The Influence of Securities Analysts on Innovation: An Evolutionary Approach

Mary J. Benner
3-365 Carlson School of Management
University of Minnesota
321-19th Avenue South
Minneapolis, MN 55455
612-626-6660
mbenner@umn.edu

Daniel Beunza
Faculty of Management
Cass Business School
106 Bunhill Row
London, EC1Y 8TZ
+44 20 7040 8622
daniel.beunza@city.ac.uk

January 15, 2020

Preliminary Draft – Please do not cite or quote without permission
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Abstract

The literature on sell-side securities analysts is marked by a debate about their influence on innovation. Some researchers find analysts supportive of innovation, spurring high valuations for innovative firms, while others emphasize their constraints on firms. We take an evolutionary view to reconcile this contrast. We consider evolution in technology and the shifting characteristics of industry contexts in addition to evolution in analysts’ “interpretive frames,” i.e. the categories, schema, and narratives that shape analysts’ evaluations of the firms they cover and explain how firms’ strategies link to stock valuations. We present our theory in three parts: nascent industries sparked by technological change, where analysts develop new interpretive frames to make sense of radical innovation by new firms, convergent periods of technology evolution, where analyst frames become increasingly institutionalized, and technological discontinuities affecting incumbents in existing industries. We describe the mechanisms underlying changes in analysts’ interpretive frames as the industry technology evolves, and develop testable predictions about the influences of analysts’ evolving frames on firm innovation. Our theory depicts how analysts make sense of nascent industries and develop new interpretive frames that enable radical innovation, while institutionalized frames enable incremental but dampen radical innovation by firms already categorized in existing industries.
Researchers across multiple fields have begun to study securities analysts’ reactions to – and influences on – innovation and novelty (e.g. Benner, 2010; Benner & Ranganathan, 2012; 2013; 2017; Beunza & Garud, 2007; Derrien & Kecskes, 2013; Guo, Perez-Castrillo, & Toldra-Simats, 2019; He & Tian, 2013; Litov, Moreton, & Zenger, 2012; Theeke, Polidoro, & Fredrickson, 2017). This research is marked by contrasting findings. Some scholars find that analysts dampen innovation and novelty in firms, through their coverage decisions or the content of their recommendations (e.g. Benner & Ranganathan, 2012; He & Tian, 2013; Theeke et al, 2017). Yet, other work finds a positive influence of analysts on innovation (Derrien & Kecskes, 2013; Guo et al, 2019), and portrays analysts as supportive enablers of innovation, in particular, facilitating high stock prices for innovative firms (e.g. Beunza and Garud, 2007). These divergent views in research coincide with notable examples: Analysts were critical of Verizon’s investments to respond to the radical technological change in telecommunications that would allow it to compete with cable firms (Benner, 2010; Benner & Ranganathan, 2017). But analysts also play an important part in enabling high stock market valuations (i.e. lower costs of capital) for publicly traded firms like Amazon, Uber, or Tesla, that pursue novel technologies and business models (e.g. Beunza & Garud, 2007; Damodaran, 2017).

We develop theory to help explain this puzzle by considering how analysts’ influences on innovation changes as an industry technology evolves. Our starting point is evolutionary theory (Aldrich & Ruef, 2006), and specifically, research on technological evolution (e.g. Abernathy & Utterback, 1978; Anderson & Tushman, 1990; Tushman & Anderson, 1986). This theory depicts phases of technological change unfolding in industries, beginning with major technological discontinuities, i.e. radical innovation that shifts the base of knowledge underlying the products in an industry (e.g. Henderson & Clark, 1990) and

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1 Consistent with prior research on analysts in the management literature, we focus on the “sell-side” securities analysts who function as intermediaries in capital markets (e.g. Benner & Ranganathan, 2012; Brauer & Wiersema, 2018; Zuckerman, 1999; 2000). Sell-side analysts typically specialize in one or two industries, providing forecasts of firms’ earnings and stock prices, assessments of how firms’ strategies will influence financial performance and stock prices, and recommendations to “buy,” “hold,” or “sell” a firm’s stock. Sell-side analysts function as the “critics” in research about the influences of categories in equity markets (Zuckerman 1999; 2000; 2004). “For the community of publicly traded organizations, securities analysts thus operate as powerful arbiters of categorical conformity to cultural codes” (Aldrich and Ruef, 2006:197).
triggers an era of ferment, i.e. a period of rapid innovation, variation, and high uncertainty about the technology and how quickly it will diffuse. Eras of ferment typically close with the emergence (selection) of a technical standard (a “dominant design”), often the outcome of competition between product designs, but also influenced by social, political, and organizational factors (Murmann & Frenken, 2006; Tushman & Rosenkopf, 1992). Periods of convergence follow dominant designs, characterized by firms engaging in incremental innovation that elaborates and improves the selected technology.

We ask how analysts influence innovation as an industry technology evolves. We propose that the main mechanism underlying analysts’ influences on innovation is the corresponding evolution in their “interpretive frames” as technology evolves. Interpretive frames include the “category,” i.e. the firms classified into the industry an analyst covers (Zuckerman, 1999), the accompanying “schemas” analysts use to evaluate the firms they cover (e.g. Benner & Ranganathan, 2017; Feldman, 2016; Hsu, 2006), and the “narratives,” or stories (Damodaran, 2017; Wansleben, 2012) that explain how the strategies and financial performance of firms in the category translate into stock valuations. In considering evolution in interpretive frames, our theory also builds on prior research on socio-cognitive categories and category evolution (Grodal, Gotsopoulos, & Suarez, 2015; Navis & Glynn, 2010; Ruef & Patterson, 2009; Zuckerman 1999; 2000; 2004).

