City Research Online

City St George's, University of London

Citation: Adams, P., Bahoo-Torodi, A., Fontana, R. & Malerba, F. (2024). Employee spinouts along the value chain. Industrial and Corporate Change, 33(1), pp. 90-105. doi: 10.1093/icc/dtad073

This is the accepted version of the paper.

This version of the publication may differ from the final published version. To cite this item please consult the publisher's version.

Permanent repository link: https://openaccess.city.ac.uk/id/eprint/31862/

Link to published version: https://doi.org/10.1093/icc/dtad073

Copyright and Reuse: Copyright and Moral Rights remain with the author(s) and/or copyright holders. Copies of full items can be used for personal research or study, educational, or not-for-profit purposes without prior permission or charge, unless otherwise indicated, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way. For full details of reuse please refer to City Research Online policy.

City Research Online: http://openaccess.city.ac.uk/ publications@citystgeorges.ac.uk

EMPLOYEE SPINOUTS ALONG THE VALUE CHAIN

Pamela Adams
Stillman School of Business, Seton Hall University
pamela.adams@shu.edu

Aliasghar Bahoo-Torodi
Bayes Business School, City University of London
Aliasghar.bahoo-torodi@city.ac.uk

Roberto Fontana
University of Pavia and ICRIOS—Bocconi University
Roberto.fontana@unipv.it

Franco Malerba
Department of Management and Technology and ICRIOS, Bocconi University
Franco.malerba@unibocconi.it

Forthcoming
Industrial and Corporate Change

ABSTRACT

While much of the academic literature on spinouts focuses on new ventures launched by the ex-employees of incumbent firms within the same industry, recent research shows that spinouts may also enter a focal industry from 'knowledge contexts' outside of the incumbent industry. In particular, recent studies show that spinouts may enter from both upstream and downstream industries related to a focal industry along the value chain. Such spinouts have been called user-industry and supplier-industry spinouts. In this article, evidence from existing studies is collected to provide an indication of the relevance of such spinouts across various industries. This survey also includes an analysis of industry studies in which user- and supplier-industry spinouts may have been present but were not identified as such by scholars due to a difference in focus. The paper then considers the evidence accumulated to date in order to explore the industry contexts in which these two types of spinouts appear and to develop propositions concerning differences in entry timing and product/market strategies of these entrants.

1. Introduction

Entry by employee spinouts[1] has received increasing attention in the literature on strategy, industry dynamics, and entrepreneurship over the past decades (Cao and Posen, 2023; Gambardella et al., 2015; Ganco, 2013; Kaul et al, 2021; Yeganegi et al., 2022; Klepper, 2009; Sørensen and Fassiotto, 2011). The focus of much of this research is on the knowledge resources that the founders of these independent ventures inherit from their pre-entry experience in other companies. Research over a broad range of industries shows that the pre-entry experience and know-how inherited by independent startups through their founders play a significant role in determining both the strategic choices and the success rates of new entrants (Agarwal et al., 2004; Chatterji, 2009; Klepper and Sleeper, 2005). This work is largely based on evolutionary theory that suggests that the resources and capabilities of new firms affect both their likelihood to enter an industry and their performance once entered (Nelson and Winter, 1982). It is argued that spinouts differ from other *de novo* startups and university spinoffs because their founders inherit knowledge from previous employment in firms in an industrial context (Chen et al*.,* 2012; Helfat and Lieberman, 2002; Klepper and Sleeper, 2005).[2] This inheritance may include managerial skills (Feldman et al., 2019; Moore and Davis, 2004); technological knowledge (Bae and Lee, 2022; Basu et al., 2015; Teece, 1986); market knowledge related to customer needs and market opportunities (Bahoo-Torodi and Torrisi, 2022; Buenstorf, 2007; Sleeper, 1998; Tripsas, 2008); industry knowledge concerning regulations, practices, and marketing networks (Chatterji, 2009); knowledge related to operations or organizational procedures (Bayus and Agarwal, 2007); or some combination of marketing and technological knowledge (Agarwal et al*.,* 2004; Franco et al*.,* 2009). It is also

[1] In this article we use the term employee spinout to identify new and independent ventures founded the ex-employees of incumbent firms. In other studies, such ventures are often referred to as 'spinoffs'.
[2] In this article we use the term startup as a category of new ventures that includes both spinouts (whose founders have previous industry experience) and *de novo* ventures (whose founders do not have previous industry experience).

argued that spinouts benefit as much from 'what they know' as from 'who they know' since founders may have established networks within the industry (Higgins and Gulati, 2003), social connections (Sorenson and Audia, 2000), or contacts with important suppliers and other actors in the industry (Phillips, 2002).

While much of the academic literature on spinouts focuses on new ventures that remain within the same industry, research also shows that spinouts may enter a focal industry from 'knowledge contexts' outside of the incumbent industry (Chatterjee and Wernerfelt, 1991; Helfat and Lieberman, 2002; Agarwal and Shah, 2014; Frischmann et al., 2014; Sakakibara and Balasubramanian, 2020). Much of the work in this field relates to academic institutions and user contexts where researchers or personal consumers develop informational advantages that help them launch a new firm (Shah and Tripsas, 2007; Wennberg et al., 2011). But outside knowledge contexts also include the downstream and upstream industries related to a focal industry along the value chain (Adams et al., 2019). The downstream context refers to demand and industrial use as a source of knowledge. Recent research shows that downstream industries represent a rich context from which employee spinouts may originate and cross into an upstream, focal industry (Adams et al., 2013). Such spinouts, formed by the ex-employees of firms in a downstream industry with respect to the focal industry that they enter, are called '*user-industry spinouts'* (Adams et al., 2016). Similarly, upstream industries represent knowledge contexts from which spinouts may originate and enter into a downstream industry (Alcácer and Oxley, 2014). In this case, employees of firms in a supplier industry, with knowledge of specific components, tools or materials used in a downstream product or service, spinout from their parent companies to found a new venture in the related, downstream industry (Fontana et al., 2016). Therefore, with respect to the focal industry in which they enter, these startups are called *'supplier-industry spinouts'* (Adams et al., 2019).

Two examples may help to explain the dynamics at play in user- and supplier-industry spinouts. The first is a user-industry spinout in the semiconductor industry called *Alchemy Semiconductors*. Alchemy was founded in 1999 as a fabless semiconductor company engaged in the design, development, and marketing of low-power systems-on-chips. The founders of this startup had previously worked for the Digital Equipment Corporation (DEC), a major American company in the minicomputer industry and a downstream user of semiconductor chips. The founders brought their engineering knowledge of computer architecture systems (ALPHA) and the microprocessor designs needed for computer applications into their new venture in semiconductors. They were able to build a successful company which was eventually sold to AMD (an American semiconductor producer) in 2002.[3] The second example originates from the supplier industry context. In this case, an engineer who had previously worked for MAXIM, a producer of integrated circuits, left his employer in 2000 to form a startup -*Transparent Networks* - in the downstream telecommunications industry. As the telecommunications industry was moving from electric to optical switching systems, he realized that his knowledge of MEMS technology (semiconductors) could provide him with a competitive advantage in the telecom industry. He teamed up with other engineers who had complementary knowledge in optical switching and software to produce an innovative switching system. The venture was eventually sold with great success in 2002.[4] These two examples show how the knowledge inherited by spinout founders may be transferred from their pre-entry experience in one industry into a related industry along the vertical chain to create competitive advantage and build successful entrepreneurial ventures. In the first example, knowledge was transferred from a user industry into an upstream industry while, in the second example, knowledge flowed from the supplier industry into the downstream industry.

