market interactions in tandem can yield insights into the factors influencing actors' choices to utilize them, as well as the complementarities that exist between them. Moreover, modes of market and non-market interactions can be interdependent with actors' capability portfolios constructed based on initial endowments or subsequent reconfiguration efforts, thereby offering research opportunities at this intersection. Future studies can investigate which combinations of reconfiguration modes, for which types of capabilities, undertaken at what time junctures, shape the feasibility of each mode of interaction. Relatedly, key questions remain about the temporal sequence and causal relationship of these modes, for example, whether an overarching strategic plan concurrently dictates undertaking congruent capability reconfiguration and interaction modes, or whether one mode trails the other. A holistic examination of how different reconfiguration modes interact with different interaction modes can shed light on a division of action, where some uncertainties are better tackled by particular modes.

The Antecedents and Instances of Non-Emergence

Unlike the majority of industries that received scholarly attention, not all industries progress to commercial viability. Some might-have-been industries never reach commercialization. Others do move to commercialization, but never achieve takeoff and growth. Still other industries languish, before regaining momentum. By alleviating the sampling bias and considering contexts with various shades of non-emergence, future research can unpack impediments that preclude industries from

advancing to subsequent stages. The counterfactual cases of non-emergence, the number of which likely exceeds emerged cases, can also caution against generalizing recommendations from a few success stories about whether and how the public sector can support industry creation.

The emphasis in the literature on the progression of industries often translates into focusing on actors who positively contribute to industry creation. One avenue for research is the role of opposing actors whose actions may passively or actively hinder, block, or hijack industry evolutionary processes. Opposing forces can stem from actors with relevant endowments yet conflicting interests, from activists and social movements whose values contrast with an industry, or from actors in obsolescing industries who perceive an industry as devaluing their endowments and threatening their survival.

Research can also benefit from the development of a systematic view that incorporates both positive and negative market and non-market interactions in shaping outcomes. Industries often emerge due to purposeful actions for resolving critical uncertainties. To consider the reverse scenario about the nature and intensity of unresolved uncertainties in cases of non-emergence, future research can shed light on actions that exacerbate existing uncertainties, add new uncertainties, or neutralize previously resolved uncertainties. For example, in tackling institutional uncertainty, future studies can examine regulatory ambiguity, delay, or constraints, all of which may stand against emergence.

Cross-Level Dynamics of Success and Failure

Future research can examine the implications of failure at one level for success at other levels. At the industry-level, when a nascent industry fails to achieve commercial viability, future research can shed light on how actors can avoid concurrent adverse outcomes such as dissolving firms and leaving customers' preferences unmet. Fruitful areas of investigation include how actors reposition their capabilities for successful operations in adjacent industries, or how firms and passionate customers persist in their interaction in a re-emerged niche. At the actor-level, when any actor or project fails, future research can explore how the failed actor or project can contribute to success at the industry level. For example, by leveraging markets for human capital, intellectual property rights, and corporate control, its generated knowledge can continue to inform the future efforts of other actors.

At the intersection of actors, technologies, and industries, our review revealed a misinterpretation

of the failure of incumbents in industries, which were created based on radical technologies introduced by outside firms and led to the obsolescence of existing products. Such a definitional assumption of failure of existing industries as the default and inevitable option has led to numerous studies examining the imperatives incumbent firms face to adapt, if not to die. To avoid definitional tautology, future research can study industries where alternative technologies and industries may co-exist or be adapted using existing industry knowledge bases. This can uncover factors that predicate such contexts, including deliberate processes through which actors enact it to be the case.

RESEARCH ADVANCES IN EMPIRICAL DESIGN

Examining the above questions requires combined attention to global contexts, the development of novel data sets, and the use of new analytical approaches, for which we next outline some directions.

Covering Global Contexts

Our review reveals that almost all studies focus on a single country, often in the US or another Western country. A research design that covers global contexts can fill this gap, shedding light on the mechanisms for and barriers to the global emergence of nascent industries. For born-global industries, where the nascent industry operates at a global scale from its inception, future studies can unpack which actors are better positioned for the creation of these industries and which within-country and cross-country reconfiguration and interaction modes they rely on. For industries originating from a small set of countries, future studies can explore diffusion patterns, by exploring how the uncertain industry state in technological, demand, and ecosystem dimensions may promote or restrict actors' engagements and knowledge adjustments in each recipient country.

The commercial viability and growth of industries in developing countries is another research opportunity. Future studies can deepen insights about how actors address potential institutional voids in these contexts through informal structures, abandonment of dysfunctional institutions, and creation of new institutional arrangements (e.g., Mair & Marti & Ventresca, 2012). Questions remain about the relative use of market and non-market interactions, the necessity of establishing new institutions, and the possibility of circumventing voids altogether. Future studies can also shed light on the interactions between actors from local communities or outside organizations in tackling these voids. Importantly,

future studies can explicitly focus on indigenous industries that emerge and become mainstays in developing countries, and in so doing, go beyond the notion of importing knowledge from elsewhere.

Creating Novel Data Sets

Future studies can draw on data sets that account for the multi-level and multi-actor nature of emergence, creating opportunities to examine understudied stages, actors, and outcomes. Curating and triangulating data from several sources and levels of analysis can overcome typical single-source representation. Registers of firms and products are systematic in creating populations of firms, but often overlook non-firm actors. Media sources add social and non-market perspectives, but the attention often occurs only after an industry gains visibility in product sales and only for actors with celebrity status. Publications, patents, and regulatory disclosures are systematic and exhaustive, but limit the attention to industries and activities where these scientific, inventive, and regulatory indicators prevail. Interview- and observation-based data shed light on actors' direct views, but they suffer from actors' incentives for self-disclosure as well as researchers' limitations for large-scale inference. Real-time surveys, on the other hand, can provide primary large-scale data about actors and difficult-to-measure attributes and actions. The advent of digital data, including digital footprints for recent actors and digitization of historical archives, allows tracing back the origins of activities, possibly aided by computational text analysis for unmasking new trends, visual image analysis for tracking technological components and systems, and machine automated translation tools for expanding global data reach.

Nonetheless, collection of flawless data may not be always feasible. These tradeoffs call for a transparent attention to biases in inference based on each dataset, thereby underscoring the need for building a cumulative body of empirical research where diverse datasets offset each other's limitations.

Tailoring Research Methods to Evolutionary Phenomena

Future opportunities stem from new analytical and inference approaches. Because other resources exist about empirical methods, we focus on two under-emphasized directions.

Future studies can sharpen their contextualization of the nascent industry. Due to the ambiguity and incompleteness in the evolutionary evidence at the outset, researchers can benefit from immersing themselves in the context and gaining in-depth knowledge about actors, the industry, and its

environment. Contextualization can mitigate the following concerns. First, the temporal and historical circumstances, where actors allocate their economic effort toward industry creation, point to the interconnectedness of factors before emergence. Researcher's investments to gain in-depth knowledge about an industry provide the necessary background to trace this holistic system. Second, researchers often draw on their prior knowledge and perspective, for example, in the prioritization of research questions, selection of sources, and interpretation of findings. When studying phenomena distant from their technical, social, and geographic domain, contextualization can enable recognizing and reflecting on the differences across their perspectives and the context. To remain sensitive to the context, this reflexive assessment can help ask better questions and find sharper answers. Finally, in the absence of real-time observation of events, retrospective bias can misconstrue interpretations. By contextually scrutinizing actors' choices and the resultant outcomes in the time period when they unfolded, researchers can avoid attributing ex-post outcomes to hindsight conclusions such as "an industry with no ex-ante prospect for emergence" or "a technology with no ex-ante chance for dominance."

In parallel, abductive modes for inference can offer suitable research designs for uncovering the co-evolution of actors and industries. This mode of inference combines the advantages of population-level quantitative analysis with the advantages of contextual interpretation. In iterative steps, population-level or anecdotal evidence about the phenomena of interest can arise from statistical relationships, longitudinal trends, and archival or primary observations. The follow-on interpretation can leverage a blend of summary statistics, regression analysis, experiments, and historical and multi-case descriptions to adjudicate among a list of potential explanations and infer the best explanations.

CONCLUSION

The objective of our review was to learn from the rich literature about nascent industries to identify the generative role of heterogeneous actors in their creation. We were empowered by the evolution of literature streams using different conceptual lenses to examine temporal patterns across hundreds of industries over time. By creating a systematic integration of these studies, we identified distinctive themes and introduced a framework to address the questions of who chooses to create new industries, what activities they undertake, and how their activities shape the trajectory of nascent

industries. Our framework revealed that prior histories of actors were critical determinants of their endowments and inducements, and additionally, interacted with their identities and cognitive frames. These attributes distinguished actors from each other within and across firms, non-firm organizational forms, and individuals. Heterogeneity in these aspects translated to different actors engaging in nascent industries at different stages, addressing different knowledge gaps, and choosing different modes of market and non-market interactions. Collectively, these differential foci are critical for industries to evolve towards commercial viability, achieve sufficient scale, and become established.

Our review also uncovered important future directions that we hope researchers will undertake so we can continue to build and evolve our scholarly base. We are encouraged by prospects that this scholarly knowledge can inform and inspire the imaginative and dedicated efforts of heterogeneous actors who will be the creators of industries of the future, so that we can all enjoy a better future.