We address the puzzle that motivates our paper by describing how analysts have both a positive and negative influence on firm innovation as an industry technology evolves. We depict these influences in three parts, considering how analysts influence radical and incremental innovation in new firms and incumbents. First, in nascent industries sparked by technological discontinuities, analysts engage in sensemaking interactions with investors, executives, and other analysts to develop new interpretive frames; in turn, these frames help explain and enable the radical innovation undertaken by new firms in eras of ferment. Second, as the technology evolves through a phase of convergence characterized by

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2 “Narratives” explain how the activities and performance of firms in a category translate to stock valuations. This broad concept is similar to other concepts that have been used in the literature to describe related ideas, such as “stories” (Wansleben, 2012), “analogies” (Beunza & Garud, 2007) or “logics” (Benner & Ranganathan, 2017).
incumbent firms engaging in incremental innovation, analysts’ interpretive frames similarly converge. With increasing institutionalization in interpretive frames, analysts become enforcers of categorical boundaries, rewarding incumbents for category-conforming incremental innovation. Third, when subsequent technological discontinuities challenge incumbents in existing industries, analysts’ institutionalized frames persist, continuing to reward incumbents’ incremental innovations while penalizing radical innovations, even in settings of discontinuous technological change. We further consider how managerial actions in these different stages of evolution can shape analysts’ reactions. We draw on theory and evidence from past research to support our deductive theory and develop testable propositions. We depict the mechanisms in our theory in Figure 1.

Our work makes three important contributions. First, we contribute to research on the influence of sell-side securities analysts’ on firms. We explain the divergent findings in prior work and provide new insights into how analysts shape innovation. Prior research on analysts has considered their influences on innovation and has found both positive and negative effects, but has not explained how it can be that analysts both enable and constrain innovation. Prior work has not studied how analysts’ views of innovation shift across different phases of technology evolution. By theorizing about how technological change shapes analysts’ interpretive frames, and in turn how analysts’ frames shape innovation, we provide fresh insights into the influence of analysts, as important capital market participants, on innovation outcomes for different types of firms. We unpack the specific mechanisms that underlie the shifts from analysts enabling radical innovation for new firms in nascent industries as they initially develop interpretive frames, to enabling incremental but constraining radical innovation in already-categorized incumbent firms as these frames become institutionalized. Innovation is an important engine underlying the growth and success of firms, industries, and nations, and a rich stream of research has sought to understand the forces that facilitate it (e.g. Tushman & Nelson, 1990; Solow, 1957). As analysts directly influence the availability of capital for public firms and therefore, their resources for innovation, a better understanding of the factors that shape analysts’ influences on firm innovation is critical for
gaining an understanding of the drivers of innovation more generally. Our theory also points to underlying reasons why new firms in nascent industries may appear more innovative than incumbents.

Second, our work contributes to theories of technological evolution. Theories of technology evolution typically consider how a body of new scientific or engineering knowledge influences technological change and subsequent firm outcomes, but this work has not studied how firms’ categorization in public equity markets influences both the outcomes for firm innovation and technological evolution more broadly. Our work further suggestions how coevolution in technology and analysts’ frames unfolds. While variation and convergence in analysts’ interpretive frames are driven, in part, by corresponding phases of technology evolution, evolving analyst frames further support these phases of technological evolution. Specifically, the formation of new analysts’ frames during eras of ferment is driven in part by the technological discontinuity and corresponding variation in technical designs, but the creation of new interpretive frames also explains and supports the technological variation during these periods.

Correspondingly, periods of technological convergence drive convergence in analysts’ frames, while the convergence in frames also rewards incumbent firms for engaging in the incremental product and process innovation that characterizes these periods.

Third, we contribute to research on the socio-cognitive processes that underpin industry emergence and evolution (Benner & Tripsas, 2012; Bingham & Kahl, 2013; Grodal et al, 2015; Kaplan & Tripsas, 2008). Past work has not considered the important role of capital markets in how industries emerge and evolve. We provide a deeper understanding of securities analysts as a key audience in industry and category emergence, as they create, label and legitimate new categories of firms and enable sensemaking about new phenomena. Understanding the role of securities analysts in industry emergence and evolution is important since legitimation by analysts directly affects the availability of capital for firms’ innovative efforts.

TECHNOLOGICAL DISCONTINUITIES AND NASCENT INDUSTRIES: ANALYST INTERPRETIVE FRAME CREATION AND RADICAL INNOVATION BY NEW FIRMS
We first consider how analysts influence innovation in nascent industries sparked by technological discontinuities. Our argument is that in new industries, analysts have opportunities to create new interpretive frames for understanding novel phenomena. When they do and initiate coverage of new firms, their efforts spur sensemaking interactions with managers and investors, enabling the radical innovation by new firms that characterizes these periods.

Prior work studying how new industries are established and legitimated has highlighted the important interactions between producers and audiences as they engage in sensemaking about the identities and activities of firms classified in the category (Durand & Khaire, 2017; Navis & Glynn, 2010). Among these audiences are securities analysts, the intermediaries who create the categories and evaluation criteria to help investors in equity markets assess firms and make stock purchase decisions (Wansleben, 2012). When analysts engage in interactions with investors and managers to create new interpretive frames, they facilitate sensemaking about how to evaluate firms in new industry categories.

Daniel Reingold’s (Reingold & Reingold, 2006) description of his experiences as an analyst covering the new telecommunications industry provides an example of the creation of an entirely new interpretive frame for assessing firms in a new industry. Seven new telecommunications companies were created from the breakup of AT&T in 1984 (i.e. the “Baby Bells,” or RBOCs, the Regional Bell Operating Companies). Reingold highlights the new industry category and the heightened activities to “help investors figure it all out,” via interactions between firms’ executives, investors, and analysts.

Every time a new industry came along, Wall Street staffed up with analysts, traders, and bankers to cover it….Wall Street desperately needed people who could help investors figure it all out. So in the early 1980s the Street went on a hiring binge, recruiting practically everyone it could find with experience in both financial analysis and the telecom sector….analysts were doing everything from analyzing the financial trends in an industry to interviewing top executives to gauging the impact of upcoming regulatory changes…

More evidence of the increased attention and search analysts devote to understanding new industries is provided by the “initiating coverage” reports they produce on new industries. These lengthy reports
often contain 50-100 pages (CFI Institute)\(^3\) and more thorough analyses of industry-level information than the typical reports on individual firms (Crawford, Roulstone, & So, 2012).

Beunza and Garud (2007) also highlight an example of a new industry category, Internet and New Media, created by analysts around 1999, that included new firms in the nascent Internet industry. These firms also were valued at a premium; these authors suggest that the new frames that analysts created played a part in enabling their high valuations.