[3] Source: https://www.wsj.com/articles/SB10130146434023355 20

[4] Source: personal interview with the entrepreneur. Also https://www.crunchbase.com/organization/transparent-networks

Further examples of both user- and supplier-industry spinouts are presented in Tables 1a and 1b, respectively. All of the examples, with the exception of the workstations industry, are drawn directly from the empirical work on spinouts done by the authors of this paper (see Table 2) and will be used in later sections of the paper to help us to theorize about the contexts in which such spinouts tend to be found. They also help us to develop propositions about the entry timing and product/market strategies of these two types of startups. Given the limited number of studies focused specifically on spinouts from related industries along the value chain, this paper underscores the idea that the presence of such spinouts throughout the industrial dynamics of a diverse set of industries may have been greater than is reflected in the extant literature. While the propositions that will be presented speak to the many theories developed concerning the formation and performance of spinouts, the paper shows that much remains to be understood about spinouts along the vertical chain.

Table 1a. Examples of User-industry Spinouts from Different Industries

Sector	Company Name (Year Founded)	Description of Company and Founder Background
SEMICONDUCTORS	Internet Machines (2009)	Internet Machines - A fabless semiconductor company that offered integrated circuits for network processing and high-speed optical and internet infrastructure equipment. The founder was formerly employed by Xylan Corporation, that became a division of Alcatel. He worked on Ethernet and ATM switching products.
	Alchemy Semiconductors (1999)	Alchemy Semiconductors was founded by ex-employees of the Digital Equipment Corporation (DEC), a major American company in the minicomputer industry and a downstream user of semiconductor chips. The founders had knowledge of computer architecture systems (ALPHA).
ARTIFICIAL INTELLIGENCE	Analytic Measures (2014)	Analytic Measures (a provider of artificial intelligence technologies for instruction, assessment, and learning outcomes) was founded by a former employee of Pearson Education, a media and education company.
	Agnito Labs (2014)	Based on his experience as a director of solutions management in McKesson (a medical services and IT company), the founder launched Agnito Labs (Legal Robot) in 2014, a company that helps its users to better understand legal language.
WORKSTATIONS	Nematron Corporation (1983)	Nematron Corporation (1983) produced ruggedized computers and workstations. The founder had previous experience in the design and manufacturing of test equipment for the telecom industry and electronic controls for medical laboratory research equipment at PHC Inc.

	Advanced Video Products (1985)	Advanced Video Products (AVP) developed one of the first digital imaging systems for medical use. The founder had previous experience in GE Medical.
PACKAGED SOFTWARE	MicroRim (1981)	MicroRim (1981) was founded by two brothers to sell the first relational database program for the PC. The founder had previously worked at Boeing Computer services as part of NASA's IPAD project where they gained experience with the application of relational information management systems.
	Retix (1985)	Retix produced OSI (Open Systems Interconnection) software for companies such as AT&T. The founder had previously worked for Olivetti, an Italian manufacturer of computers, tablets, printers, calculators and other business products which provided the founder with experience with application needs in downstream markets.

Table 1b. Examples of Supplier-industry Spinouts from Different Industries

Sector	**Company Name (Year Founded)**	**Description of Company and Founder Background**
TELECOM EQUIP	Wayport (1996)	Wayport - A leading supplier of Ethernet connections for hotel rooms (Telecomm). The founders both had former experience in AMD in the semiconductor industry.
	Transparent Network (2000)	Transparent Network – Developed optical switching system for telecom industry. The founder had former experience in Maxim Integrated, which produces integrated circuits in semiconductor industry.
ARTIFICIAL INTELLIGENCE	Blaize (2010)	Blaiz (formerly Thinci), an AI computing platforms company that developed products for the automotive, smart vision, and enterprise computing markets was founded in 2010 by two former employees of Intel to meet growing consumer demands for new interactive products.
	Cognitive Scale (2014)	CognitiveScale, a provider of enterprise cognitive cloud software that transforms massive amounts of multi-structured data, including text, images, and video into cognitive insights was founded by two former employees of IBM.
WORKSTATIONS	Xyvision, Inc (1982)	Xyvision, Inc, a leading supplier of high-resolution workstations and publishing systems. The founder had previous experience in XyLogic Systems, which designed and manufactured communications controllers and disk subsystems.
	NeuralWare (1987)	NeuralWare developed professional neural network environments. The founder was previously employed by American Industrial Vision, which produced visual based inspection and tracking systems.
PACKAGED SOFTWARE	Tolerant Systems (1983)	Tolerant Systems was founded in 1983 and was later renamed Veritas Software. It specialized in storage management software. It was founded by two former employees of the Intel Corporation (semiconductors).
	OrCad (1985)	OrCad produced electronic data automations (EDA) software. The founders had previously worked for both National Semiconductor and Intel.

The article is organized into the following sections. In section 2, we review the literature to find evidence of the relevance of both user- and supplier-industry spinouts. In section 3, we

discuss the boundary conditions that regard the entry of these types of spinouts. In section 4, we set out a discussion that may represent the basis for future research on the differences between user- and supplier-industry spinouts. In section 5, we discuss our findings within a broader framework of industry dynamics, entry, and knowledge resources.

2. Relevance of Vertical Spinouts across Industries

As stated above, the first question to explore in this analysis is whether or not the entry of entrepreneurial ventures across industries along the value chain is a relevant phenomenon for study. The challenges of collecting detailed information on all entrants in an industry over time, including background information on the founders of startups, has no doubt limited more fine-grained research in this area. However, we may draw from the evidence presented in recent studies, albeit limited in number, to begin to answer this question. Table 2 below presents the quantitative data extracted from recent studies on the semiconductor, telecommunications, artificial intelligence, workstations, and packaged software industries. With the data presented, we are able to distinguish between focal spinouts (with parent firms in the same industry), user-industry spinouts, and supplier-industry spinouts. While some studies cover all three categories, others cover only one or two of them.

The classic category of focal spinouts, defined as new ventures that spawn from parent companies in the same incumbent industry, remains a prominent category in almost all of the studies reported. The only exception is artificial intelligence which is a young industry with relatively few parent companies from which to spawn new spinouts. For our purposes, it is noteworthy that both user- and supplier-industry spinouts represent significant shares of total startup entrants in most cases. User-industry spinouts are most numerous in workstations (52%) but are also substantial in semiconductors (30%) and artificial intelligence (28%). These statistics clearly suggest that knowledge of the user context and user applications provided a base for entrepreneurs from downstream industries to enter their related supplier industries in

the contexts examined. The data presented for supplier-industry spinouts also indicates that, in at least two cases, such spinouts played a relevant role in industry entry. In telecommunications equipment, they represented 39% of all startup entrants, while in artificial intelligence they accounted for 24% of these entrants in the years studied. Again, these percentages suggest that knowledge of one or more of the core components in these two industries provided a basis for entrepreneurs to enter and compete against other companies in their respective industries. These numbers also indicate that, at least in the few industries examined here, user- and supplier-industry spinouts did not represent marginal or exceptional cases of entry. Between 10% and 52% of spinout entrants were from one of these two categories in the reported industries. As a result, they have had an impact on the roster of participants competing, and on the knowledge base active, in these industries.