Table 1: Conceptual Lenses Explaining Industry Emergence

Conceptual Lens	Factors Contributing to Industry Creation	Uncertainty Dimension	Unit of Analysis	Classic/Example Studies
Foundational Perspectives: Focus on Firm and Post-Commercialization Industry Stages				
Evolutionary Economics	Supply-push transformation of inventions to innovations; reliance on external knowledge sources; reduced learning and R&D costs	Technology	Industries; Firms in focal industry	Gort & Klepper (1982); Jovanovic & MacDonald (1994); Klepper (1996)
Marketing	Demand-pull adoption; information transmission across diverse customer segments	Demand	Industries; Customers in focal industry	Bass (1969); Davies (1979); Rogers (1962)
Technology Management and History	Variation/selection of technical design; firm experimentation in design components and systems; customer selection around a dominant design	Technology Demand	Technologies; Technical design and products in focal industry	Abernathy & Utterback (1978); Anderson & Tushman (1990); Clark (1985); Dosi (1982); Rosenberg (1982, 1992)
Organizational Theory and Sociology	Collective action for legitimacy seeking and legal boundaries	Institutional	Firm populations in focal industry	Aldrich & Fiol (1994); Hannan & Freeman (1977); Rao (1994)
Recent Perspectives: Incorporating Non-Firm Actors and Industry Incubation Stage				
Ecosystems and Value Chains	Collaboration and competition within an interdependent value chain and ecosystem	Ecosystem	Firms in focal and related value chains	Adner & Kapoor (2010); Rosenkopf & Tushman (1998); Teece (1986)
Organizational Theory	Non-market influence for institutional legitimization; strategic categorization	Institutional	Firms; Non-firm actors	Lee, Struben & Bingham (2018); Navis & Glynn (2010)
Strategy and Entrepreneurship	Sequential and interdependent reduction of uncertainties through knowledge generation and aggregation	Technology Demand Ecosystem Institutional	Individuals; Firms; Non-firm actors	Greenstein (2015); Moeen & Agarwal (2017); Moeen, Agarwal & Shah (2020)

Table 2: Actors and Their Attributes

Actors	Definition	Endowments	Identity and Cognitive Frames	Inducements
Firms				
Incumbents in existing industries	Established firms who serve the focal purpose using other products or technological systems	Non-obsolescing technological component capabilities Demand knowledge Complementary assets Integrative capabilities	Inertial and tied to the existing industry	Financial Leveraging existing capabilities Nonfinancial
Diversifying entrants from other industries	Established firms who serve a different focal purpose	Novel and related technological capabilities Demand knowledge Complementary assets Integrative capabilities	Tied to their previous industry	Financial Growth opportunities through diversification
Entrepreneurial startups	New firms founded within the nascent industry	User, employee or scientist knowledge context Demand knowledge Knowledge of complementary assets Managerial capabilities	Novel, agile, and adaptive to the nascent industry	Financial stemming from underlying inducements of desire to address unmet needs, invent or leverage industry-specific knowledge
Non-Firm Organizational Forms				
Universities and public labs	Research laboratories for basic science and applied research	Scientific expertise Novel base principles for component and system capabilities	Not discussed in reviewed studies	Creating new knowledge Disseminating knowledge to society for impact
User communities	Formal or informal organizations of individuals who have similar unmet needs	Demand knowledge	Not discussed in reviewed studies	Addressing unmet needs Pursuing personal passion Status and recognition

Industry associations	Formal organizing structures for assembly of firms or non-firm actors	Knowledge of industry activities	Not discussed in reviewed studies	Promoting an industry trajectory consistent with their mutual interest
Advocacy and non-profit organizations	Formal or informal organization of activists with a shared cause and concern	Knowledge of social institutions Leadership and advocacy capabilities	Not discussed in reviewed studies	Promoting an industry trajectory consistent with their values and cause
Public agencies and regulatory bodies	Government agencies that organize mission focused activities or regulate economic activity	Knowledge of societal trends Rule-making and legislative knowledge	Not discussed in reviewed studies	Protecting public interest Creating national competitiveness and economic growth
Media	Channels for information communication to a wide audience	Knowledge of social trends	Not discussed in reviewed studies	Disseminating information Shaping of opinions
Individuals				
Scientists	Individuals engaged in basic or applied research in public, university, or corporate labs	Scientific expertise Novel base principles for component and system capabilities	Not discussed in reviewed studies	Inventing and applying knowledge in innovative applications Gaining status recognition
Users	Individuals whose unmet needs constitute the focal purpose	Demand knowledge	Not discussed in reviewed studies	Addressing unmet needs Gaining peer recognition
Product and mission champions	Individuals who champion the development of nascent industries	Novel technological or market opportunities Knowledge of social trends Managerial capabilities	Not discussed in reviewed studies	Financial and growth opportunities Mission oriented needs

Table 3: Actions Targeting and Addressing Uncertainties

Modes of Action	Type of Uncertainty and Knowledge Gap			
	Technology	Demand	Ecosystem	Institutions
Internal capability generation and reconfiguration	Internal R&D Technology spillover	Interactions with customers Spillover from user communities	Redeployment of value chain activities and complementary assets from other units	Not discussed in reviewed studies
Markets for technology and value chain activities	Licensing agreements Alliances Acquisitions	Not discussed in reviewed studies	Industry-specific supplier agreements Acquisitions	Not discussed in reviewed studies
Product market interactions	Offering variations of technical designs	Catering to preferences of distinct customer segments	Not discussed in reviewed studies	Not discussed in reviewed studies
Non-market interactions	Seeking or providing regulatory support and incentives for technology development	Discursive interactions that create social legitimacy and shape demand	Seeking or providing regulatory support and incentives for supply and ecosystem development	Discursive interactions Collective action and social movements Regulatory engagement
Market intermediations	Technology standard setting	Use compatibility standard setting	Production standard setting	Evaluation criteria Certification