Yet it is not clear from prior research specifically what spurs analysts to create the entirely new interpretive frames that enable sensemaking about new phenomena. While prior research has shown that the industry categories that structure analysts’ coverage, once established, have important influences on stock prices and firms’ strategies (Benner & Ranganathan, 2013; Zuckerman, 1999; 2000), this work does not explain the emergence of new analyst categories. Findings from prior work further suggest that new interpretive frames do not automatically arise due to a major technological discontinuity, even when firms are engaging in radical innovation (Benner & Ranganathan, 2017). Therefore, understanding the mechanisms that underlie the emergence of new analyst frames is important for understanding their potential influences on innovation in nascent industries. Thus, we first describe mechanisms that underlie the formation of new interpretive frames, and then propose how the activities to develop these new frames shape analysts’ influences on innovation in nascent industries.

**New Interpretive Frames in Nascent Industries**

The creation of new interpretive frames in nascent industries frames is driven first, by the technological discontinuity and corresponding factors that arise during an era of ferment, that increase the difficulty of evaluating firms using already established interpretive frames. As firms undertake radical innovation, involving new technologies, products, and business models that depart from existing categories, analysts face increased difficulty using existing interpretive frames to categorize, evaluate, and explain firms’ stock valuations. This challenge of valuation is even greater when the firms engaging in

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\(^3\) [https://corporatefinanceinstitute.com/resources/knowledge/valuation/equity-research-report/]
Uncertain radical innovation in a nascent industry are “growth” stocks, i.e. firms that have revenues but no earnings or dividends (e.g. Benner, 2007; Benner & Ranganathan, 2013), and frequently have high valuations (Aghion & Stein, 2008). Such firms are relatively common in nascent industries created by new technologies, such as the dot-coms in the early years of the Internet, or more recent examples of firms like Uber and Tesla. In these cases, understanding the relationships between firm performance and investor behaviors is not straightforward, since stock price forecasts cannot proceed from conventional calculations of valuation using discounted earnings or dividends (e.g. Brealey & Myers, 1984; see also Zuckerman, 2004). Therefore, explaining and forecasting the stock valuations of these public firms likely drives increased analyst attention to understanding the drivers of investors’ behaviors in the absence of profits or dividends. For example, firms like Tesla, Uber, and AirBnB⁴, have little to no profit but relatively high valuations, in particular higher than the values of their traditional industry counterparts (i.e. auto, taxicab, and hotel firms, respectively), suggesting that investors are positive about the promise of such firms (Damodaran, 2017). In such cases, narratives that explain investors’ behaviors become particularly important for making sense of firms’ stock prices, triggering analysts’ activities to create new interpretive frames.

However, findings from prior research also suggest that technological discontinuities and eras of ferment do not necessarily spur analysts to create entirely new categories or schema for evaluating firms (e.g. Benner & Ranganathan, 2017). Other research similarly finds that even when firms radically shift their strategies or identities, analysts do not automatically create new categories or change their schemas for evaluating such firms (Feldman, 2016; Tripsas, 2009).

Indeed, accounts of the triggers of new categories often involve entirely new firms, such as the example of the dot-coms and Amazon in the late 1990s, the new firms that sparked the formation of a new Internet industry category. This suggests a second important mechanism underlying the formation of new interpretive frames: the entry of de novo firms into a nascent industry. In prior work on the “disk array”

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⁴ AirBnB is not yet a public company, but currently is valued by private investors at $38 billion.
industry (McKendrick & Carroll, 2001), researchers similarly suggest the importance of de novo firms in the process of legitimating a new industry category. These researchers found that despite 130 producers of disk arrays, over $12 billion in annual revenues, and industry associations, the disk array industry did not emerge as a recognized, legitimated industry category. They speculate that it was because most of the entrants in the disk array industry were existing firms with a substantial portion of their activities (and identities) still in other industry domains. They suggest further that recognition of an industry category by external audiences is more likely when the new industry involves new firms.

As analysts ask “what type of firm is this?” in their efforts to categorize a firm, evaluate its performance, and explain and anticipate its stock price, existing firms are analyzed within prevailing categories. It is the new firms that are engaging in radical innovation and are not previously categorized in existing industries that trigger analysts’ search and activities to create new interpretive frames.

**Analysts’ Influence on Innovation in Nascent Industries**

In turn, as analysts encounter difficulties evaluating the new firms that are undertaking radical innovation and seek to explain the valuations of these firms, they undertake search and sensemaking interactions with firms’ executives or founders and investors, determining how to classify firms and evaluate their activities and financial performance. These activities include organizing investor conferences that include buy-side investors and executives, as well as company visits for investors to meet with managers (Groysberg & Healy, 2013: 29). Brown et al (2015) also found, in their survey of analysts, that analysts regularly communicate with managers on quarterly earnings conference calls and follow-ups on earnings conference calls. As analysts undertake these activities in nascent industries, they develop and disseminate new interpretive frames, including the evaluative schemas and narratives that explain how firms’ actions and performance translate into current and future stock prices (e.g. Beunza & Garud, 2007; Damodaran, 2017; Wansleben, 2012). As frames develop, they help investors and other analysts sort and assess these new firms, products, and business models, leading to increasing legitimation of the new category (e.g. Navis & Glynn, 2010), and spurring further acceptance and adoption of the new frame by investors and other analysts. As the narratives provided by analysts become accepted, they
further legitimate classification and evaluation of firms in the new category. Emerging interpretive frames both reflect investors’ views of these nascent public firms and influence investors’ behaviors, as “investors draw on analysts (critics) to learn about socially legitimated valuation” (Wansleben, 2012:16). In nascent industries involving new firms engaged in novel activities, analysts therefore specifically shape and disseminate explanations of how to evaluate firms engaging in radical innovation, enabling an understanding of its value.

More generally, analyst coverage reduces information asymmetries and provides the important recognition that improves firms’ stock price performance, reduces firms’ costs of capital, and enables innovation (Derrien & Kecskes, 2014; Li & You, 2015; Litov et al, 2012; Mola, Rau, & Khorana, 2013). Thus, to the extent that analysts make coverage decisions and engage in interactions to build and disseminate new interpretive frames to facilitate understanding of new firms in nascent industries, these industries and firms gain investor recognition, enabling the radical innovation they are undertaking during eras of ferment.

**Proposition 1:** In nascent industries sparked by technological discontinuities, the more analysts engage in sensemaking interactions with executives, investors, and other analysts to develop new interpretive frames, the more they will be positive toward and enable radical innovation undertaken by new firms.