Table 2. Frequency of Different Types of Employee Spinouts*

Sector (years covered in study)	**Focal Spinout**	**UISO****	**SISO****	**Source of Data**
SEMICONDUCTORS (1996-2007)	429/936 (45%)	280/936 (30%)		Adams, Fontana, and Malerba, 2016
TELECOM EQUIPMENT (1996-2007)	42/90 (47%)		35/90 (39%)	Adams, Fontana, and Malerba, 2019
ARTIFICIAL INTELLIGENCE (1980-2014)	119/1175 (10%)	325/1175 (28%)	277/1175 (24%)	Bahoo-Torodi, Fontana, and Malerba, 2023
WORKSTATIONS (1980-1996)	23/61 (38%)	32/61 (52%)	6/61 (10%)	Our calculation is based on original data from Sorenson, 2000
PACKAGED SOFTWARE (1980-1990)		117/1130***	54/1130***	Our calculation is based on original data from Lee, Fontana and Malerba, 2022

* The denominator represents the total number of startup entrants (spinouts + de novo startups + university spinoffs) in each industry during the time period indicated.
** UISO refers to user-industry spinout and SISO refers to supplier-industry spinout.
*** For packaged software, we had access to a list of 1130 entrants in the industry over this decade. We were able to identify the indicated number of SISO and UISO from the list. It is important to note that this is not necessarily the complete number of UISO and SISO in the list and may be a lower bound.

While these empirical studies provide important insights into the relevance of user- and supplier-industry spinouts, they may not represent the full breadth and depth of their presence

across both time and industries. Looking further, in fact, evidence of the presence of such spinouts may be found in other related studies in the literature. In his review article on the academic literature on employee spinouts[5], Klepper (2009) surveys the evidence produced on the formation and performance of spinouts and assesses various stylized facts that have been developed about spinouts from the extant research. The studies covered in his review, in fact, have laid the groundwork for much of the subsequent theorizing about spinouts (Capone et al., 2019; Cao and Posen, 2023). Although Klepper notes in his introduction that spinouts 'are hardly all alike' (Klepper, 2009:159), the research reviewed in his survey focuses almost exclusively on spinouts formed by the ex-employees of incumbent firms within the same industry (our category of focal spinouts). Other types of entrants, including other types of spinouts, are aggregated into categories of 'incumbent firms in 'related industries'', 'other *de novo* entrants', or 'diversifying entrants'. While this is understandable for scholars seeking to understand the entry strategies and performance of employee spinouts within the same industry versus all other types of entrants, the result is that the full heterogeneity of the entrants that Klepper mentions does not emerge from these studies. While this method was appropriate for his objective, the use of such broad categories overlooks the fact that, within these other categories, we may find firms with very different types of resources and capabilities and that this may be important for understanding entry dynamics.

In this article, we argue that, most notably within the category of 'other *de novo* entrants', there exist sub-categories of different types of spinouts. In particular, we argue that this category may include spinouts that come from parent companies along the value chain. Although we do not have the lists of companies examined in the studies mentioned by Klepper (2009), a careful examination of the categories used by the researchers of many of these studies,

[5] In much of the literature, including the publications of Klepper cited here, the category of new and independent ventures founded by the ex-employees of incumbent firms in an industry is referred to as 'spinoffs'. As noted in Footnote 1, because this category matches our definition of spinouts, for reasons of consistency, we maintain the title of spinouts when referring to the work presented in these studies.

together with a cursory investigation of the history of the industries analyzed in these studies, offers supporting evidence that spinouts from related upstream and downstream industries do exist and indeed present interesting cases of the heterogeneous relationship between knowledge resources and entry decisions. Take, for example, the automobile industry which has been a major engine of growth of the economy since the late 19th century. Given the amount of material available on the origins of automobile producers and the cars they produced, the automobile industry offers a rich context for the study of spinouts. Major studies on spinouts in the automobile industry include Klepper (2007), Carroll et al. (1996), and Boschma and Wenting (2007). These studies each distinguish spinout entrants from incumbent firms in the automobile industry as well as from diversifiers from related industries such as bicycles, carriages and engines, and other startups. While their focus is to analyze the performance of spinouts versus other types of entrants, they indirectly signal the importance of upstream knowledge in the early stages of the industry. In fact, a different reading of these industries may allow us to classify some of the entrants as coming from upstream suppliers of key components to automobiles (e.g. supplier-industry spinouts), rather than 'diversifiers' from related industries. Elwood Haynes, for example, came from a background in the oil and gas industry. He had experience in the construction of gas pipes and a knowledge of the metals best suited for gas engines, both of which were fundamental components for automobile manufacturing. In the 1890's he began to develop his own design for a car in his spare time and, in 1894, road tested his first model. Two years later, he left his job and founded the Haynes-Apperson company for the commercial production of automobiles, which was one of the earliest entrants into the industry.[6] Similarly, Henry Babcock had experience working for companies that manufactured both windmills and carriages in the 1870s. In 1882, he went out on his own to launch the H.H. Babcock Buggy Company for the production of automobiles.

[6] Source: https://www.cityofkokomo.org/departments/elwood_haynes_museum.php

His experience was in a related, upstream industry (carriages) similar to the experience of many more successful diversifying entrants noted by Klepper (2007), such as the famous Studebaker Company. It is argued that the craftmanship the company showed in producing carriages led them to become one of the quality producers of ambulances and hearses in later years, and a leader in the production of coachwork automobile bodies.[7]

Similar examples of spinout entrants from supplier industries may also be found in other studies. Bayus and Agarwal (2007) examine the U.S. personal computer industry between 1974 and 1989 to understand how pre-entry experience and entry timing affect the product strategies and survival rates of entrants in technologically dynamic industries. They distinguish between two general categories of entrants: diversifying entrants (firms listed in a different industry the year before they entered the PC industry) and startups (firms with no previous industry classification before their entry). The focus here is on the pre-entry experience embodied in organizations. In their conclusions, they note, however, that certain types of startups may have advantages due to the prior experience of the founders in incumbent firms (i.e., spinouts). They also note that, as the PC industry grew, several spinouts entered the market. We add to this observation, that some of these spinouts may also have come from related, upstream industries. Compaq, for example, was founded in 1982, ten years into the growth of the industry. Compaq was founded by three entrepreneurs who left their previous employment as top managers in Texas Instruments, a producer of semiconductors and integrated circuits, both of which are key components of personal computers. The pre-entry experience of the founders, therefore, came from their backgrounds in a related supplier industry that produced core components of computers, and not from their experience in another computer manufacturer. The knowledge resources gained from this experience in the semiconductor industry contributed to the success of Compaq, which was partly based on its initial choice of processors for its products. Again,

[7] Source: https://www.conceptcarz.com/profile/3401,14756/1923-dodge-brothers-babcock-custom.aspx

this example shows that a closer examination of startup entrants into industries over time might reveal the existence of spinouts from supplier industries.