Figure 1: Actors' Timing of Engagement with the Industry

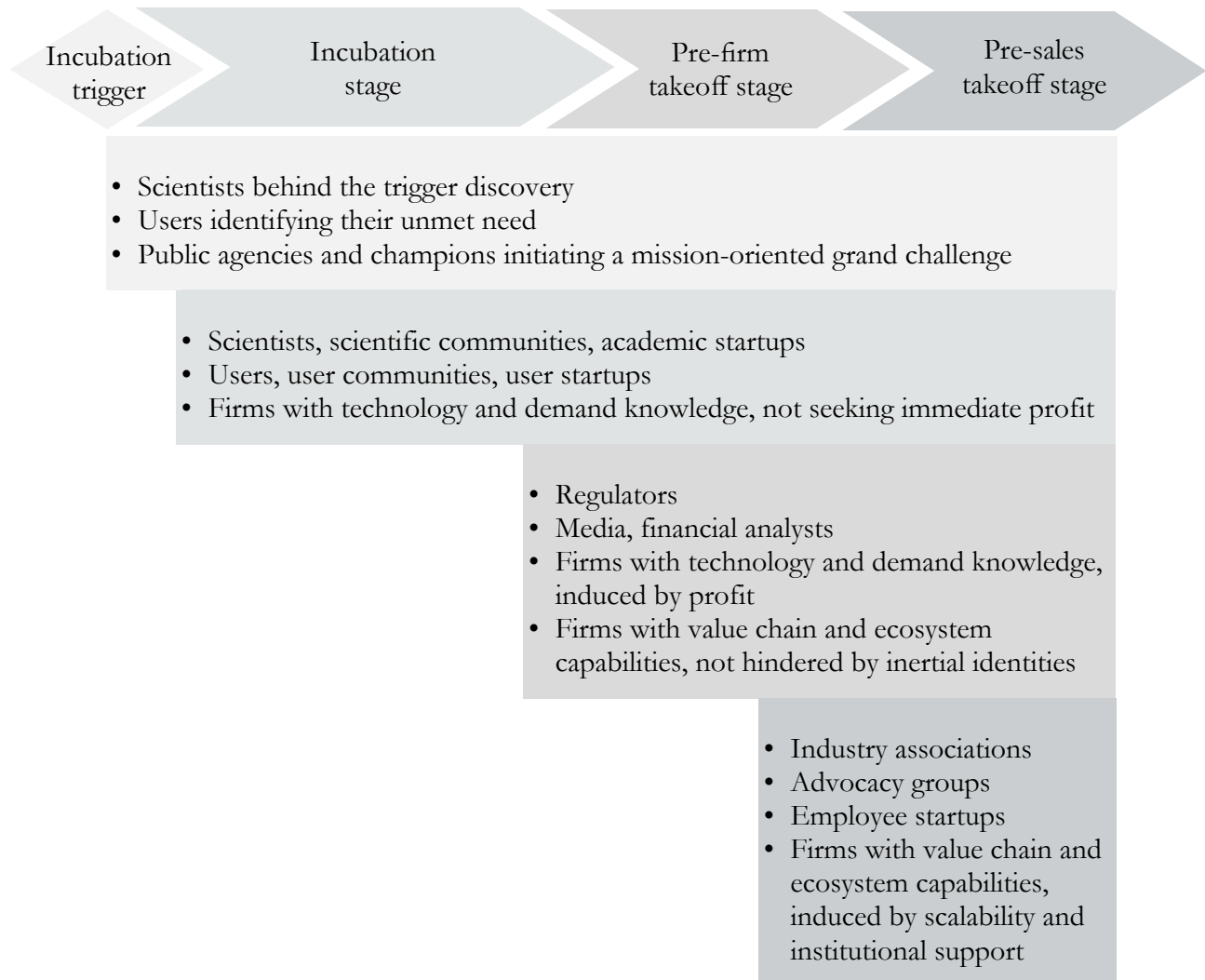
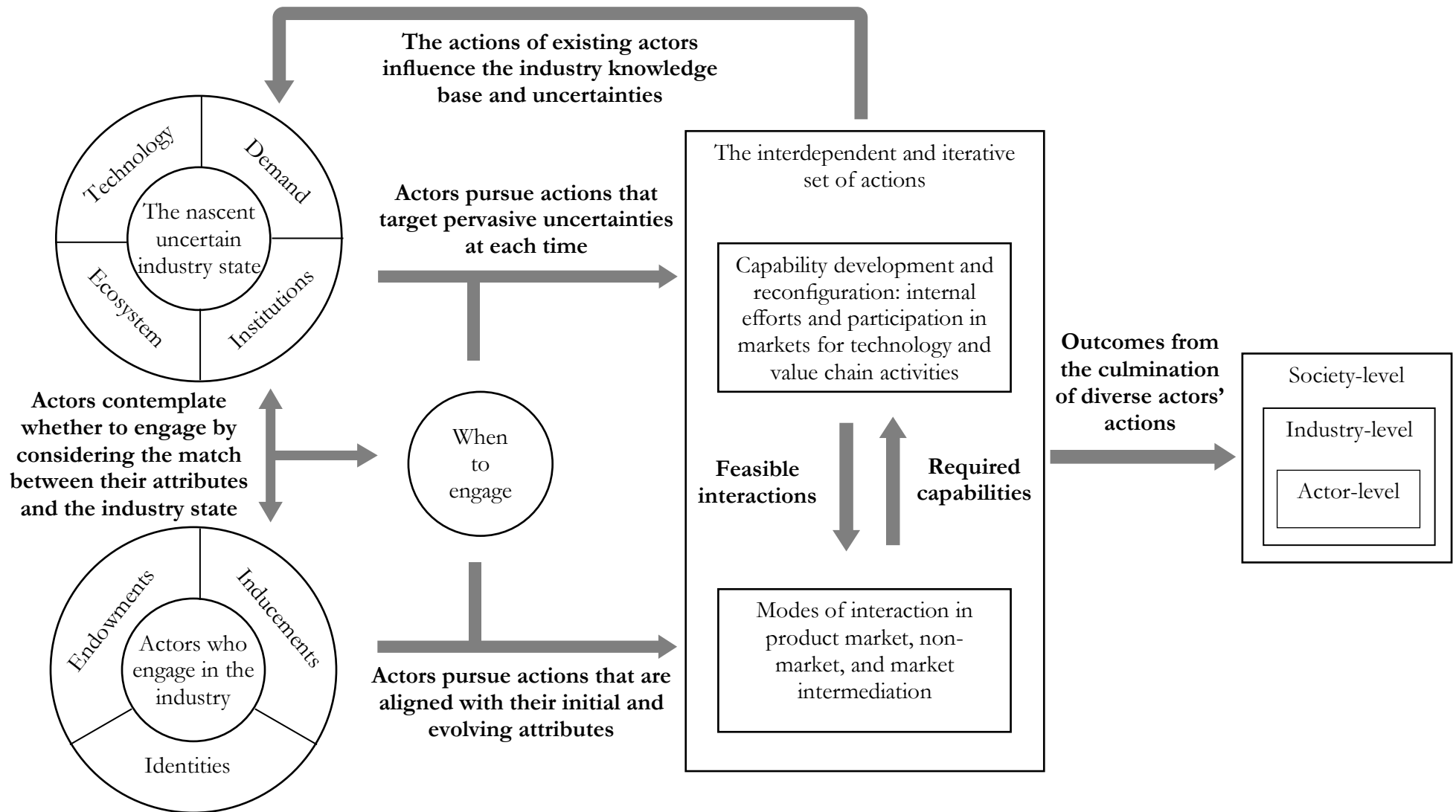


Figure 2: The Actor-Centric Framework of Industry Creation



REFERENCES

- Abernathy, W. J., Utterback, J. M. 1978. Patterns of industrial innovation. *Technology Review*, 80(7): 40-47.
- Adams, P., Fontana, R., Malerba, F. 2016. User-industry spinouts: downstream industry knowledge as a source of new firm entry and survival. *Organization Science*, 27(1): 18-35.
- Adner, R., Helfat, C. E. 2003. Corporate effects and dynamic managerial capabilities. *Strategic Management Journal*, 24(10): 1011-1025.
- Adner, R., Kapoor, R. 2010. Value creation in innovation ecosystems: how the structure of technological interdependence affects firm performance in new technology generations. *Strategic Management Journal*, 31(3): 306-333.
- Adner, R., Levinthal, D. 2001. Demand heterogeneity and technology evolution: Implications for product and process innovation. *Management Science*, 47(5): 611-628.
- Adner, R., Snow, D. 2010. Old technology responses to new technology threats: Demand heterogeneity and technology retreats. *Industrial and Corporate Change*, 19(5): 1655-1675.
- Adner, R. 2017. Ecosystem as structure: An actionable construct for strategy. *Journal of Management*, 43(1): 39-58.
- Afuah, A. 2001. Dynamic boundaries of the firm: Are firms better off being vertically integrated in the face of a technological change?. *Academy of Management Journal*, 44(6): 1211-1228.
- Agarwal, R., Audretsch, D., Sarkar, M. B. 2007. The process of creative construction: knowledge spillovers, entrepreneurship, and economic growth. *Strategic Entrepreneurship Journal*, 1(3-4), 263-286.
- Agarwal, R., Bayus, B. L. 2002. The market evolution and sales takeoff of product innovations. *Management Science*, 48(8): 1024-1041.
- Agarwal, R., Gort, M. 2001. First-mover advantage and the speed of competitive entry, 1887–1986. *The Journal of Law and Economics*, 44(1): 161-177.
- Agarwal R., Shah S. K. 2014. Knowledge sources of entrepreneurship: Firm formation by academic, user and employee innovators. *Research Policy*, 43(7), 1109-1133.
- Agarwal, R., Tripsas, M. 2008. Technology and industry evolution. *The handbook of technology and innovation management*, 1: 1-55.
- Agarwal, R., Moeen, M., Shah, S. K. 2017. Athena's birth: Triggers, actors, and actions preceding industry inception. *Strategic Entrepreneurship Journal*, 11(3): 287-305.
- Agarwal, R., Kim, S., Moeen, M. 2021. Leveraging private enterprise: Incubation of new industries to address the public sector's mission-oriented grand challenges. *Strategy Science*, 6(4): 385-411.
- Agarwal, R., Braguinsky, S., Ohyama, A. 2020. Centers of gravity: The effect of stable shared leadership in top management teams on firm growth and industry evolution. *Strategic Management Journal*, 41(3): 467-498.
- Agarwal, R., Sarkar, M. B., Echambadi, R. 2002. The conditioning effect of time on firm survival: An industry life cycle approach. *Academy of Management Journal*, 45(5): 971-994.
- Albert, S., Whetten, D. A. 1985. Organizational identity. *Research in Organizational Behavior*, 7, 263–295.
- Aldrich, H. E., Fiol, C. M. 1994. Fools rush in? The institutional context of industry creation. *Academy of Management Review*, 19(4): 645-670.
- Alvarez-Garrido, E., Dushnitsky, G. 2016. Are entrepreneurial venture's innovation rates sensitive to investor complementary assets? Comparing biotech ventures backed by corporate and independent VCs. *Strategic Management Journal*, 37(5): 819-834.
- Amit, R., Schoemaker, P. J. 1993. Strategic assets and organizational rent. *Strategic Management Journal*, 14(1), 33-46.