These dynamics suggest further the potential for co-evolution in technology and analysts’ frames. The development of (and variation in) analysts’ frames is driven in part by the advent of a discontinuous technological change. But variation in analysts’ frames during an era of ferment also provides the requisite variety for understanding and supporting the technological variation in this period. As new firms enter with different radical innovations and competing technological designs, analysts are facilitating an understanding of – and capital market support for – this variation. Therefore, while technological variation drives variation in analysts’ frames, analysts’ sensemaking activities during eras of ferment also support the technological variation that characterizes these periods.
TECHNOLOGY CONVERGENCE AND CATEGORY INSTITUTIONALIZATION: INCREMENTAL INNOVATION BY INCUMBENT FIRMS

Next, we consider the convergent periods following the selection of a dominant design, characterized by incumbent firms engaging in incremental innovation (Anderson & Tushman, 1990). Our argument is that analysts’ interpretive frames similarly converge and become institutionalized during these periods, and as they do, analysts’ activities shift to evaluating individual firms’ fit with prevailing interpretive frames, supporting and enabling incremental innovation, while highlighting deviance and dropping coverage or issuing negative evaluations as firms pursue innovation that departs from categorical expectations.

Convergence in Interpretive Frames

Convergence and institutionalization in interpretive frames is driven first, by convergence in the evolving technology. As one or a small number of technological standards emerges from among the variation in previously competing designs (Anderson & Tushman, 1990; Grodal et al, 2015; Murmann & Frenken, 2006), both technological and demand uncertainty are increasingly resolved (Anderson & Tushman, 1990). Elimination of competing variants of the technological design simplifies market participants’ understandings about how the technology and product designs work and are produced, as well as about the features that are valued by customers (Benner & Tripsas, 2012). Correspondingly, variation in - and uncertainty about - business models is also reduced, as managers, investors, and analysts increasingly understand how firms’ activities and financial performance drive investor behaviors and corresponding stock prices, making assessments increasingly straightforward. Selection among technological designs typically involves selection among firms as well, via a “shakeout,” as a few firms emerge as the industry leaders, while many firms exit the product class, typically those lacking knowledge, capabilities, or products in the selected technology (Anderson & Tushman, 1990; Argyres, Bigelow, & Nickerson, 2015; Murmann & Frenken, 2006). This reduction in the number of firms in the industry further reduces variation and uncertainty. Taken together, these mechanisms, spurred by convergence phase in the evolving technology, allow greater clarity about category membership, business
models, firm activities, and the appropriate ways to evaluate firms and anticipate stock values, driving convergence in interpretive frames.

A second mechanism underlying interpretive frame convergence is the rise of one or a small number of frames to dominance, as an analyst promoting a particular frame provides a more compelling narrative than other analysts for explaining drivers of investor behavior and stock valuations. For example, in the early years of the Internet, analysts held markedly different views of how to value the new Internet firms, illustrated by the striking differences in valuation for Amazon (McGough & Wingfield, 2000). Analysts ranged from categorizing Amazon as a high-tech company, with a valuation of $400 per share, to categorizing it as a brick and mortar bookstore, with a valuation of $50 per share. A leading analyst’s framing of Amazon as a high-tech firm provided a more accurate prediction and a clearer narrative for explaining its high stock market valuation (Beunza & Garud, 2007).

As particular analysts appear prescient in their assessments and explanations, and as investors adopt these frames, other analysts also adopt these frames, abandoning their own frames, and spurring further convergence in interpretive frames. Conversely, when forecasts of future stock price arising from an analyst’s frame are persistently inaccurate, analysts will be more likely to abandon these frames, also driving convergence on the more compelling and accurate frames.

Prior work similarly suggests that in situations of high uncertainty, analysts imitate each other or even herd, i.e. ignore their own private information and beliefs, and follow an emerging consensus view (Hong, Kubik, & Solomon, 2000). Convergence in views among analysts also unfolds through social psychological mechanisms such as social proof (Rao, Greve & Davis, 2001) or pluralistic ignorance (Zhu & Westphal, 2011). Ideas about convergence in analysts’ frames are also echoed in research that observes that analysts tend to use similar heuristics and metrics to evaluate firms within the same industry category (e.g. Schipper, 1991; Zuckerman, 1999; Benner & Ranganathan, 2017).

With convergence in analysts’ interpretive frames, the surviving frames become increasingly coherent, institutionalized, and “stricter” (e.g. Grodal, et al 2015; Ruef & Patterson, 2009). Scholars adopting evolutionary views of category change (e.g. Grodal, et al 2015; Navis & Glynn, 2010; Ruef &
Patterson, 2009) highlight the increasing institutionalization and hardening of categories as they mature, as the outcome of social processes involving interactions and negotiation among market participants. Institutionalization in analysts’ frames similarly proceeds from both directions, i.e. as interpretive frames in an industry are increasingly shared across analysts making similar classifications of firms in their coverage decisions, and as firms, seeking to gain coverage by analysts, increasingly conform to the expectations for membership in an increasingly legitimated category (Zuckerman, 1999). Institutionalization unfolds further when analysts drop coverage of firms engaging in category-deviant innovation, moving the remaining firms in the category toward even greater coherence. In turn, analysts’ understanding of the remaining category-conforming firms is also likely to improve, further supporting the institutionalization of a dominant interpretive frame.

An additional mechanism driving institutionalization unfolds as the metrics and models to evaluate category members are codified into spreadsheets and handed from the senior or lead analysts who initially developed the frames, to the lower level research associates on the analyst team to perform routinized analyses (Groysberg & Healy, 2013). While more senior, experienced analysts may have engaged in the initial search and activities to understand the industry and create a new interpretive frame, once these codified models are handed off to more junior assistants in the form of spreadsheets, such models arrive as part of the junior analysts’ jobs – as established, taken for granted “facts” and ways to do their job evaluating firm performance (cf. Scott, 2001). The continued routinized application of interpretive frames gives rise to further institutionalization and hardening of the frames.

**Analysts’ Influences on Innovation in Convergent Phases**

Once interpretive frames are established, and subsequently converge and become institutionalized, the analysts’ search and sensemaking activities that characterized the nascent period are reduced. As analysts’ interpretive frames cohere, their boundaries likely become increasingly rigid in evaluations of category members, categorical expectations become clearer, and boundary violations become more salient (e.g. Ruef & Patterson, 2009).
As analysts now apply the increasingly shared and institutionalized interpretive frames to evaluate the activities and performance of individual firms within an established category, the alignment of individual firms’ strategies, activities, and financial performance against the category expectations becomes increasingly salient. Firms that are coherent with the category or best represent the category “prototype” receive positive evaluations, whereas firms whose activities, strategies, or financial performance depart from the expectations of the category receive more negative evaluations or less coverage (Ruef & Patterson, 2009; Zuckerman, 1999; 2004). Notably, the activities that are most consistent with the institutionalized frame are the incremental product and process innovations that elaborate the current technological design, while the activities that depart most from categorical expectations are likely to be the most novel or innovative with respect to the increasingly rigid category.