The same may be said for spinout entrants from downstream, user industries. Two studies on entry and exit in the laser industry provide some initial evidence in this direction. Klepper and Sleeper (2005) examine entry by spinouts in the laser industry from 1961 to 1994, while Bhaskarabhatla and Klepper (2014) look at the relationship between the development of submarkets and the entry and exit of competitors in the laser industry. Klepper and Sleeper, trace the lineage of all producers and identify 79 spinouts (one or more founders had previously worked for a laser company) of the total of 193 startup entrants into the industry. Their focus is on the analysis of the product strategies and survival rates of these spinouts. But their finding leaves open the question of whether or not any of the startups in their residual category (114) actually came from vertically related industries and, in particular, downstream user industries which acted as significant submarkets for laser producers. This is key since the study by Bhaskarabhatla and Klepper (2014) shows that firms in the laser industry had to serve an increasing number of distinct submarkets with different application needs. Although we do not have a list of the companies included in Klepper and Sleeper's database, it is possible to identify examples of entrepreneurial ventures that entered the industry during this period whose founders had backgrounds in user industries. *ThorLabs*, for example, was founded in 1989 by a scientist who had previously worked for Bell Labs and who had invented a scanning tunneling microscope for DuPont. While ThorLabs initially served the telecommunications market, it eventually branched out into other markets to build a successful business in laser manufacturing. In fact, in 2007 ThorLabs was awarded the Laser Focus World Phast Innovation Award for its adaptive scanning optical microscope (ASOM).[8] Similarly, *Cutting Edge Optronics* was founded in 1992 by the ex-employees of the McDonnell Douglas Aircraft

[8] Source: https://en.wikipedia.org/wiki/Thorlabs

company. McDonnell Douglas had a long tradition of developing and using laser products in its aviation applications. The founders of Cutting Edge Optronics were able to capitalize on the knowledge inherited from their experience at McDonnell Douglas to develop commercial lasers for use in industrial manufacturing.[9] Like ThorLabs, Cutting Edge Optronics represents a user-industry spinout that was able to enter the laser industry successfully with knowledge resources inherited from the pre-entry experience of its founders in downstream application areas.

The above examples from the automobile, personal computer, and laser industries indicate that, although the academic literature on entry has contributed significantly to our understanding of how pre-entry knowledge inherited from incumbent firms in the same industry may influence both the entry and performance of new ventures, it may have overlooked similar patterns in startup ventures whose founders inherited knowledge from vertically related industries. The examples identified are few and do not constitute a representative sample of spinout entrants in each industry. A more exhaustive search would require an in-depth analysis of these and other related studies (Khessina and Carroll, 2008; Chatterji, 2009; Dencker et al., 2009; Clarysse et al., 2011; Furr, 2019). Still, these examples serve to highlight a major point. Both user- and supplier-industry spinouts have been a part of the history of these industries and may even have played a relevant role in the industry dynamics of many sectors. These examples also point to the need of further investigation into the distinctive nature of the knowledge resources that spinouts from vertically related industries inherit through their founders, as well as into the conditions that might govern their entry and performance in the related industry contexts.

3. The Conditions Favoring the Entry of User- and Supplier-Industry Spinouts

Given the above evidence on the presence and relevance of user- and supplier-industry spinouts

[9] Source: https://cuttingedgeoptronics.com/2022/11/02/cutting-edge-optronics-celebrates-30-years-in-business

in the development of several industrial sectors, we may now explore the contexts in which we are more likely to find their presence. In other words, in this section, we examine the industry conditions that seem to favor (or not) the formation of such spinouts. As with other startup entrants, user- and supplier-industry spinouts are more likely to be present in contexts where economies of scale and high capital requirements do not function as barriers to entry or where such barriers may be circumvented by the strategic choices adopted by such ventures. In semiconductors, for example, user-industry spinouts were able to circumvent the challenges of scale and capital by engaging in design rather than manufacturing using the fabless model. As can be seen by the two examples cited in Table 1a (Internet Machines and Alchemy), user-industry spinouts in the semiconductor industry were fabless firms that tended to focus on specific market segments rather than compete with large-scale incumbents in generic products such as memories.

Other industry conditions, however, may work to favor user- and supplier-industry spinouts in more direct ways. A lack of strong property rights regimes across industry boundaries, for example, may favor the presence of such spinouts. In fact, because the founders of such spinouts come from parent companies in either a downstream or upstream context, they may evade the challenges that arise in industries with a presence of strong patent enforcement policies and/or non-compete clauses within the industry, both of which are associated with a reduction of employee mobility (Agarwal et al., 2009; Ganco et al., 2015).

Another condition that favors the entry of user- and supplier-industry spinouts is the presence of market segments. The presence of segmented markets generally limits the creation of strong economies of scale in production and, therefore, lowers entry barriers as discussed above (Klepper and Thompson, 2006). While lack of scale economies may enhance the opportunity to enter for all startup ventures, there are reasons to believe that user- and supplier-industry spinouts may benefit relatively more than *de novo* startups from the presence of

segmented markets. This is due to the fact that market segmentation depends on the variety of customer and user needs. When there are many and specific customer needs for which to cater, user- and supplier-industry spinouts may exploit their ability to cross industry boundaries and to leverage their knowledge endowments in order to address those needs. Often, they do this by responding to needs that have been left 'unexplored' by incumbents or focal spinouts due to the small size or specificity of user needs. In the Artificial Intelligence industry, for example, the proliferation of possible applications of the technology to a variety of contexts and needs ranging from biotechnology to insurance, e-commerce, and fintech favored entry by user-industry spinouts that were able to leverage their deep and contextual knowledge of specific downstream application areas. The examples cited in Table 1a for both the semiconductor and AI industries also illustrate this point. In these examples, the new ventures entered the industry offering products tailored to the specific needs of defined market segments with which they were familiar, rather than competing in broader market categories.

In this way, however, market segmentation links to another condition that tends to favor the presence of user- and supplier-industry spinouts directly: knowledge relatedness. Generally understood, knowledge relatedness refers to the degree of 'matching' between the endowment of a potential entrant and the needs of a target industry (Bettis, 1981; Helfat and Lieberman, 2002; Uzunca, 2018). It has been identified as one of the key drivers of firm entry (Sapienza et al., 2004; Tanriverdi and Venkatraman, 2005; Benner and Tripsas, 2012; Chang et al., 2022). In a value chain perspective, relatedness may also refer to knowledge complementarities between industries located either upstream or downstream with respect to the target industry. User-industry spinouts inherit deep and contextual knowledge about applications and users, about the specific needs of users, and about the commercialization, communication, and regulatory contexts of downstream markets (Adams et al., 2016). Through their founders, they also inherit firsthand experience with the functionality, as well as the shortcomings, of the

related supplier industry's products in a specific application context that is more direct and more continuous than what might be learned by supplier firms that work with the customers through more indirect mechanisms. Along the same lines, supplier-industry spinouts inherit knowledge about technologies and inputs needed in downstream industries, about opportunities and constraints in the use of such inputs, and about innovation trajectories in the supplier's product areas (Adams et al, 2019). They may also inherit a broad understanding of sourcing patterns in the upstream industry, as well as other commercial and regulatory patterns (Alcácer and Oxley, 2014; Balboni et al., 2017; Sikombe and Phiri, 2019). Both types of spinouts, therefore, have contextual knowledge that may match or complement the needs of the new industries in which they enter. Such informational advantages may help them to compete against other firms in the new focal industry. Moreover, the more the knowledge inherited by the founders of these spinouts is tacit, embedded in routines and teams, or 'sticky' to those individuals with contextual experience (Nelson and Winter, 1982; von Hippel, 1998), the more it offers user- and supplier-industry spinouts a competitive advantage over firms that try to gain such knowledge through various forms of relationships with customers or suppliers. Characteristics of knowledge relatedness may be found in each of the examples presented in Tables 1a and 1b for both types of spinouts.