- Anand, J., Singh, H. 1997. Asset redeployment, acquisitions and corporate strategy in declining industries. *Strategic Management Journal*, 18(S1): 99-118.
- Anderson, E., Tushman, M. 1990. Technological discontinuities and dominant designs: A cyclical model of technological change. *Administrative Science Quarterly*, 35(4): 604-633
- Anthony, C., Nelson, A. J., Tripsas, M. 2016. “Who are you?... I really wanna know”: Product meaning and competitive positioning in the nascent synthesizer industry. *Strategy Science*, 1(3): 163-183.
- Argyres, N., Bigelow, L. 2007. Does transaction misalignment matter for firm survival at all stages of the industry life cycle? *Management Science*, 53(8): 1332-1344.
- Argyres, N., Mostafa, R. 2016. Knowledge inheritance, vertical integration, and entrant survival in the early US auto industry. *Academy of Management Journal*, 59(4): 1474-1492.
- Armanios, D. E., Lanahan, L., Yu, D. 2020. Varieties of local government experimentation: US state-led technology-based economic development policies, 2000–2015. *Academy of Management Discoveries*, 6(2): 266-299.
- Arora, A., Nandkumar, A. 2011. Cash-out or flameout! Opportunity cost and entrepreneurial strategy: Theory, and evidence from the information security industry. *Management Science*, 57(10): 1844-1860.
- Arora, A., Fosfuri, A., Gambardella, A. 2004. *Markets for technology: The Economics of Innovation and Corporate Strategy*. MIT Press.
- Arslan, B., Vasudeva, G., Hirsch, E. B. 2024. Public–private and private–private collaboration as pathways for socially beneficial innovation: Evidence from antimicrobial drug-development tasks. *Academy of Management Journal*, 67(2): 554-582.
- Arthur, W. B. 2009. *The Nature of Technology: What it is and how it evolves*. London, United Kingdom: Penguin Books.
- Augustine, G., Soderstrom, S., Milner, D., Weber, K. 2019. Constructing a distant future: Imaginaries in geoengineering. *Academy of Management Journal*, 62(6): 1930-1960.
- Aversa, P., Bianchi, E., Gaio, L., Nucciarelli, A. 2022a. The Grand Tour: The Role of Catalyzing Places for Industry Emergence. *Academy of Management Journal*, 65(6): 2058-2091.
- Aversa, P., Furnari, S., Jenkins, M. 2022b. The Primordial Soup: Exploring the emotional micro-foundations of cluster genesis. *Organization Science*, 33(4): 1340-1371.
- Aversa, P., Guillotin, O. 2018. Firm technological responses to regulatory changes: A longitudinal study in the Le Mans Prototype racing. *Research Policy*, 47(9): 1655-1673.
- Aversa, P., Huyghe, A., Bonadio, G. 2021. First impressions stick: Market entry strategies and category priming in the digital domain. *Journal of Management Studies*, 58(7): 1721-1760.
- Bagozzi, R. P., Dholakia, U. M. 2006. Antecedents and purchase consequences of customer participation in small group brand communities. *International Journal of research in Marketing*, 23(1): 45-61.
- Baldwin, C., Hienert, C., von Hippel, E. 2006. How user innovations become commercial products: A theoretical investigation and case study. *Research Policy*, 35(9): 1291-1313.
- Bao, J., Zhang, M. 2024. Regulatory uncertainty, entrepreneurial entry, and market identity specificity: Evidence from the U.S. autonomous vehicle industry. Working Paper.
- Baron, D. P. 1995. Integrated strategy: Market and nonmarket components. *California Management Review*, 37(2): 47-65.
- Bass, F. M. 1969. A new product growth for model consumer durables. *Management Science*, 15(5): 215-227.
- Bayus, B. L., Agarwal, R. 2007. The role of pre-entry experience, entry timing, and product technology strategies in explaining firm survival. *Management Science*, 53(12): 1887-1902.
- Benner, M. J. 2010. Securities analysts and incumbent response to radical technological change: Evidence from digital photography and internet telephony. *Organization Science*, 21(1): 42-62.

- Benner, M. J., Ranganathan, R. 2013. Divergent reactions to convergent strategies: Investor beliefs and analyst reactions during technological change. *Organization Science*, 24(2): 378-394.
- Benner, M. J., Ranganathan, R. 2017. Measuring up? Persistence and change in analysts' evaluative schemas following technological change. *Organization Science*, 28(4): 760-780.
- Benner, M. J., Tripsas, M. 2012. The influence of prior industry affiliation on framing in nascent industries: The evolution of digital cameras. *Strategic Management Journal*, 33(3): 277-302.
- Bercovitz, J., Feldman, M. 2008. Academic entrepreneurs: organizational change at the individual level. *Organization Science*, 19(1): 69-89.
- Bingham, C. B., Kahl, S. J. 2013. The process of schema emergence: Assimilation, deconstruction, unitization and the plurality of analogies. *Academy of Management Journal*, 56(1): 14-34.
- Bingham, C. B., Eisenhardt, K. M., Furr, N. R. 2007. What makes a process a capability? Heuristics, strategy, and effective capture of opportunities. *Strategic Entrepreneurship Journal*, 1(1-2): 27-47.
- Braguinsky, S., Hounshell, D. A. 2016. History and nanoeconomics in strategy and industry evolution research: Lessons from the Meiji-Era Japanese cotton spinning industry. *Strategic Management Journal*, 37(1): 45-6.
- Capron, L., Mitchell, W. 2012. Build, borrow, or buy: Solving the growth dilemma: Harvard Business Press.
- Carroll, G. R., Bigelow, L. S., Seidel, M. D. L., Tsai, L. B. 1996. The fates of de novo and de alio producers in the American automobile industry 1885–1981. *Strategic Management Journal*, 17(S1): 117-137.
- Cattani, G. 2005. Preadaptation, firm heterogeneity, and technological performance: a study on the evolution of fiber optics, 1970–1995. *Organization Science*, 16(6): 563-580.
- Cattani, G. 2006. Technological pre-adaptation, speciation, and emergence of new technologies: how Corning invented and developed fiber optics. *Industrial and Corporate Change*, 15(2), 285-318.
- Cattani, G., Fontana, R., Malerba, F. 2024. Entrants' heterogeneity, pre-entry knowledge, and the target industry context: a taxonomy and a framework. *Industrial and Corporate Change*, 33(1): 8-39.
- Chai S.; Doshi A.R., Silvestri L. 2022. How Catastrophic Innovation Failure Affects Organizational and Industry Legitimacy: The 2014 Virgin Galactic test flight crash. *Organization Science*, 33(3), 1068-1093.
- Chandler, A. D. 1977. *The Visible Hand: The Managerial Revolution in American Business*. Cambridge, MA. Harvard/Belknap.
- Chandy, R. K., Tellis, G. J. 2000. The incumbent's curse? Incumbency, size, and radical product innovation. *Journal of Marketing*, 64(3): 1-17.
- Charles, D. 2001. *Lords of the harvest: Biotech, big money, and the future of food*. Cambridge, MA: Basic Books.
- Chaturvedi, T., Prescott, J. E. 2020. Dynamic fit in an era of ferment: Product design realignment and the survival-enhancing role of alliances and acquisitions. *Research Policy*, 49(6): 103989.
- Chen, P. L., Williams, C., Agarwal, R. 2012. Growing pains: Pre-entry experience and the challenge of transition to incumbency. *Strategic Management Journal*, 33(3): 252-276.
- Chen, T., Qian, L., Narayanan, V. 2017. Battle on the wrong field? Entrant type, dominant designs, and technology exit. *Strategic Management Journal*, 38(13): 2579-2598.
- Christensen, C., Bower, J. 1996. Customer power, strategic investment, and the failure of leading firms. *Strategic Management Journal*, 17(3): 197-218.
- Cinar, E., Demircioglu, M. A., Acik, A. C., Simms, C. 2024. Public sector innovation in a city state: exploring innovation types and national context in Singapore. *Research Policy*, 53(2): 104915.
- Clark, K. B. 1985. The interaction of design hierarchies and market concepts in technological evolution. *Research Policy*, 14(5): 235-251.

- Cohen, W. M., Klepper, S. 1996. Firm size and the nature of innovation within industries: The case of process and product R&D. *Review of Economics and Statistics*, 78(2): 232-243.
- Cohen, W. M., Sauermann, H., Stephan, P. 2020. Not in the job description: The commercial activities of academic scientists and engineers. *Management Science*, 66(9): 4108-4117.
- Danneels, E. 2011. Trying to become a different type of company: Dynamic capability at Smith Corona. *Strategic Management Journal*, 32(1): 1-31.
- David, P. A. 1985. Clio and the Economics of QWERTY. *American Economic Review*, 75(2): 332-337.
- Davies, S. 1979. The diffusion of process innovations. CUP Archive.
- de Figueiredo, J. M., Silverman, B. S. 2007. Churn, baby, churn: Strategic dynamics among dominant and fringe firms in a segmented industry. *Management Science*, 53(4): 632-650.
- Dobrev S., Gotsopoulos A. 2010. Legitimacy vacuum, structural imprinting, and the first mover disadvantage. *Academy of Management Journal*, 53(5): 1153-1174.
- Dokko, G., Rosenkopf, L. 2010. Social capital for hire? Mobility of technical professionals and firm influence in wireless standards committees. *Organization Science*, 21(3): 677-695.
- Dosi, G. 1982. Technological paradigms and technological trajectories: a suggested interpretation of the determinants and directions of technical change. *Research Policy*, 11(3): 147-162.
- Durand, R., Georgallis, P. 2018. Differential firm commitment to industries supported by social movement organizations. *Organization Science*, 29(1): 154-171.
- Durand, R., Khaire, M. 2017. Where do market categories come from and how? Distinguishing category creation from category emergence. *Journal of Management*, 43(1): 87-110.
- Dutt, N., Joseph, J. 2019. Regulatory uncertainty, corporate structure, and strategic agendas: Evidence from the US renewable electricity industry. *Academy of Management Journal*, 62(3), 800-827.
- Dutta, S., Vasudeva, G. 2024. How demand shocks “jumpstart” technological ecosystems and commercialization: Evidence from the global electric vehicle industry. *Strategy Science*, forthcoming.
- Eggers, J. P. 2012. Falling flat: Failed technologies and investment under uncertainty. *Administrative Science Quarterly*, 57(1): 47-80.
- Eggers, J. 2014. Competing technologies and industry evolution: The benefits of making mistakes in the flat panel display industry. *Strategic Management Journal*, 35(2): 159-178.
- Eggers, J. 2016. Reversing course: Competing technologies, mistakes, and renewal in flat panel displays. *Strategic Management Journal*, 37(8): 1578-1596.
- Eggers, J., Grajek, M., Kretschmer, T. 2020. Experience, consumers, and fit: Disentangling performance implications of pre-entry technological and market experience in 2G mobile telephony. *Organization Science*, 31(2): 245-265.
- Eggers, J. P., Kaplan, S. 2009. Cognition and renewal: Comparing CEO and organizational effects on incumbent adaptation to technical change. *Organization Science*, 20(2): 461-477.
- Eggers, J. P., Kaplan, S. 2013. Cognition and capabilities: A multi-level perspective. *Academy of Management Annals*, 7(1): 295-340.
- Eggers, J., Park, K. F. 2018. Incumbent adaptation to technological change: The past, present, and future of research on heterogeneous incumbent response. *Academy of Management Annals*, 12(1): 357-389.
- Engler, D., Cattani, G., Porac, J. 2020. Studying the incubation of a new product market through realized and alternative histories. *Strategy Science*, 5(3): 160-192.
- Feldman, M., Francis, J., Bercovitz, J. 2005. Creating a cluster while building a firm: Entrepreneurs and the formation of industrial clusters. *Regional Studies*, 39(1): 129-141.
- Ferriani S., Lazerson M.H., Lorenzoni G. 2020 Anchor entrepreneurship and industry catalysis: The rise of the Italian Biomedical Valley. *Research Policy*, 49(8): 104045.