Thus, as analysts view firms’ activities through institutionalized interpretive frames, they are likely to issue more positive recommendations on the firms that are undertaking incremental innovations that “fit” with the period of convergence, and issue more negative recommendations or abandon coverage as firms undertake the more radical innovation that departs from expectations (e.g. Benner & Zenger, 2016; Litov et al, 2012; Theeke et al, 2017).

For example, Benner (2010) found that analysts were positive toward Kodak’s and Polaroid’s incremental efforts to extend film technology, but ignored or were negative toward these firms’ investments in the radically new digital technology. Litov et al (2012) found that analysts tended to drop coverage of firms pursuing novel corporate strategies that were unique compared to industry peers (but that were on average more valuable), triggering a lower stock price. Similarly, Theeke et al (2017) found that medical device firms pursuing novelty were less likely to obtain analyst coverage. Thus, as interpretive frames converge and become institutionalized, analysts become gatekeepers, rewarding incremental innovation and highlighting deviations; generally influencing the availability and cost of capital through their coverage decisions and the content of their recommendations.

Proposition 2: In phases of technological convergence, the greater the convergence and institutionalization of analysts’ interpretive frames (i.e. the more that similar categories, schema, and narratives are shared across analysts covering the same industry), the more that analysts will be
positive toward incumbents’ incremental innovations that extend the current technology and negative toward radical innovations that depart from the current technology.

In turn, firms face pressures for conformity; both those already covered in an analyst category or those seeking coverage by analysts. Firms that are pursuing incremental innovations will be rewarded by analysts, whereas firms that attempt more radical innovations in these periods of convergence will elicit negative evaluations or dropped coverage. Firms are likely to seek to alleviate the penalties that arise from category deviance and change strategies, retreating from radical innovation and novelty and engaging in incremental innovation that improves their coherence with the category (e.g. Benner & Ranganathan, 2012; Benner & Zenger, 2017). Analysts’ enforcement of category boundaries in this convergent phase is therefore likely to spur an increase in incremental innovation in incumbent firms and a decrease in radical innovation or novelty that is difficult to evaluate within an institutionalized interpretive frame.

Proposition 3: The more that analysts’ evaluations toward firms engaging in incremental innovations become negative or result in dropped coverage, the more firms will respond to pressures for conformity. This will spur incremental innovations that extend the current technology, and dampen the more radical innovation that departs from existing categories.

Our arguments here further illustrate co-evolution in technology and analysts’ frames. While convergence in the technology spurs convergence in analysts’ frames, as we discuss above, as analysts’ frames converge, they also reward incremental innovation by incumbents, supporting the corresponding convergence phase in technological evolution. That is, as frames converge and analysts encourage incremental innovation, incumbent firms are rewarded for focusing on elaborating a dominant design through the incremental product innovation and process innovation characteristic of this phase (Anderson & Tushman, 1990; Abernathy & Utterback, 1980).

REVISITING TECHNOLOGICAL DISCONTINUITIES: ANALYSTS INFLUENCES ON INNOVATION IN INCUMBENT FIRMS DURING ERAS OF FERMENT

Next, we revisit technological discontinuities, but now consider incumbent firms that already are classified in the industry categories covered by analysts. We explore forces that underpin persistence in
analysts’ interpretive frames and the resulting influences of analysts on innovation undertaken by incumbent firms faced with technological discontinuities.

Even as technological discontinuities spark nascent industries, they also have important implications for the incumbent firms in existing industries affected by the change. For example, the radical technological change to digital photography spurred many new entrants into the new digital camera product class, but also fundamentally challenged Kodak and Polaroid, incumbent firms in the existing “photography” industry (Benner, 2010; Tripsas & Gavetti, 2000). Similarly, the potential for a radical shift to electric vehicle technology that is currently underway clearly has important implications for firms currently in the auto industry that are producing autos based on the traditional internal combustion technology.

**Heterogeneous incumbent responses to technological discontinuities**

Recent work highlights ways that incumbent firms respond to technological discontinuities. An important approach for responding to a radically new technology is to directly engage in radical innovation that allows a firm to adopt - or even initiate - the technological change. Indeed, evidence from research on incumbent adaptation suggests that incumbent firms often do respond directly to technological discontinuities, both initiating and adopting radical technological changes (Benner, 2010; Benner & Ranganathan, 2017; Eggers & Kaul, 2018; Eggers & Park, 2018). For example, Kodak created the first camera incorporating digital technology, initiating a technological discontinuity (Benner, 2010). Verizon responded to the discontinuous technological change in telecommunications (from copper wireline technology to voice over Internet protocol (VoIP)) by undertaking investments in radical innovation in fiber to the home (Benner & Ranganathan, 2017).

Alternatively, incumbent firms can retain their focus on an existing technology rather than attempt the transition to a radically new technology (Adner & Snow, 2010). For example, rather than engaging in investments in radical innovation as Verizon did in response to the technological discontinuity, Qwest curtailed its investments and focused on more incremental changes (Benner & Ranganathan, 2017).
Incumbents’ efforts focused on incremental improvements can improve the performance of an old technology sufficiently to prevent or slow substitution by the new technology for a time. This corresponds with the observation that the price and performance of old technologies can improve dramatically as the technology faces a threat of substitution. For example, Furr and Snow (2014) identify a “last gasp” of carburetor technology when faced with substitution by fuel injection systems, Utterback (1994) describes the efficiency improvements in the ice harvesting industry as mechanical refrigeration technology emerged, and Kodak’s efforts to lower the price and improve the resolution in “reusable” film cameras lengthened the time for digital cameras to achieve the superior price and performance required for substitution. Firms can deliberately engage in a technology “racing” strategy as they face the threat of new technologies, i.e. attempts to radically improve an old technology to allow it to compete for a time with the potential substitute technology (Adner & Snow, 2010).