It should be noted, however, that the ability to re-deploy industry-specific knowledge becomes less and less effective the further the target industry is in terms of knowledge relatedness. Thus, we would tend to observe user- and supplier-industry spinouts entering adjacent industries (downstream or upstream) rather than 'leapfrogging' into more distant ones. Indeed, Adams et al, (2019) find a higher frequency of entry by supplier-industry spinouts from the semiconductor industry into telecom equipment (the adjacent market), but a relatively lower frequency of entry into network and connectivity (or telecom services) that are further down the value chain. They also find substantially more entry by user-industry spinouts from telecom

into semiconductor equipment design, than into lithography or the production of EDA equipment, both of which are further up the value chain.

Finally, a related condition that favors the presence of supplier-industry spinouts is the identification of the upstream product as a 'core' input in the downstream industry. According to De Figueiredo and Silverman (2012), core inputs display two main characteristics. First, they are 'specific' in the sense that they involve tailored investments both upstream and downstream. Second, they tend to cater to a restricted set of industries. 'Core components' constitute one type of core input. They are typically integrated into a system and provide a competitive advantage to buyers in terms of lower costs, greater performance, higher product differentiation, or a combination of these advantages. Examples of 'core components' vary from transmissions, engines, and onboard electronics in the automotive industry (Argyres and Bigelow, 2007; Novak and Stern, 2008), to laser engines in the laser printer industry (De Figueiredo and Silverman, 2012; De Figueiredo and Kyle, 2006), to 'claviature' and 'piano actions' in the piano industry (Stuerz, 2014), to special purpose chips custom designed for telecom equipment, medical equipment, and automobiles in the semiconductor industry.

Given their extreme specificity, the design and production of core components require detailed and ad-hoc knowledge about their characteristics, as well as deep and contextual knowledge about the systems in which they will be integrated. If the design of core components demands increasing knowledge of the system in which the components must be integrated, prior experience accumulated in the design of the core component itself becomes a key asset for suppliers who want to engage directly in the production of the system.

This is exactly what happened in the telecommunications industry with the advent of the system-on-a-chip (SoC). SoCs allow the integration of essential electronic parts of telecom equipment onto a single circuit, with a consequent reduction in both power consumption and the number of components needed (Naviner and Amara, 2004). This made prior expertise in

the supply of the core input increasingly instrumental for successful entry into the downstream telecom industry by former employees of semiconductor firms. The two supplier-industry spinouts cited in Table 1b from the telecom equip industry (Wayport and Transparent Networks) provide relevant examples. As semiconductor technology became a key component for many downstream telecom products, supplier-industry spinouts from the semiconductor industry were able to enter and compete in the downstream telecom industry.

4. Differences between User- and Supplier-Industry Spinouts

Building on our previous discussion of the conditions that may favor the presence of user- and supplier-industry spinouts and drawing on some of the examples and recent studies presented in Tables 1a, 1b and 2, in this section we advance a few propositions pertaining to the entry and market strategy of user- vs. supplier-industry spinouts. In particular, we explore ways in which differences in the pre-entry resources and capabilities of such spinouts may shape the timing of entry and their choice of market/product strategy. We build our arguments upon prior research which emphasizes the importance of a 'match' between the pre-entry resources and capabilities of startups and the required resource profiles needed to enter and survive in specific industrial environments (Helfat and Lieberman, 2002).

4.1. When do user- and supplier-industry spinouts enter the focal industry?

The classic literature on industrial dynamics suggests that the early stages of the industry life cycle are characterized by a high degree of uncertainty related to the nature of technology (Anderson and Tushman, 2018), product characteristics (Utterback, 1994), and user preferences (Bayus and Agarwal, 2007). Missing are the stocks of industry-specific knowledge and complementary assets which get developed over time as the industry grows (Anderson and Tushman, 2018; Bayus and Agarwal, 2007; Gort and Klepper, 1982; Sorenson, 2000). Such an environment is conducive to entry by firms that have access to relevant resources and capabilities, developed in similar knowledge contexts, which can be leveraged for entry (Gort

and Klepper, 1982; Helfat and Lieberman, 2002; Scherer, 1982). Empirical studies across multiple industries have shown, in fact, that relevant knowledge assets favor the entry of entrepreneurial spinouts from incumbents into new and emerging industries (Klepper, 2002; Klepper and Sleeper, 2005; Christensen, 1993; Malerba, 1985). But a similar logic may also be used to argue that the early period of an industry's development is also conducive to the entry of user- and supplier-industry spinouts given their inheritance of resources and capabilities from a related industry.

But which of these two types of spinouts from related industries is more likely to enter during the early phases of an industry's development? From the discussion above, in focal industries where an upstream industry supplies a core component, where the barriers to entry are low, and where segments with strong and distinct application needs have not yet developed, it may be argued that supplier-industry spinouts are more likely than user-industry spinouts to enter during the early phases of development. The core technological knowledge that supplier-industry spinouts inherit from their pre-entry experience as suppliers to the downstream industry may be a better match to meet generic needs across the focal industry than the more application specific knowledge inherited by user-industry spinouts. Moreover, in industries that follow the classic description of a life cycle, market segments with distinct application needs tend to develop in later phases of an industry's development. Until such distinctions appear and are substantiated, user-industry spinouts with knowledge assets that may provide a competitive advantage in the focal industry will be lacking.

Not all industries, however, follow the classic framework of the life cycle theory (Klepper, 1997). In some cases, market segments with distinct customer needs are quick to appear and develop. In such cases, user-industry spinouts may also enter during the early phases of industry growth. In the artificial intelligence industry, for example, distinct user applications were identified early into the industry's history. Given the relatively low barriers

to entry into the industry, entrepreneurs from downstream user industries were able to enter and compete in artificial intelligence. A recent study (Bahoo-Torodi et al., 2023) shows, in fact, that during the early phases of the AI industry (up to the growth phase starting in 2008), user-industry spinouts accounted for a similar share of the total of startup entrants as did supplier-industry spinouts (27% vs 32%).[10] Therefore, in industries where market segments with distinct applications for the core technology develop early, differences between the entry of user- and supplier-industry spinouts will be less pronounced than in industries where segmentation takes longer to develop.

4.2. Which product markets do user- and supplier-industry spinouts enter?

The extant literature on startups suggests that the pre-entry resources with which they enter a new market affect not only the timing of their entry, but also the choice of product/market strategies upon which they focus (Adams et al., 2016; Helfat and Lieberman, 2002). In general, user- and supplier-industry spinouts may adopt two types of product/market strategies upon entering the focal industry: strategies targeting generic product categories versus strategies targeting specific ones. Generic product strategies involve products that can be sold in multiple markets with little or no customization. Generic products thereby address standardized needs across a wide range of customer categories. By contrast, specific product strategies refer to products that require some degree of customization in order to meet the needs of defined groups of customers.