- Folta, T. B., O'Brien, J. P. 2004. Entry in the presence of dueling options. *Strategic Management Journal*, 25(2): 121-138.
- Forbes, D. P., Kirsch, D. A. 2011. The study of emerging industries: Recognizing and responding to some central problems. *Journal of Business Venturing*, 26(5), 589-602.
- Franco, A. M., Sarkar, M., Agarwal, R., Echambadi, R. 2009. Swift and smart: the moderating effects of technological capabilities on the market pioneering–firm survival relationship. *Management Science*, 55(11): 1842-1860.
- Franke, N., Shah, S. 2003. How communities support innovative activities: an exploration of assistance and sharing among end-users. *Research Policy*, 32(1): 157-178.
- Furr, N. R. 2019. Product Adaptation During New Industry Emergence: The Role of Start-Up Team Preentry Experience. *Organization Science*, 30(5): 1076-1096.
- Furr, N. R., Kapoor, R. 2018. Capabilities, technologies, and firm exit during industry shakeout: Evidence from the global solar photovoltaic industry. *Strategic Management Journal*, 39(1): 33-61.
- Furr, N. R., Szerb, A. 2024. The Origins and Evolution of Ecosystems -- Evidence from the Solar PV Ecosystem. Working Paper.
- Gambardella, A., Raasch, C., von Hippel, E. 2017. The user innovation paradigm: impacts on markets and welfare. *Management Science*, 63(5): 1450-1468.
- Ganco, M., Agarwal, R. 2009. Performance differentials between diversifying entrants and entrepreneurial start-ups: A complexity approach. *Academy of Management Review*, 34(2): 228-252.
- Gao, C., McDonald, R. 2022. Shaping nascent industries: Innovation strategy and regulatory uncertainty in personal genomics. *Administrative Science Quarterly*, 67(4): 915-967.
- Gao, C., DeSantola, A., Gheihman, N. 2024. “Clean” meat? Regulatory entrepreneurship and jurisdictional contestation in the nascent cultivated meat industry. Working paper.
- Garud, R., Rappa, M. A. 1994. A socio-cognitive model of technology evolution: The case of cochlear implants. *Organization Science*, 5(3): 344-362.
- Gavetti, G., Levinthal, D. 2000. Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45(1): 113-137.
- Gavetti, G., Helfat, C. E., Marengo, L. 2017. Searching, shaping, and the quest for superior performance. *Strategy Science*, 2(3): 194-209.
- Georgallis, P., Dowell, G., Durand, R. 2019. Shine on Me: Industry Coherence and Policy Support for Emerging Industries. *Administrative Science Quarterly*, 64(3): 503-541.
- Giarratana, M. S. 2004. The birth of a new industry: Entry by start-ups and the drivers of firm growth: The case of encryption software. *Research Policy*, 33(5), 787-806.
- Gioia, D. A., Schultz, M., Corley, K. G. 2002. On celebrating the organizational identity metaphor: A rejoinder to Cornelissen. *British Journal of Management*, 13(3): 269-275.
- Goldenberg, J., Libai, B., Muller, E. 2002. Riding the saddle: How cross-market communications can create a major slump in sales. *Journal of Marketing*, 66(2): 1-16.
- Golder, P. N., Tellis, G. J. 1997. Will it ever fly? Modeling the takeoff of really new consumer durables. *Marketing Science*, 16(3): 256-270.
- Golder, P. N., Shacham, R., Mitra, D. 2009. Innovations' origins: When, by whom, and how are radical innovations developed. *Marketing Science*, 28(1): 166-179.
- Gort, M., Klepper, S. 1982. Time paths in the diffusion of product innovations. *The Economic Journal*, 92(367): 630-653.
- Granqvist N., Grodal S., Woolley J.L. 2013. Hedging your bets: Explaining executives' market labeling strategies in nanotechnology. *Organization Science*, 24(2): 395-413.
- Grant, R. M. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109-122.

- Greenstein, S. 2015. How the internet became commercial: Innovation, privatization, and the birth of a new network. Princeton, NJ: Princeton University Press.
- Grodal, S., Krabbe, A. D., Chang-Zunino, M. 2023. The evolution of technology. *Academy of Management Annals*, 17(1): 141-180.
- Grodal, S., O'Mahony, S. 2017. How does a Grand Challenge Become Displaced? Explaining the Duality of Field Mobilization. *Academy of Management Journal*, 60(5): 1801-1827.
- Gross, D. P., Sampat, B. N. 2023. America, jump-started: World War II R&D and the takeoff of the US innovation system. *American Economic Review*, 113(12): 3323-3356.
- Guerra, M., Agarwal, R. 2024. Technology (non-)emergence: The role of (mis-)alignment of uncertainty dimensions in alternative solar technology trajectories. Working Paper
- Haefliger, S., Jäger, P., & Von Krogh, G. 2010. Under the radar: Industry entry by user entrepreneurs. *Research Policy*, 39(9): 1198-1213.
- Hannah, D. P., Eisenhardt, K. M. 2018. How firms navigate cooperation and competition in nascent ecosystems. *Strategic Management Journal*, 39(12): 3163-3192.
- Hannan, M. T., Freeman, J. 1977. The population ecology of organizations. *American Journal of Sociology*, 82(5): 929-964.
- Hargadon, A. B., Douglas, Y. 2001. When innovations meet institutions: Edison and the design of the electric light. *Administrative Science Quarterly*, 46(3): 476-501.
- Harmon D., Rhee E., Cho Y.H. 2023. Building a bridge to the future: Prospective legitimation in nascent markets. *Strategic Management Journal*, 44(11): 2597-2633.
- Helfat, C. E. 1997. Know-how and asset complementarity and dynamic capability accumulation: The case of R&D. *Strategic Management Journal*, 18(5): 339-360.
- Helfat, C. E., Lieberman, M. B. 2002. The birth of capabilities: market entry and the importance of pre-history. *Industrial and Corporate Change*, 11(4): 725-760.
- Helfat, C. E., Peteraf, M. A. 2015. Managerial cognitive capabilities and the microfoundations of dynamic capabilities. *Strategic Management Journal*, 36(6): 831-850.
- Helfat, C. E., Raubitschek, R. S. 2000. Product sequencing: co-evolution of knowledge, capabilities and products. *Strategic Management Journal*, 21(10-11): 961-979.
- Helfat, C. E., Winter, S. G. 2011. Untangling dynamic and operational capabilities: Strategy for the (N) ever-changing world. *Strategic Management Journal*, 32(11): 1243-1250.
- Helveston, J. P., Wang, Y., Karplus, V. J., Fuchs, E. R. 2019. Institutional complementarities: The origins of experimentation in China's plug-in electric vehicle industry. *Research Policy*, 48(1): 206-222.
- Henderson, R. 1993. Underinvestment and incompetence as responses to radical innovation: Evidence from the photolithographic alignment equipment industry. *The RAND Journal of Economics*, 248-270.
- Henderson, R. M., Clark, K. B. 1990. Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35(1): 9-30.
- Hiatt, S. R., Park, S. 2013. Lords of the harvest: Third-party influence and regulatory approval of genetically modified organisms. *Academy of Management Journal*, 56(4): 923-944.
- Hiatt, S. R., Sine, W. D., Tolbert, P. S. 2009. From Pabst to Pepsi: The deinstitutionalization of social practices and the creation of entrepreneurial opportunities. *Administrative Science Quarterly*, 54(4): 635-667.
- Hoetker, G. 2005. How much you know versus how well I know you: Selecting a supplier for a technically innovative component. *Strategic Management Journal*, 26(1): 75-96.
- Holbrook, D., Cohen, W. M., Hounshell, D. A., Klepper, S. 2000. The nature, sources, and consequences of firm differences in the early history of the semiconductor industry. *Strategic*