**Persistence in analysts’ interpretive frames**

Evidence from prior research suggests that analysts tend to persist in applying existing interpretive frames to evaluate the activities and performance of established firms, even in industries facing technological discontinuities, and even in the cases where incumbents do adopt the radically new technologies and business models. For example, as analysts continued to apply a persistent frame to evaluating Kodak and Polaroid, they issued positive evaluations of Kodak’s and Polaroid’s film-related products that did not address the unfolding challenge of digital technology, while ignoring or issuing negative views of these firms’ digital camera efforts (Benner, 2010). Similarly, analysts persisted in analyzing Verizon using evaluative schema and metrics that were increasingly obsolete given the major technological change and the accompanying radical changes in Verizon’s strategy (Benner & Ranganathan, 2017). Scholars have found further evidence of analysts’ persistence in other settings of underlying change, for example, when firms undertake fundamental changes in their corporate strategies (Feldman, 2016) or identities (Tripsas, 2009), that would make new interpretive frames appropriate, analysts tended to continue to evaluate firms within pre-change industry categories and schema.
We first describe drivers of persistence in analysts’ interpretive frames, followed by the effects of persistent frames on innovation by incumbents. Persistence in analysts’ frames arises, in part, from their continued usefulness in providing accurate forecasts and explanations of firms’ financial performance and stock price. Accuracy in assessments using existing frames, in turn, can arise from several factors. First, if incumbent firms engage in incremental innovation in the old technology rather than undertaking investments to respond directly to a new technology, existing frames are more likely to continue to provide an accurate view of firm performance. Moreover, even if one or a small number of the incumbent firms covered by an analyst undertakes radical innovation to respond to a new technology, analysts are likely to drop coverage of those firms rather than revisit and revise their interpretive frames.

Characteristics of the new technology, and in particular, the pace of technology diffusion among producers and customers is also a factor influencing the continued usefulness of existing interpretive frames. Although a technological discontinuity may be underway, additional technological improvements or innovations to overcome ecosystem bottlenecks are often required for new technologies to be adopted and diffuse widely. For example, Adner and Kapoor (2016b) discuss the relatively slow diffusion of high definition television (HDTV) over 30 years. Although pioneering producers initially created HDTV products in the 1980s, additional innovation in other parts of the ecosystem were necessary before HDTV diffused. As a new technology diffuses relatively slowly, the implications of the change may not be revealed in the financial performance of an individual firm for a time. In turn, this might allow the existing interpretive frames to continue to provide accurate forecasts and explanations of stock valuation based on the old technology.

Second, retention of existing interpretive frames is reinforced further by the extent to which the frames have become institutionalized, widely shared among the analysts covering firms in the same industry category, as well as important buy-side investors who have adopted the same frames in their investment behaviors. Sell-side analysts are evaluated for their usefulness by these buy side customers, and are rewarded through broker votes and recommendations for Institutional Investor rankings (Groysberg & Healy, 2013). To the extent existing interpretive frames have provided accurate forecasts...
and compelling explanations for stock valuations, analysts may be more reluctant to abandon these models and metrics. In part, this is because the relationships with buy side investors arise from shared, negotiated understandings about particular stocks that are built from – and reflected in – existing interpretive frames. Marked changes in an analysts’ interpretive frame for evaluating incumbent firms might negatively affect stock prices and harm the investors currently holding the stock.

**Analysts’ Influence on Incumbents’ Innovations during Eras of Ferment**

In turn, the extent to which analysts continue to apply persistent interpretive frames in their assessments of firms further shapes their views of – and influences on – innovation. Incumbents’ investments and innovations in radically new technologies to address a technological discontinuity are likely to depart from the expectations of persistent interpretive frames. These innovations are likely to receive negative reactions from analysts, constraining innovation, even during the eras of ferment triggered by discontinuous technological change. For example, as Benner & Ranganathan (2012) highlight, analysts covering Kodak were negative toward its investments in digital technology:

> Shareholders will revolt once the meager (and distant) potential returns from electronic imaging become clear. . . . We are eager to see shareholders’ reactions when they realize how much of their money is squandered on “digital nonsense.” (Prudential Securities, 1994)

Analysts covering Verizon were similarly critical of its investments in radical innovation in fiber-to-the home technology to respond to the technological discontinuity in telecommunications (Benner & Ranganathan, 2012):

> We are concerned about the economics of the FiOS initiative [Verizon’s investment to respond to VoIP], but a pull-back on this could make us more constructive on the stock (Morgan Stanley, 2005–06).

Thus, we propose:

*Proposition 4: In an era of ferment following a technological discontinuity, to the extent that interpretive frames persist, incumbent firms that undertake radical innovation will be penalized by analysts with negative evaluations or downgrades in recommendations.*

In contrast, when an incumbent firm continues to engage incrementally in an existing technology rather than undertaking radical innovation to respond directly to the new technology, reactions from analysts are likely to be positive, further enabling incremental innovation. Incremental innovation in an
old technology is likely to be more consistent than radical innovation with the expectations arising from the persistent analyst frames. For example, even as Polaroid faced the threat of digital technology and invested in digital camera products, it also continued to introduce instant film cameras that extended both the old technology and the existing razor/blade business model (Tripsas & Gavetti, 2000). As Benner (2010) highlights, analysts were particularly positive about the instant film cameras, as they viewed these innovations through existing interpretive frames as an important driver of performance and stock price.

New products and new market segments should drive near-term growth in the core instant consumer photography business. The products that we saw give us confidence (Credit Suisse First Boston 1998).

A key driver of Polaroid’s stock price will be the success of the new products, particularly the Pop-Shot Instant single-use camera (Credit Suisse First Boston 1998).

Similarly, analysts were positive toward the more incremental approach that Qwest took in response to technological change in telecommunications (Benner & Ranganathan, 2017). Therefore, we propose:

Proposition 5: In an era of ferment following a technological discontinuity, to the extent that existing interpretive frames persist, incumbent firms undertaking incremental innovations that extend an old technology will be rewarded by analysts with positive evaluations and upgrades in recommendations.