As discussed in detail above, user-industry spinouts learn about the shortcomings of upstream products from the user side of supplier-user relationships. Further, from their pre-entry experience in a user industry, they inherit knowledge of the downstream market including distribution and communication channels (Adams et al., 2016). Therefore, the knowledge possessed by user-industry spinout is largely local (Von Hippel, 1998), limited to a specific

[10] Other startups were identified as focal spinouts, academic spinoffs or de novo startups.

context (Adams et al., 2016), and not extendable across heterogeneous applications. In fact, prior research on user entrepreneurship provides evidence to support the argument that 'demand' driven startups serve niche markets with similar needs (Shah et al., 2012, Chatterji, 2009). In this regard, user-industry spinouts tend to enter specific market segments close to their originating application contexts. For example, in a study of the semiconductor industry, Adams et al. (2016) find that user-industry spinouts are more likely to both enter and survive in market-specific product categories that require knowledge and resources related to their own originating application contexts. These arguments are in line with examples of user-industry spinouts presented in Table 1a. For example, the two examples of user-industry spinouts in the AI industry (Analytic Measures and Agnito Labs) entered specific product categories related to their industry of origin.

Supplier-industry spinouts, by contrast, enter the focal industry with deep and contextual knowledge of upstream products and technologies. This may include knowledge concerning innovation trajectories in the supplier context or more generally opportunities and constraints concerning the products and their applications (Adams et al, 2019). They may also have market knowledge of how their product is used in multiple downstream industries (Alcácer and Oxley, 2014). This market knowledge is less contextual than what user-industry spinouts inherit since the experience of supplier-industry spinouts is working with, rather than directly as, customers in specific application areas. Still, it may provide them with informational advantages over other entrants that lack such experience. Their pre-entry experience may also help founders from a supplier industry to detect similarities among different demand segments and to design products that simultaneously meet multiple downstream needs. Therefore, compared to user-industry spinouts, supplier-industry spinouts are better equipped to address the 'needs of a broad range of downstream customer segments by adopting a generic product/market strategy upon entering the downstream market (Adams

et al., 2019; p.534). Again, the examples above in Table 1b are consistent with such statements. Both examples of supplier-industry spinouts in the telecommunications industry (*Wayport* and *Transparent Network*) adopted a generic product strategy by offering generic telecom equipment products to be used in a wide range of markets. Based on this discussion, we may argue that user-industry spinouts are more likely to pursue specific product strategies, while supplier-industry spinouts are more likely to pursue generic product strategies in the focal industry.

5. Discussion

To date, much of the empirical research on the entry of startup firms in industries has been focused on spinouts from incumbent firms within the same industry as contrasted with *de novo* entrants. This research offers important insights into the knowledge resources that spinouts that remain within their focal industry may possess and use to compete against larger and more established incumbents. This paper adds to this literature and argues that a much greater degree of heterogeneity exists within the category of startup entrants. Although this has long been observed by scholars working in this area (Helfat and Lieberman, 2002; Agarwal et al., 2004; Klepper, 2009), few empirical studies go into detailed analyses of this heterogeneity and its implications for entry and industry dynamics. The objective of this article is to highlight these differences for two specific types of employee spinouts (user-industry and supplier-industry spinouts) that enter into a new focal industry from a vertically related industry along the value chain. Rather than address a particular research question, the article reviews the state of the art on this issue to identify unanswered questions regarding both the extent of the phenomenon and the characteristics and performance of user- and supplier-industry spinouts. Propositions concerning the differences between user- and supplier-industry spinouts are developed to delineate new research opportunities and to enrich both academic and policy discussions concerning employee spinouts. The analysis indicates, moreover, that the phenomenon of user-

and supplier-industry spinouts may be more widespread than indicated by the current literature (Yeganegi et al., 2016; Cao and Posen, 2023). The article therefore highlights the need for more detailed analyses to understand the extent to which the patterns and propositions identified in this article hold in a broader set of industries.

The article is relevant for the topics addressed in this Special Issue on entry for several reasons. While user- and supplier-industry spinouts have distinctive knowledge resources that distinguish them from focal spinouts, they also differ from other types of entrants. For example, user- and supplier-industry spinouts are different from organizations characterized by vertical integration or specialization. In the case of vertical integration, a firm active in two related industries benefits from internal integrative capabilities to bring together, in a single organization, specific complementary knowledge coming from the two industries (Langlois, 1992). Integrated knowledge is therefore combined and shared within an organization that spans across multiple industries. In the case of specialization, on the contrary, specific knowledge remains confined in a specialized organization that operates in one (or the other) of the vertically related industries. However, in the case of spinouts that cross industry boundaries, the specific knowledge comes from two vertically related industries and it is integrated into a specialized organization that operates only in one (or the other) of the vertically related industries. User- and supplier-industry spinouts also differ from university spinoffs that lack pre-entry experience in an industrial context. Finally, they differ from diversifiers, in that these startup ventures are independent of any parent firm. More analysis of when, where, and how they compete in their new industries, therefore, opens up rich opportunities for research on entrepreneurship, knowledge resources, and industry dynamics.

Highlighting the relevance of spinouts originating from user and supplier industries also provides useful suggestions to investors and public policy makers interested in the sources of entrepreneurship. This study suggests that the support of, and search for, new investment

opportunities should reach beyond scientific labs and universities, and beyond contacts with incumbent firms within an industry, to include promising ideas and entrepreneurs from both upstream and downstream industry contexts. Experience in closely related industries along the value chain may provide entrepreneurs with significant knowledge resources, especially in specific product/market niches. Understanding the industry contexts from which new and independent ventures originate also provides a good indication of the knowledge endowments that founders bring into their new organizations, and of the kinds of technologies, products, markets, and applications with which they have had experience. A more fine-grained approach that encompasses upstream and downstream contexts may therefore help investors and policy makers identify potential new sources of innovation and assess how the proposed strategies of new ventures from such contexts align with their knowledge resources.

Beyond a mere presence, however, it is necessary to examine the relevance of user- and supplier-industry spinouts in terms of both their total number and their effect on the competitive dynamics and innovation in the industries in which they enter. As noted above, few studies to date provide quantitative evidence of the prevalence of user- and supplier-industry spinouts with respect to other competitors, including both established firms, university spinoffs, and other new entrants. More such studies would provide a better perspective about whether such spinouts represent a marginal phenomenon in the industries in which they appear or one that may impact the composition and market structure of these industries in some significant way. The higher survival rates of such spinouts with respect to other new entrants suggest that, in many cases, they affect the selection process and change the roster of participants in their new industries (Adams et al., 2019; Cao and Posen, 2023). But relevance may also be measured in terms of the knowledge resources that such spinouts bring to play in the new industry from their founders' pre-entry experience in a related upstream or downstream context. For example, Adams et al. (2013) show that downstream, user firms patented more in the semiconductor

industry than semiconductor firms themselves between 1984 and 2003. To what extent did the knowledge brought into the semiconductor industry by the entry of user-industry spinouts in this and later periods then change the patterns of innovation in the industry and increase attention given to the needs of specific application areas? Even further, while extant studies show that spinouts frequently enter a new industry with patents, less is known about the extent to which these patents are relevant and cited within the new, focal industry or have generated a subsequent stream of innovations and complementary investments. More in general, much remains to be learned about how the knowledge spillovers that result from the entry of user- and supplier-industry spinouts into a new industry affect innovation trajectories in any significant way.