- Management Journal, 21(10-11): 1017-1041.
- Hsu, G., Grodal, S. 2021. The double-edged sword of oppositional category positioning: A study of the US e-cigarette category, 2007–2017. *Administrative Science Quarterly*, 66(1): 86-132.
- Hsu, G., Kovács, B., Koçak, Ö. 2019. Experientially diverse customers and organizational adaptation in changing demand landscapes: A study of US cannabis markets, 2014–2016. *Strategic Management Journal*, 40(13): 2214-2241.
- Jacobides, M. G., Cennamo, C., Gawer, A. 2018. Towards a theory of ecosystems. *Strategic Management Journal*, 39(8): 2255-2276.
- Jahanbakht, M., Mostafa, R., Veloso, F. 2022. Pre-entry experience, postentry adaptations, and internationalization in the African mobile telecommunications industry. *Organization Science*, 33(3): 969-990.
- Jeppesen, L. B., Frederiksen, L. 2006. Why do users contribute to firm-hosted user communities? The case of computer-controlled music instruments. *Organization Science*, 17(1): 45-63.
- Joshi, A. M., Nerkar, A. 2011. When do strategic alliances inhibit innovation by firms? Evidence from patent pools in the global optical disc industry. *Strategic Management Journal*, 32(11): 1139-1160.
- Jovanovic, B., MacDonald, G. M. 1994. Competitive diffusion. *Journal of Political Economy*, 102(1): 24-52.
- Kaplan, S., Murray, F., Henderson, R. 2003. Discontinuities and senior management: Assessing the role of recognition in pharmaceutical firm response to biotechnology. *Industrial and Corporate Change*, 12(2): 203-233.
- Kaplan, S., & Tripsas, M. 2008. Thinking about technology: Applying a cognitive lens to technical change. *Research Policy*, 37(5), 790-805.
- Kapoor, R., Furr, N. R. 2015. Complementarities and competition: Unpacking the drivers of entrants' technology choices in the solar photovoltaic industry. *Strategic Management Journal*, 36(3): 416-436.
- Kapoor, R., Klueter, T. 2015. Decoding the adaptability–rigidity puzzle: Evidence from pharmaceutical incumbents' pursuit of gene therapy and monoclonal antibodies. *Academy of Management Journal*, 58(4): 1180-1207.
- Kapoor, R., Klueter, T. 2020. Progress and setbacks: The two faces of technology emergence. *Research Policy*, 49(1): 103874
- Kapoor, R., McGrath, P. J. 2014. Unmasking the interplay between technology evolution and R&D collaboration: evidence from the global semiconductor manufacturing industry, 1990–2010. *Research Policy*, 43(3): 555-569.
- Karim, S., Mitchell, W. 2000. Path-dependent and path-breaking change: reconfiguring business resources following acquisitions in the US medical sector, 1978–1995. *Strategic Management Journal*, 21(10-11): 1061-1081.
- Katila, R., Ahuja, G. 2002. Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal*, 45(6): 1183-1194.
- Kennedy, M. T. 2008. Getting counted: Markets, media, and reality. *American Sociological Review*, 73(2): 270-295.
- Khaire, M., Wadhvani, R. D. 2010. Changing landscapes: The construction of meaning and value in a new market category—Modern Indian art. *Academy of Management Journal*, 53(6): 1281-1304.
- Khessina, O. M., Carroll, G. R. 2008. Product demography of de novo and de alio firms in the optical disk drive industry, 1983–1999. *Organization Science*, 19(1): 25-38.
- Kim, S., Agarwal, R., Goldfarb, B. D. 2024. Creating competencies for radical technologies: Revisiting incumbent-entrant dynamics in the bionic prosthetic industry. *Organization Science*, forthcoming.
- Kim, M. J., Shaver, J. M., Funk, R. J. 2022. From mass to motion: Conceptualizing and measuring the

- dynamics of industry clusters. *Strategic Management Journal*, 43(4), 822-846.
- Kirsch, D. A. 2000. *The electric vehicle and the burden of history*. New Brunswick, NJ: Rutgers University Press.
- Kirsch, D., Moeen, M., Wadhwani, R. D. 2014. Historicism and industry emergence: Industry knowledge from pre-emergence to stylized fact. *Organizations in time: History, theory, methods*, 217-240.
- Klepper, S. 1996. Entry, exit, growth, and innovation over the product life cycle. *American Economic Review*, 86(3): 562-583.
- Klepper, S. 2007. Disagreements, spinoffs, and the evolution of Detroit as the capital of the US automobile industry. *Management Science*, 53(4), 616-631.
- Klepper, S., Simons, K. L. 2000. Dominance by birthright: Entry of prior radio producers and competitive ramifications in the US television receiver industry. *Strategic Management Journal*, 21(10-11), 997-1016.
- Klepper, S., Sleeper, S. 2005. Entry by spinoffs. *Management Science*, 51(8): 1291-1306.
- Klepper, S., Thompson, P. 2010. Disagreements and intra-industry spinoffs. *International Journal of Industrial Organization*, 28(5): 526-538.
- Lakhani, K. R., Wolf, R. G. 2005. *Why hackers do what they do: Understanding motivation and effort in free/open source software projects, Perspective on free and open source software*. Boston, MA: MIT Press.
- Lampert, C. M., Kim, M., Polidoro Jr, F. 2020. Branching and anchoring: Complementary asset configurations in conditions of Knightian uncertainty. *Academy of Management Review*, 45(4): 847-868.
- Lashley, K., Pollock, T. G. 2020. Waiting to inhale: Reducing stigma in the medical cannabis industry. *Administrative Science Quarterly*, 65(2): 434-482
- Lavie, D. 2006. Capability reconfiguration: An analysis of incumbent responses to technological change. *Academy of Management Review*, 31(1): 153-174.
- Lee, B. H., Hiatt, S. R., Lounsbury, M. 2017. Market mediators and the trade-offs of legitimacy-seeking behaviors in a nascent category. *Organization Science*, 28(3): 447-470.
- Lee B.H., Struben J., Bingham C.B. 2018. Collective action and market formation: An integrative framework. *Strategic Management Journal*, 39(1): 242-266.
- Lee, G. K. 2007. The significance of network resources in the race to enter emerging product markets: The convergence of telephony communications and computer networking, 1989–2001. *Strategic Management Journal*, 28(1): 17-37.
- Lee, G. K., Paruchuri, S. 2008. Entry into emergent and uncertain product-markets: The role of associative rhetoric. *Academy of Management Journal*, 51(6): 1171-1188.
- Leiponen, A. E. 2008. Competing through cooperation: The organization of standard setting in wireless telecommunications. *Management Science*, 54(11): 1904-1919.
- Levy, D., Reinecke, J., Manning, S. 2016. The political dynamics of sustainable coffee: Contested value regimes and the transformation of sustainability. *Journal of Management Studies*, 53(3): 364-401.
- Lieberman, M. B. 1990. Exit from declining industries: “shakeout” or “stakeout”? *The RAND Journal of Economics*, 21(4): 538-554.
- Lim, N., Ranganathan, R., Agarwal, R. 2024. Demand-led standardization: How user involvement shapes voluntary standard setting. Working Paper
- Lounsbury, M., Ventresca, M., Hirsch, P. M. 2003. Social movements, field frames and industry emergence: a cultural–political perspective on US recycling. *Socio-Economic Review*, 1(1): 71-104.
- Lu, X., Lee, H., Coles, R. 2023. Move fast and break things? The contingent nature of product acceleration in nascent markets. *Strategy Science*, 8(4): 484-507.
- Maguire, S., Hardy, C., Lawrence, T. B. 2004. Institutional entrepreneurship in emerging fields:

- HIV/AIDS treatment advocacy in Canada. *Academy of Management Journal*, 47(5): 657-679.
- Mair, J., Marti, I., Ventresca, M. J. 2012. Building inclusive markets in rural Bangladesh: How intermediaries work institutional voids. *Academy of Management Journal*, 55(4): 819-850.
- Malerba, F. 2002. Sectoral systems of innovation and production. *Research Policy*, 31(2): 247-264.
- Malhotra A.; Schmidt T.S.; Huenteler J. 2019. The role of inter-sectoral learning in knowledge development and diffusion: Case studies on three clean energy technologies. *Technological Forecasting and Social Change*, 146: 464-487
- Martin, X., Mitchell, W. 1998. The influence of local search and performance heuristics on new design introduction in a new product market. *Research Policy*, 26(7-8): 753-771.
- McGahan, A. M., Porter, M. E. 1997. How much does industry matter, really? *Strategic Management Journal*, 18(S1): 15-30.
- Mitchell, W. 1989. Whether and when? Probability and timing of incumbents' entry into emerging industrial subfields. *Administrative Science Quarterly*, 34(2): 208-230.
- Mitchell, W. 1991. Dual clocks: Entry order influences on incumbent and newcomer market share and survival when specialized assets retain their value. *Strategic Management Journal*, 12(2): 85-100.
- Mitchell, W., Singh, K. 1992. Incumbents' use of pre-entry alliances before expansion into new technical subfields of an industry. *Journal of Economic Behavior & Organization*, 18(3): 347-372.
- Mody, C. C. 2006. Corporations, universities, and instrumental communities: commercializing probe microscopy, 1981-1996. *Technology and Culture*, 47(1): 56-80.
- Moeen, M. 2017. Entry into nascent industries: Disentangling a firm's capability portfolio at the time of investment versus market entry. *Strategic Management Journal*, 38(10): 1986-2004.
- Moeen, M., Agarwal, R. 2017. Incubation of an industry: Heterogeneous knowledge bases and modes of value capture. *Strategic Management Journal*, 38(3): 566-587.
- Moeen, M., Agarwal, R., Shah, S. 2020. Building Industries by Building Knowledge: Uncertainty Reduction Over Industry Milestones. *Strategy Science*, 5(3): 147-291.
- Moeen, M., Mitchell, W. 2020. How do pre-entrants to the industry incubation stage choose between alliances and acquisitions for technical capabilities and specialized complementary assets? *Strategic Management Journal*, 42(8): 1450-1489.
- Mokyr, J. 1992. *The Lever of Riches: Technological Creativity and Economic Progress*. Oxford University Press.
- Moore, G., Davis, K. 2004. Learning the Silicon Valley way. *Building high-tech clusters: Silicon Valley and beyond*, 7, 36.
- Mowery, D. C. 2012. Defense-related R&D as a model for "Grand Challenges" technology policies. *Research policy*, 41(10), 1703-1715.
- Mowery, D. C., Rosenberg, N. 1991. *Technology and the pursuit of economic growth*. Cambridge University Press.
- Munir, K. A., Phillips, N. 2005. The birth of the 'Kodak Moment': Institutional entrepreneurship and the adoption of new technologies. *Organization Studies*, 26(11): 1665-1687.
- Munir, K., Ansari, S., Brown, D. 2021. From Patañjali to the "gospel of sweat": Yoga's remarkable transformation from a sacred movement into a thriving global market. *Administrative Science Quarterly*, 66(3): 854-899.
- Murmann, J. P. 2003. *Knowledge and competitive advantage: The coevolution of firms, technology, and national institutions*. Cambridge University Press.
- Murmann, J. P., Frenken, K. 2006. Toward a systematic framework for research on dominant designs, technological innovations, and industrial change. *Research Policy*, 35(7): 925-952.
- Nagarajan, A., Mitchell, W. 1998. Evolutionary diffusion: Internal and external methods used to acquire encompassing, complementary, and incremental technological changes in the lithotripsy

- industry. *Strategic Management Journal*, 19(11), 1063-1077.
- Navis, C., Glynn, M. A. 2010. How new market categories emerge: Temporal dynamics of legitimacy, identity, and entrepreneurship in satellite radio, 1990–2005. *Administrative Science Quarterly*, 55(3): 439-471.
- Nelson, A., Anthony, C., Tripsas, M. 2023. “If I Could Turn Back Time”: Occupational Dynamics, Technology Trajectories, and the Reemergence of the Analog Music Synthesizer. *Administrative Science Quarterly*, 68(2): 551-599.
- North, D. C., Wallis, J. J. 1994. Integrating institutional change and technical change in economic history a transaction cost approach. *Journal of Institutional and Theoretical Economics*, 150(4): 609-624.
- O'Reilly III, C. A., Harrell, J. B., Tushman, M. L. 2009. Organizational ambidexterity: IBM and emerging business opportunities. *California Management Review*, 51(4): 75-99.
- Ocasio, W. 1997. Towards an attention-based view of the firm. *Strategic Management Journal*, 18(S1): 187-206.
- Ozcan, P., Eisenhardt, K. M. 2009. Origin of alliance portfolios: Entrepreneurs, network strategies, and firm performance. *Academy of Management Journal*, 52(2): 246-279.
- Ozcan, P., Gurses, K. 2018. Playing Cat and Mouse: Contests over Regulatory Categorization of Dietary Supplements in the United States. *Academy of Management Journal*, 61(5): 1789-1820.
- Ozcan, P., Santos, F. M. 2015. The market that never was: Turf wars and failed alliances in mobile payments. *Strategic Management Journal*, 36(10): 1486-1512.
- Pacheco, D. F., York, J. G., Hargrave, T. J. 2014. The coevolution of industries, social movements, and institutions: Wind power in the United States. *Organization Science*, 25(6): 1609-1632.
- Paik, Y., Kang, S., Seamans, R. 2019. Entrepreneurship, innovation, and political competition: How the public sector helps the sharing economy create value. *Strategic Management Journal*, 40(4): 503-532.
- Park, U. D., Rha, Y., Shah, S. K., Chattopadhyay, S. 2024. An image of industry: Exploring the effects of knowledge sources in the medical imaging industry. *Industrial and Corporate Change*, 33(1), 64-89.
- Pillai, S. D., Giacomini, V. 2024. From a creative cluster to a creative hub: Prêt-à-porter's emergence in Italy and Milan's transition to a fashion hub. Working paper
- Pillai, S. D., Goldfarb, B., Kirsch, D. A. 2020. The origins of firm strategy: Learning by economic experimentation and strategic pivots in the early automobile industry. *Strategic Management Journal*, 41(3): 369-399.
- Polidoro Jr, F., Jacobs, C. 2024. Knowledge diffusion in nascent industries: Asymmetries between startups and established firms in spurring inventions by other firms. *Strategic Management Journal*, 45(4): 807-845.
- Pontikes, E. G. 2018. Category strategy for firm advantage. *Strategy Science*, 3(4): 620-631.
- Pontikes, E. G. 2022. Category innovation in the software industry: 1990–2002. *Strategic Management Journal*, 43(9): 1697-1727.
- Pontikes, E. G., Rindova, V. P. 2020. Shaping markets through temporal, constructive, and interactive agency. *Strategy Science*, 5(3): 149-159.
- Qian, L., Agarwal, R., Hoetker, G. 2012. Configuration of value chain activities: The effect of pre-entry capabilities, transaction hazards, and industry evolution on decisions to internalize. *Organization Science*, 23(5): 1330-1349.
- Quadrini, V. 2000. Entrepreneurship, saving, and social mobility. *Review of Economic Dynamics*, 3(1): 1-40.
- Raffaelli, R. 2019. Technology reemergence: Creating new value for old technologies in Swiss

- mechanical watchmaking, 1970–2008. *Administrative Science Quarterly*, 64(3): 576-618.
- Ranganathan, R., Rosenkopf, L. 2014. Do ties really bind? The effect of knowledge and commercialization networks on opposition to standards. *Academy of Management Journal*, 57(2): 515-540.
- Rao, H. 1994. The social construction of reputation: Certification contests, legitimation, and the survival of organizations in the American automobile industry: 1895–1912. *Strategic Management Journal*, 15(S1): 29-44.
- Rathje, J. M., Katila, R. 2021. Enabling technologies and the role of private firms: A machine learning matching analysis. *Strategy Science*, 6(1): 5-21.
- Rindova, V. P., Kotha, S. 2001. Continuous “morphing”: Competing through dynamic capabilities, form, and function. *Academy of Management Journal*, 44(6): 1263-1280.
- Rindova, V. P., Petkova, A. P. 2007. When is a new thing a good thing? Technological change, product form design, and perceptions of value for product innovations. *Organization Science*, 18(2): 217-232.
- Rindova, V. P., Petkova, A. P., Kotha, S. 2007. Standing out: How new firms in emerging markets build reputation. *Strategic Organization*, 5(1): 31-70.
- Rogers, E. 1962. *Diffusion of innovations*. New York, NY: The Free Press.
- Romer, P. M. 1990. Endogenous technological change. *Journal of Political Economy*, 98(5, Part 2): S71-S102.
- Rosenberg, N. 1969. The direction of technological change: inducement mechanisms and focusing devices. *Economic development and cultural change*, 18(1, Part 1): 1-24.
- Rosenberg, N. 1982. *Inside the black box: Technology and economics*. Cambridge, UK: Cambridge University Press.
- Rosenberg, N. 1992. Economic experiments. *Industrial and Corporate change*, 1(1): 181-203.
- Rosenbloom, R. S., Cusumano, M. A. 1987. Technological pioneering and competitive advantage: the birth of the VCR industry. *California Management Review*, 29(4): 51-76.
- Rosenkopf, L., Tushman, M. L. 1998. The coevolution of community networks and technology: Lessons from the flight simulation industry. *Industrial and Corporate Change*, 7(2): 311-346.
- Rothaermel, F. T. 2001. Incumbent’s advantage through exploiting complementary assets via interfirm cooperation. *Strategic Management Journal*, 22(6-7): 687-699.
- Rothaermel, F. T., Boeker, W. 2008. Old technology meets new technology: Complementarities, similarities, and alliance formation. *Strategic Management Journal*, 29(1): 47-77.
- Rothaermel, F. T., Hill, C. W. 2005. Technological discontinuities and complementary assets: A longitudinal study of industry and firm performance. *Organization Science*, 16(1): 52-70.
- Rothaermel, F. T., Thursby, M. 2007. The nanotech versus the biotech revolution: Sources of productivity in incumbent firm research. *Research Policy*, 36(6): 832-849.
- Roy, R., Cohen, S. K. 2017. Stock of downstream complementary assets as a catalyst for product innovation during technological change in the US machine tool industry. *Strategic Management Journal*, 38(6): 1253-1267.
- Roy, R., Lampert, C. M., Sarkar, M. 2019. The pre-commercialization emergence of the combination of product features in the charge-coupled device image sensor. *Strategic Entrepreneurship Journal*, 13(4): 448-477.
- Roy, R., Sarkar, M. B. 2016. Knowledge, firm boundaries, and innovation: Mitigating the incumbent’s curse during radical technological change. *Strategic Management Journal*, 37(5): 835-854.
- Sanderson, S. W., Simons, K. L. 2014. Light emitting diodes and the lighting revolution: The emergence of a solid-state lighting industry. *Research Policy*, 43(10): 1730-1746.
- Santos, F. M., Eisenhardt, K. M. 2009. Constructing markets and shaping boundaries: Entrepreneurial