Change in Analysts’ Interpretive Frames

Our arguments above suggest that new firms in nascent industries elicit positive reactions from analysts and support for radical innovation, while incumbent firms in convergent phases elicit positive reactions from analysts and support for incremental innovation. In both cases, analysts’ influences are generally in alignment or “fit” with the type of innovation that generally characterizes these periods of technology evolution. However, as incumbent firms are faced with technological discontinuities, analysts’ persistent frames are no longer aligned with innovation firms seek to undertake, creating a constraint on innovation. While incumbents’ incremental innovation will continue to be rewarded when viewed through persistent interpretive frames, these frames prevent the radical innovation that would allow an incumbent to respond directly to the technology change. In these cases, positive reactions and support for radical innovation from analysts is possible only if firms can, at the same time, also spur increased analyst search and attention to the technological change, and drive change in interpretive frames.
Past research suggests that analysts covering established industry incumbents can eventually change their interpretive frames as changes unfold. For example, the schema analysts used for evaluating firms in the wireline telecommunications industry changed, as VoIP technology increasingly substituted for copper wire, and Verizon (and AT&T) changed their strategies and increased investments in “fiber to the home” products (Benner & Ranganathan, 2017). Notably however, these changes in analysts’ interpretive frames did not occur for several years. Tripsas (2009) that new analysts covering Linco changed their categorization of the firm as it changed its identity. In turn, to the extent analysts’ interpretive frames do change, existing firms may be re-categorized or the schema employed to evaluate them may be updated, such that the more radical innovations that previously departed from categorical expectations are more likely to be understood and enabled.

As we note above, if incumbents conform to pressures from analysts and continue to engage in incremental innovation, frames are likely to persist. However, if incumbents undertake radical innovation to respond directly to technological change despite the pressures, analysts are more likely to engage in the search that leads to changes in their frames. Thus, despite the pressures for conformity we note above, incumbents’ persistence in radical innovation and investments in new technologies is one factor that makes analysts more likely to engage in sensemaking activities to understand the new technology and create new frames.

As incumbents undertake radical innovation to respond to a new technology, the prevailing interpretive frame becomes less useful for accurate forecasts and explanations of firms’ financial performance and stock valuations. The inaccuracies or difficulties that spur change in analysts’ frames could arise from behaviors of firms or investors. For example, if firms’ investments or financial performance changes unexpectedly with a technological discontinuity, analysts may be spurred to search for new schema to guide their assessments and forecasts of earnings and stock price. Inaccuracy in analysts’ recommendations and stock price forecasts can also arise from investor behaviors, as investors

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5 That frames eventually change, but with a long delay, suggests inertia in interpretive frames, as opposed to the persistence of a “correct” frame.
become particularly positive or negative toward an industry undergoing technological change, and these beliefs are reflected in unanticipated changes in stock prices. While the difficulty of assessing radical innovation undertaken by a single incumbent may spur analysts to simply drop coverage, as more firms that an analyst covers change their strategies or experience unexpected changes in performance, analysts may incur the information costs to re-engage in search and initiate changes in their interpretive frames. Lounsbury and Rao (2004) similarly highlight increased ambiguity and performance variation as drivers of change in categories.

Second, prior research also suggests that to the extent an incumbent firm focuses on activities corresponding with a new technology and abandons participation in other technologies or product classes, analysts are more likely to engage in revising interpretive frames. Feldman (2016) showed that analysts were more likely to update their schema and subsequently provide more accurate evaluations of firms after firms spun off their legacy businesses. As the firms entering the new product class created by the technological change abandon old technologies and have identities and activities focused largely in a new industry, analysts face pressure to re-categorize firms that no longer fit in an existing industry category. This is likely to trigger the search and sensemaking interactions with managers and investors to create new frames to understand the new technology and business models.

Third, as managers undertaking radical innovation emphasize growth in their interactions with investors and analysts, and as their performance and stock price become more difficult to forecast using conventional discounted dividend or cash flow calculations, analysts are more likely to engage in search to revise interpretive frames or develop new ones. Benner & Ranganathan (2017) showed that as Verizon’s CEO provided analysts with new metrics focused on growth (rather than profit) to evaluate Verizon’s performance, analysts became more positive.

As analysts increase interactions with investors and managers, seeking ways to revise or reconstruct interpretive frames, they are increasingly likely to facilitate understanding of firms’ innovations and enable radical innovation (e.g. Benner & Ranganathan, 2017).
Proposition 6: In an era of ferment following a technological discontinuity, the more that incumbent firms persist in radical innovation, abandon participation in other industry domains, and emphasize growth, the more that analysts will re-engage in search to understand a technological discontinuity and change interpretive frames.

DISCUSSION

Prior research on sell-side securities analysts is marked by contrasting views of analysts’ influences on firm innovation. While some research depicts analysts as supportive enablers of innovation, others emphasize the constraints they impose on firms. We offer a way to reconcile these competing views, by developing theory that explains how analysts’ influences on innovation shift through evolutionary stages in an industry technology (Anderson & Tushman, 1990), differentially affecting innovation in new firms and incumbents. Our core theoretical mechanism is the evolution in analysts’ interpretive frames, i.e. the categories, schema, and narratives that analysts develop (through their interactions with managers and investors) for classifying and evaluating firms and explaining the links between firm behavior, financial performance, and stock prices. By adopting an evolutionary view, we are able to understand how changing contexts shape these different influences of analysts on innovation, allowing us to explain why analysts can both enable and constrain innovation. Figure 1 depicts these relationships in our theory.

We present our theory about analyst influences on firms’ innovation in three parts, including their influences on incremental and radical innovation in both new and incumbent firms. First, we consider new firms in nascent industries sparked by technological discontinuities. In these settings, analysts engage in heightened interactions with managers and investors to understand new phenomena. They build and disseminate the interpretive frames that shape new industry categories and category membership, and provide the schema and narratives for assessing performance and explaining the drivers of investors’ behaviors and firms’ stock prices. These activities, and the developing frames, help capital market participants make sense of novelty during eras of ferment, spurring recognition of new firms in new industries, lowering their costs of capital for innovative activities, and spurring radical innovation.

In subsequent phases of technological convergence that follow the emergence of dominant designs, analysts’ interpretive frames also converge and become increasingly institutionalized. During these
phases, analysts’ activities shift to applying a shared interpretive frame to evaluating now-incumbent firms. As interpretive frames become institutionalized, misalignments between firms’ strategies and the interpretive frames, i.e. “boundary violations” (Ruef & Patterson, 2009) become increasingly salient. Firms that fit clearly with the category by undertaking incremental innovations receive positive evaluations, while firms that deviate by undertaking more radical innovation receive negative evaluations or spur analysts to drop coverage (Zuckerman, 1999; Benner & Zenger, 2016). Firms are rewarded in these periods for the incremental innovation that elaborates an existing technological design.