A final issue concerns the kinds of industries in which user- and supplier-industry spinouts are found (Capone et al., 2019). Few efforts have been made to date to broaden the study of employee spinouts across industries and, more specifically, of employee spinouts along the value chain in either low technology industries or in service industries. Recent work on spinouts across a wide range of industries provides some indication that the phenomenon may be more widespread than indicated by the current literature (Yeganegi et al., 2016; Cao and Posen, 2023). Studies of industries such as plastics and molds (Costa and Baptista, 2015 and 2023), legal services (Phillips, 2002), fashion design (Wenting, 2008), and banking (Zheng et al., 2016; Cao and Posen, 2019) suggest that spinouts from upstream and downstream may be present. Still, more detailed analysis is needed to understand the extent to which patterns similar to those reported for high technology industries are observable across a wider range of industries.

6. References

Adams, P., Fontana, R. and Malerba, F. (2013), The magnitude of innovation by demand in a sectoral system: The role of industrial users in semiconductors, *Research Policy,* 42(1), 1–14.

Adams, P., Fontana, R., and Malerba, F. (2016), User-industry spinouts: Downstream industry knowledge as a source of new firm entry and survival, *Organization Science,* 27(1), 18-35.

Adams, P., Fontana, R., and Malerba, F. (2019). Linking vertically related industries: entry by employee spinouts across industry boundaries. *Industrial and Corporate Change*, 28(3), 529-550.

Agarwal, R., Echambadi, R., Franco,A. and Sarkar, M. (2004), Knowledge transfer through inheritance: Spin–out generation, development and survival, *Academy of Management Journal,* 47(4),501–522.

Agarwal, R., Ganco, M., and Ziedonis, R. H. (2009). Reputations for toughness in patent enforcement: Implications for knowledge spillovers via inventor mobility. *Strategic Management Journal*, *30*(13), 1349-1374.

Agarwal, R. and Shah, S. (2014), Knowledge sources of entrepreneurship: Firm formation by academic, user and employee innovators, *Research Policy*, 43(7), 1109-1133.

Alcácer, J. and Oxley, J. (2014) Learning by Supplying, *Strategic Management Journal,* 35(2), 204-223.

Anderson, P., and Tushman, M. L. (2018). Technological discontinuities and dominant designs: A cyclical model of technological change. In *Organizational Innovation* (pp. 373-402). Routledge.

Argyres, N., and Bigelow, L. (2007). Does transaction misalignment matter for firm survival at all stages of the industry life cycle?. *Management Science*, 53(8), 1332-1344.

Bae, J., and Lee, J. M. (2021). How technological overlap between spinouts and parent firms affects corporate venture capital investments in spinouts: the role of competitive tension. *Academy of Management Journal*, 64(2), 643-678.

Bahoo-Torodi, A., Fontana, R., and Malerba, F. (2023). Knowledge resources, entry strategies, and performance of spinouts in nascent industries. Paper presented at Industry Studies Association, Annual Conference, Colombus, Ohio.

Bahoo-Torodi, A., and Torrisi, S. (2022). When do spinouts benefit from market overlap with parent firms?. *Journal of Business Venturing*, 37(6), 106249.

Balboni, B., Marchi, G., and Vignola, M. (2017). Knowledge transfer in the context of buyer–supplier relationship: An analysis of a supplier's customer portfolio. *Journal of Business Research*, 80, 277-287.

Basu, S., Sahaym, A., Howard, M. D., and Boeker, W. (2015). Parent inheritance, founder expertise, and venture strategy: Determinants of new venture knowledge impact. *Journal of Business Venturing*, 30(2), 322-337.

Bayus, B. L., and 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., and 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.

Bettis, R. A. (1981). Performance differences in related and unrelated diversified firms. *Strategic Management Journal*, 2(4), 379-393.

Bhaskarabhatla, A., and Klepper, S. (2014). Latent submarket dynamics and industry evolution: lessons from the US laser industry. *Industrial and Corporate Change*, *23*(6), 1381-1415.

Boschma, R. A., and Wenting, R. (2007). The spatial evolution of the British automobile industry: Does location matter?. *Industrial and Corporate Change*, *16*(2), 213-238.

Buenstorf, G. (2007), Evolution on the shoulders of giants: entrepreneurship and firm survival in the German laser industry. *Review of Industrial Organization* 30(3), 179–202.

Cao, Z., and Posen, H. E. (2023). When does the pre-entry experience of new entrants improve their performance? A meta-analytical investigation of critical moderators. *Organization Science*, 34(2), 613-636.

Cao, Z., and Posen, H. E. (2019). How Does Pre-Entry Experience Enhance Entrant Performance? Evidence From Learning Curves of New Banks. *Evidence From Learning Curves of New Banks (May 31, 2019)*.

Capone, G., Malerba, F., and Orsenigo, L. (2019). Spinoffs in context: entry and performance across different industries. *Industrial and Corporate Change*, *28*(2), 259-282.

Carroll, G. R., Bigelow, L. S., Seidel, M. D. L., and 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.

Chang, S., Eggers, J. P., and Keum, D. D. (2022). Bottleneck resources, market relatedness, and the dynamics of organizational growth. *Organization Science*, 33(3), 1049-1067.

Chatterjee, S., and Wernerfelt, B. (1991). The link between resources and type of diversification: Theory and evidence. *Strategic Management Journal*, *12*(1), 33-48.

Chatterji, A. (2009), Spawned with a silver spoon? Entrepreneurial performance and innovation in the medical device industry, *Strategic Management Journal,* 30(2), 185–206.

Chen, P. L., Williams, C. and Agarwal, R. (2012), Growing pains: Pre-entry experience and the challenge of transition to incumbency. *Strategic Management Journal*, 33(3), 252-276.

Christensen, C. M. (1993). The rigid disk drive industry: A history of commercial and technological turbulence. *Business History Review*, 67(4), 531-588.

Clarysse, B., Wright, M., and Van de Velde, E. (2011). Entrepreneurial origin technological knowledge, and the growth of spin-off companies. *Journal of Management Studies*, 48(6), 1420-1442.

Costa, C., and Baptista, R. (2015). Organizational heritage and entrepreneurship: Steven Klepper's theories reflected in the emergence and growth of the plastic molds industry in Portugal. *Entrepreneurship, Human Capital, and Regional Development*, 281-293.

Costa, C., and Baptista, R. (2023). Knowledge inheritance and performance of spinouts. *Eurasian Business Review*, 1-27.

De Figueiredo, J. M., and Kyle, M. K. (2006). Surviving the gales of creative destruction: The determinants of product turnover. *Strategic Management Journal*, 27(3), 241-264.

De Figueiredo, J. M., and Silverman, B. S. (2012). Firm survival and industry evolution in vertically related populations. *Management Science,* 58(9), 1632-1650.

Dencker, J., Grube, M. and Shah, S. (2009). Pre-entry knowledge, learning, and the survival of new firms. *Organization Science*, 20(3), 516-537.

Feldman, M. P., Ozcan, S., and Reichstein, T. (2019). Falling not far from the tree: Entrepreneurs and organizational heritage. *Organization Science*, 30(2), 337-360.

Fontana, R., Malerba, F. and Marinoni, A. (2016), Pre-entry experience, technological complementarity, and the survival of de novo entrants. Evidence from the US telecommunications industry. *Economics of Innovation and New Technology*, 25(6), 573-593.