- power in nascent fields. *Academy of Management Journal*, 52(4): 643-671.
- Sauermann, H., Stephan, P. 2013. Conflicting logics? A multidimensional view of industrial and academic science. *Organization Science*, 24(3): 889-909.
- Schilling, M. A. 2002. Technology success and failure in winner-take-all markets: The impact of learning orientation, timing, and network externalities. *Academy of Management Journal*, 45(2): 387-398.
- Schultz, P. L., Marin, A., Boal, K. B. 2014. The impact of media on the legitimacy of new market categories: The case of broadband internet. *Journal of Business Venturing*, 29(1): 34-54.
- Seidel, V. P., O'Mahony, S. 2014. Managing the repertoire: Stories, metaphors, prototypes, and concept coherence in product innovation. *Organization Science*, 25(3): 691-712.
- Seidel, V. P., Hannigan, T. R., Phillips, N. 2020. Rumor communities, social media, and forthcoming innovations: The shaping of technological frames in product market evolution. *Academy of Management Review*, 45(2): 304-324.
- Shah, S. K., Tripsas, M. 2007. The accidental entrepreneur: The emergent and collective process of user entrepreneurship. *Strategic Entrepreneurship Journal*, 1(1-2): 123-140.
- Shah, S. K., Agarwal, R., Echambadi, R. 2019. Jewels in the crown: Exploring the motivations and team building processes of employee entrepreneurs. *Strategic Management Journal*, 40(9): 1417-1452.
- Sharkey, A., Kovács, B., Hsu, G. 2023. Expert critics, rankings, and review aggregators: The changing nature of intermediation and the rise of markets with multiple intermediaries. *Academy of Management Annals*, 17(1): 1-36.
- Shermon, A., Moeen, M. 2022. Zooming in or zooming out: Entrants' product portfolios in the nascent drone industry. *Strategic Management Journal*, 43(11): 2217-2252.
- Silverman, B. 1999. Technological resources and the direction of corporate diversification: Toward an integration of the resource-based view and transaction cost economics. *Management Science*, 45(8), 1109-1124.
- Simcoe, T., 2012. Standard setting committees: Consensus governance for shared technology platforms. *American Economic Review*, 102(1): 305-336.
- Sine, W. D., Lee, B. H. 2009. Tilting at windmills? The environmental movement and the emergence of the US wind energy sector. *Administrative Science Quarterly*, 54(1): 123-155.
- Slavich, B., Svejenova, S., Opazo, M. P., Patriotta, G. 2020. Politics of meaning in categorizing innovation: How chefs advanced molecular gastronomy by resisting the label. *Organization Studies*, 41(2): 267-290.
- Sohn, E. 2021. How local industry R&D shapes academic research: Evidence from the agricultural biotechnology revolution. *Organization Science*, 32(3): 675-707.
- Sohn, E., Seamans, R., Sands, D. B. 2024. Technology adoption and innovation: The establishment of airmail and aviation innovation in the United States, 1918–1935. *Strategic Management Journal*, 45(1): 3-35.
- Sosa, M. L. 2009. Application-specific R&D capabilities and the advantage of incumbents: Evidence from the anticancer drug market. *Management Science*, 55(8): 1409-1422.
- Sosa, M. L. 2013. Decoupling market incumbency from organizational prehistory: Locating the real sources of competitive advantage in R&D for radical innovation. *Strategic Management Journal*, 34(2): 245-255.
- Stephan, U., Patterson, M., Kelly, C., Mair, J. 2016. Organizations driving positive social change: A review and an integrative framework of change processes. *Journal of Management*, 42(5): 1250-1281.
- Stern, S. 2004. Do scientists pay to be scientists? *Management Science*, 50(6): 835-853.

- Stuart, T. E., Ding, W. W. 2006. When do scientists become entrepreneurs? The social structural antecedents of commercial activity in the academic life sciences. *American Journal of Sociology*, 112(1): 97-144.
- Suarez, F., Lanzolla, G. 2007. The role of environmental dynamics in building a first mover advantage theory. *Academy of Management Review*, 32(2): 377-392.
- Sutter, C., Bruton, G. D., Chen, J. 2019. Entrepreneurship as a solution to extreme poverty: A review and future research directions. *Journal of Business Venturing*, 34(1): 197-214.
- Taylor, A., Helfat, C. E. 2009. Organizational Linkages for Surviving Technological Change: Complementary Assets, Middle Management, and Ambidexterity. *Organization Science*, 20(4): 718-739.
- Teece, D. 1986. Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15(6): 285-305.
- Teece, D. J., Pisano, G., Shuen, A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7): 509-533.
- Toh, P. K., Miller, C. D. 2017. Pawn to save a chariot, or drawbridge into the fort? Firms' disclosure during standard setting and complementary technologies within ecosystems. *Strategic Management Journal*, 38(11): 2213-2236.
- Tripsas, M. 1997. Unraveling the process of creative destruction: Complementary assets and incumbent survival in the typesetter industry. *Strategic Management Journal*, 18(S1): 119-142.
- Tripsas, M. 2008. Customer preference discontinuities: A trigger for radical technological change. *Managerial and Decision Economics*, 29(2-3): 79-97.
- Tripsas, M. 2009. Technology, identity, and inertia through the lens of "The Digital Photography Company". *Organization Science*, 20(2): 441-460.
- Tripsas, M., Gavetti, G. 2000. Capabilities, cognition and inertia: Evidence from digital imaging. *Strategic Management Journal*, 21(10-11): 1147-1162.
- Tushman, M. L., Anderson, P. 1986. Technological discontinuities and organizational environments. *Administrative Science Quarterly*, 31(3): 439-465.
- Vakili, K., McGahan, A. M. 2016. Health care's grand challenge: Stimulating basic science on diseases that primarily afflict the poor. *Academy of Management Journal*, 59(6): 1917-1939.
- Vincenti, W. G. 1994. The retractable airplane landing gear and the Northrop "anomaly": Variation-selection and the shaping of technology. *Technology and Culture*, 35(1): 1-33.
- von Hippel, E. 1986. Lead users: A source of novel product concepts. *Management Science*, 32(7): 791-805.
- Weber, K., Heinze, K. L., DeSoucey, M. 2008. Forage for thought: Mobilizing codes in the movement for grass-fed meat and dairy products. *Administrative Science Quarterly*, 53(3): 529-567.
- Woolley J.L.; Pozner J.-E.; DeSoucey M. 2022. Raising the bar: Values-driven niche creation in u.s. bean-to-bar chocolate. *Strategy Science*, 7(1), 27-55.
- Wormald, A. 2024. Money matters: Institutional uncertainty and emergence of the African mobile money industry. Working paper.
- Wormald, A., Agarwal, R., Braguinsky, S., Shah, S. K. 2021. David overshadows Goliath: Specializing in generality for internationalization in the global mobile money industry. *Strategic Management Journal*, 42(8): 1459-1489.
- Wormald, A., Shah, S. K., Braguinsky, S., Agarwal, R. 2023. Pioneering digital platform ecosystems: The role of aligned capabilities and motives in shaping key choices and performance outcomes. *Strategic Management Journal*, 44(7): 1653-1697.
- Wry, T., Lounsbury, M., Glynn, M. A. 2011. Legitimizing nascent collective identities: Coordinating cultural entrepreneurship. *Organization Science*, 22(2): 449-463.

- Wu, B. 2013. Opportunity costs, industry dynamics, and corporate diversification: Evidence from the cardiovascular medical device industry, 1976–2004. *Strategic Management Journal*, 34(11): 1265-1287.
- Wu, B., Wan, Z., Levinthal, D. A. 2014. Complementary assets as pipes and prisms: Innovation incentives and trajectory choices. *Strategic Management Journal*, 35(9): 1257-1278.
- York, J. G., Lenox, M. J. 2014. Exploring the sociocultural determinants of de novo versus de alio entry in emerging industries. *Strategic Management Journal*, 35(13): 1930-1951.
- York, J. G., Vedula, S., Lenox, M. J. 2018. It's not easy building green: The impact of public policy, private actors, and regional logics on voluntary standards adoption. *Academy of Management Journal*, 61(4): 1492-1523.
- Younger, S., Fisher, G. 2020. The exemplar enigma: New venture image formation in an emergent organizational category. *Journal of Business Venturing*, 35(1):105897.
- Zollo, M., Winter, S. 2002. Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3): 339-351.
- Zucker, L. G., Darby, M. R., Brewer, M. B. 1998. Intellectual capital and the birth of US biotechnology enterprises. *American Economic Review*, 88(1), 290-306.
- Zuzul, T., Tripsas, M. 2020. Start-up Inertia versus Flexibility: The Role of Founder Identity in a Nascent Industry. *Administrative Science Quarterly*, 65(2): 395-433.
- Zuzul, T. W. 2019. Matter battles: Cognitive representations, boundary objects, and the failure of collaboration in two smart cities. *Academy of Management Journal*, 62(3): 739-764.