Third, we consider the already-categorized incumbents facing technological discontinuities in existing industries. We describe analysts’ reactions to the heterogeneous ways incumbents respond to technological change, and how persistence in interpretive frames in these periods shapes analysts’ influences on different types of incumbent innovation. Viewing innovation through persistent frames and strict categories, analysts are likely to continue to support incremental innovation, even in eras of ferment, but penalize incumbents for radical innovation.

Conversely, incumbents pursuing radical innovation might elicit positive evaluations from analysts if they undertake efforts to change interpretive frames at the same time. We describe how managers can influence change in the frames; spurring analysts to undertake search and heightened interactions with managers and investors to develop new interpretive frames.

Our work further suggests coevolution in industry technology and analysts’ frames (e.g. Grodal, et al, 2015). Variation in the interpretive frames held by different analysts during an era of ferment provides the requisite variety for understanding innovation and novelty, and supports the variation in technological designs that characterize this period. Moreover, as analysts develop interpretive frames that both influence and explain investors’ behaviors (and stock prices), they make sense of nascent industries and facilitate the availability of capital that allows firms to advance beyond the nascent phase. Subsequently, convergence in analysts’ frames is driven in part by convergence in technological designs. As frames are shared and become institutionalized, they also reward incumbent firms for the incremental innovation that
elaborates a specific dominant design, reinforcing the incremental product and process innovation that is characteristic of these periods of convergence following a dominant design.

We make important contributions to research, and suggest opportunities for future work. First, our theory helps resolve the puzzle that initially motivated this paper, that is, the divergent findings from past work on analysts’ influence on innovation. By taking an evolutionary approach and theorizing how analysts’ evolving interpretive frames shape innovation across different phases of technology evolution, we are able to reconcile the contrasting findings in prior work, and provide a more complete picture of analysts’ influence. Future work in this area can extend these ideas with more development and empirical tests of the mechanisms we propose.

Second, our theory contributes to research and theory in technological evolution and innovation. We explain the role that analysts, as important capital market participants, play in the emergence of new industries sparked by technological discontinuities, as well as in shaping firms’ responses to technological change. A frequent claim in research on technological change, beginning with Schumpeter (1934), is that new firms are nimble and innovative, providing sources of creative destruction in industries, whereas incumbent firms are sluggish and inertial, and struggle to respond to changes in their environments. Research has supported these stories by highlighting internal sources of inertia in established firms (e.g. Henderson & Clark, 1990). Our work highlights the potential for securities analysts, as important intermediaries in capital markets, to reinforce this mechanism of creative destruction by new firms, as they facilitate innovation for new entrants engaged in novel activities while constraining already established firms into conformity with rigid expectations of existing categories. We are able to describe how these dynamics unfold by separately considering how analysts’ frames are shaped by changing technologies and context, and how these changes in frames, in turn, shape analysts’ influences on innovation and the types of firms that are rewarded for innovation. Our theory also may help explain the apparent paradox observed in practice: while capital for innovation is readily available for new public firms that have low or no profits, like Uber or Tesla, many existing firms face pressure from shareholders to curtail innovation. For example, Dell struggled with investors seeking to prevent its investments in
innovation, and Michael Dell ultimately believed changing course was possible only by becoming a private firm (De La Merced & Hardy, 2013).

Third, our work also contributes to research on socio-cognitive drivers of industry emergence and evolution. Past work on category emergence and evolution has mainly considered the interactions of producers, customers, and the media in the development and legitimation of industry categories (e.g. Navis & Glynn, 2010; Lounsbury & Rao, 2004; Ruef & Patterson, 2009). We provide a deeper understanding of securities analysts as a key audience in industry and category emergence. Analysts play a major part in the social construction of new industries as they specifically create the new industry categories and labels, and determine which firms will be classified in the industry and gain analyst coverage. Analysts’ category structure of coverage organizes and legitimates the activities of publicly traded firms; thus, they play an important role in socio-cognitive understandings of firms during both industry emergence and subsequent evolution. Our theory sheds light on an important aspect of analysts’ influences by considering how they shape innovation outcomes in firms and industries.

Our work also highlights important managerial implications. As firms seek to engage in innovation or responses to technological discontinuities, there are possible opportunities to influence analysts’ evaluations through both the type of innovation firms engage in, and through managers’ interactions with analysts and investors.

In nascent industries, managers or founders of new firms have opportunities to shape analysts’ reactions both by undertaking the radical innovation that is expected in during eras of ferment, as well as through engagement with investors and analysts to influence understanding the new technology and the corresponding development of interpretive frames. As analysts undertake search and interactions with managers and investors to develop frames to understand and evaluate new firms in nascent industries, the frames are fluid and malleable, offering opportunities for managers to influence sensemaking, shaping analysts’ and investors’ views of their firms. An example is Amazon CEO Jeff Bezos’s early involvement with analysts that helped shape the framing of Amazon as a high tech firm rather than a bookstore.
In phases of technological convergence, incumbent firms elicit positive analyst reactions first by engaging in incremental innovation that conforms to the expectations associated with the analyst frame, and by highlighting category coherence in interactions with investors and analysts, for example by communicating compliance in meeting expectations measured institutionalized performance metrics, such as earnings forecasts.

Finally, as incumbent firms are faced with technological discontinuities, they have opportunities to influence analysts’ evaluations both by the nature of the innovation they undertake in these periods, as well as through efforts to change interpretive frames. Undertaking incremental innovation will continue to be rewarded when viewed through persistent interpretive frames, and may even slow or prevent change in interpretive frames, particularly if incumbents engage in “racing” strategies to improve the performance of an old technology (Adner & Snow, 2010). However, if incumbents undertake radical innovation to respond to a new technology, they are likely to be penalized by analysts unless interpretive frames also change. We suggest new firms are important for the creation of new analyst industry categories; this suggests further that analysts might enable radical innovation to the extent that they perceive industries and the firms in them as new, with products and business models that depart from existing categories. New firms in nascent industries spur sensemaking and new interpretive frames that can facilitate understanding of innovation and novelty. If managers’ communication with analysts emphasizes newness and growth, the new activities in incumbent firms may be increasingly evaluated outside the constraining boundaries of current categorizations, enabling firms to engage in radical innovation to respond to technological discontinuities.
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