Franco, A.M., Sarkar, M.B., Agarwal, R. and 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.

Frischmann, B. M., Madison, M. J., and Strandburg, K. J. (Eds.). (2014). *Governing knowledge commons*. Oxford University Press.

Furr, N. R. (2019). Product adaptation during new industry emergence: The role of start-up team preentry experience. *Organization Science*, *30*(5), 1076-1096.

Gambardella, A., Ganco, M., and Honoré, F. (2015). Using what you know: Patented knowledge in incumbent firms and employee entrepreneurship. *Organization Science*, 26(2), 456-474.

Ganco, M. (2013). Cutting the Gordian knot: The effect of knowledge complexity on employee mobility and entrepreneurship. *Strategic Management Journal*, 34(6), 666-686.

Ganco, M., Ziedonis, R. H., and Agarwal, R. (2015). More stars stay, but the brightest ones still leave: Job hopping in the shadow of patent enforcement. *Strategic Management Journal*, 36(5), 659-685.

Gort, M., and Klepper, S. (1982). Time paths in the diffusion of product innovations. *The Economic Journal*, *92*(367), 630-653.

Helfat, C. E., and Lieberman, M. B. (2002). The birth of capabilities: market entry and the importance of pre-history. *Industrial and Corporate Change*, *11*(4), 725-760.

Higgins, M. C., and Gulati, R. (2003). Getting off to a good start: The effects of upper echelon affiliations on underwriter prestige. *Organization Science*, *14*(3), 244-263.

Kaul, A., Ganco, M., and Raffiee, J. (2021). When subjective judgments lead to spinouts: employee entrepreneurship under uncertainty, firm-specificity, and appropriability. *Academy of Management Review*, (ja).

Khessina, O. M., and 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.

Klepper, S. (1997). Industry life cycles. *Industrial and Corporate Change*, *6*(1), 145-182.

Klepper, S. (2002). The capabilities of new firms and the evolution of the US automobile industry. *Industrial and Corporate Change*, *11*(4), 645-666.

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. (2009), Spinoffs: A review and synthesis. *European Management Review,* 6(3), 159–171.

Klepper, S., and Sleeper, S. (2005). Entry by spinoffs. *Management Science*, 51(8), 1291-1306.

Klepper, S., and Thompson, P. (2006). Submarkets and the evolution of market structure. *The RAND Journal of Economics*, 37(4), 861-886.

Langlois, R. N. (1992). Transaction-cost economics in real time. *Industrial and Corporate Change*, *1*(1), 99-127.

Lee, S. H., Fontana, R., and Malerba, F. (2022). Where do firms come from? Knowledge Relatedness and Firm Entry. *In Academy of Management Proceedings* (Vol. 2022, No. 1, p. 11260).

Malerba, F. (1985). *The semiconductor business: The economics of rapid growth and decline*. Univ of Wisconsin Press.

Moore, G., and Davis, K. (2004). Learning the Silicon Valley way. *Building high-tech clusters: Silicon Valley and beyond*, *7*, 36.

Naviner, J., and Amara, A. (2004). Systems-on-chip for Telecommunications. *Annals of Telecommunications,* 59: 755.

Nelson, R., and Winter, S. (1982), *An Evolutionary Theory of Economic Change*. Harvard University Press, Cambridge, MA.

Novak, S., and Stern, S. (2008). How does outsourcing affect performance dynamics? Evidence from the automobile industry. *Management Science*, 54(12), 1963-1979.

Phillips, D. J. (2002). A genealogical approach to organizational life chances: The parent-progeny transfer among Silicon Valley law firms, 1946–1996. *Administrative Science Quarterly*, 47(3), 474-506.

Sakakibara, M., and Balasubramanian, N. (2020). Human capital, parent size, and the destination industry of spinouts. *Strategic Management Journal*, *41*(5), 815-840.

Sapienza, H. J., Parhankangas, A., and Autio, E. (2004). Knowledge relatedness and post-spin-off growth. *Journal of Business Venturing*, 19(6), 809-829.

Scherer, F. M. (1982). Inter-industry technology flows in the United States. *Research Policy*, 11(4), 227-245.

Shah, S. K., Smith, S.W. and Reedy, E.J. (2012), Who are user entrepreneurs? Findings on innovation, founder characteristics and firm characteristics. *Kauffman Firm Survey*, Kauffman Foundation.

Shah, S.K. and Tripsas, M. (2007), The accidental entrepreneur: The emergent and collective process of user entrepreneurship. *Strategic Entrepreneurship Journal,* 1(1-2), 123–140.

Sikombe, S., and Phiri, M. A. (2019). Exploring tacit knowledge transfer and innovation capabilities within the buyer–supplier collaboration: A literature review. *Cogent Business and Management*, *6*(1), 1683130.

Sleeper, S. D. (1998). *The role of firm capabilities in the evolution of the laser industry: the making of a high-tech market*. Carnegie Mellon University.

Sorenson, O. (2000). Letting the market work for you: An evolutionary perspective on product strategy. *Strategic Management Journal*, 21(5), 577-592.

Sorenson, O. and Audia, P.G. (2000), The social structure of entrepreneurial activity: geographic concentration of footwear production in the United States. *American Journal of Sociology,* 106(2), 424–462.

Sørensen, J. B., and Fassiotto, M. A. (2011). Organizations as fonts of entrepreneurship. *Organization Science*, 22(5), 1322-1331.

Stuerz, R. A. (2014). Evolution and Firm Survival in Vertically Related Populations: The German Piano Industry. *In Academy of Management Proceedings* (Vol. 2014, No. 1, p. 13507).

Tanriverdi, H., and Venkatraman, N. (2005). Knowledge relatedness and the performance of multi-business firms. *Strategic Management Journal*, 26(2), 97-119.

Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, *15*(6), 285-305.

Tripsas, M. (2008). Customer preference discontinuities: A trigger for radical technological change. *Managerial and Decision Economics*, *29*(2-3), 79-97.

Utterback, J. M. (1994). Radical innovation and corporate regeneration. *Research Technology Management*, *37*(4), 10.

Uzunca, B. (2018). A competence-based view of industry evolution: The impact of submarket convergence on incumbent− entrant dynamics. *Academy of Management Journal*, 61(2), 738-768.

von Hippel, E. (1998), Economics of product development by users: The impact of "sticky" local information, *Management Science,* 44(5), 629–644.

Wennberg, K. Wiklund, J. & Wright, M. (2011). The effectiveness of university knowledge spillovers: Performance differences between university spinoffs and corporate spinoffs. *Research Policy*, 40(8), 1128-1143.

Wenting, R. (2008). Spinoff dynamics and the spatial formation of the fashion design industry, 1858–2005. *Journal of Economic Geography*, 8(5), 593-614.

Yeganegi, S., Laplume, A. O., Dass, P., and Huynh, C. L. (2016). Where do spinouts come from? The role of technology relatedness and institutional context. *Research Policy*, *45*(5), 1103-1112.

Yeganegi, S., Dass, P., and Laplume, A. O. (2022). Reviewing the employee spinout literature: A cross-disciplinary approach. *Journal of Economic Surveys*.

Zheng, Y., Devaughn, M. L., and Zellmer-Bruhn, M. (2016). Shared and shared alike? Founders' prior shared experience and performance of newly founded banks. *Strategic Management Journal*, *37*(12), 2503-2520.