Looking out of the window & into the mirror: The role of managerial attention in shaping responses to industry change[*]

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ABSTRACT

The strategy literature highlights the critical role that managerial attention plays in shaping adaptation to industry change. However, attention to an emerging opportunity alone is not sufficient to precipitate successful adaptation. In this paper, we identify and evaluate internal barriers that can hinder the translation of attention into adoption of a new business model. We suggest that two factors increase inertial tendencies and attenuate the relationship between attention and adaptation – attention towards the existing business model, which signifies divided priorities, and organizational complexity, which creates more roadblocks for turning vision into reality. On the other hand, attention towards internal organizational change enables the resource redeployment and reconfiguration needed to facilitate adaptation and thus amplifies the relationship between attention to the new business model and adaptation. In the context of the U.S. electric utility industry, we both find large-scale support for these hypotheses and use detailed qualitative analysis of managerial statements to clarify how each moderator affects the attention-adaptation link. Through this work, we add important depth to our understanding of the impact of managerial attention on incumbent adaptation.

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INTRODUCTION

In a changing industry environment, firms may struggle to navigate the transition from an existing, legacy business model to a novel business model built on new technologies (Ahuja and Novelli 2016). Much of the existing literature on innovation and industry evolution explores how incumbent firms respond to external changes and the factors that can make incumbents more or less likely to successfully adapt (e.g., Eggers and Park 2018, Tripsas 1997, Tushman and Anderson 1986). One key stream in this research builds on Ocasio (1997), documenting the importance of managerial attention in determining whether and how firms react to new technological opportunities, enter new markets, or adopt novel business models (e.g., Eggers and Kaplan 2009, Gerstner et al. 2013, Kaplan et al. 2003, Shepherd et al. 2017).

However, even when senior managers recognize industry change and emerging opportunities, firms may still struggle to adapt and transition to a new business model (Eggers and Park 2018). For example, despite being highly cognizant of the rising importance of digital photography, managers at Polaroid still focused on utilizing the existing "Razors and Blades" business model that had been successful for their chemical film business but was inappropriate for the sale of digital cameras (Tripsas and Gavetti 2000). Similarly, Blockbuster did not successfully transition to a digital video streaming business model despite the fact that they were experimenting with the technology before eventual industry leader Netflix (Satell 2014). In both cases, internal political and operational barriers demonstrated how attention to the emerging business model is a necessary-but-not-sufficient condition to adaptation, as dedication to the entrenched legacy business model prevented Polaroid and Blockbuster from adapting.

Failure to translate attention to the new business model into its adoption occurs when firms fail to re-deploy and adjust their resources (Ahuja and Novelli 2016, Eklund and Kapoor 2019). The inability to re-deploy existing resources is often borne out of internal organizational attributes that reinforce inertial tendencies (Gilbert 2005, Hannan and Freeman 1984). Accordingly, adopting a novel business model requires both attention towards the new business model and the ability to navigate internal barriers to change. We examine internal barriers to resource re-deployment and reorganization that may limit how effectively increased managerial attention towards an emerging business model leads to its adoption.

We identify three internal factors affecting the translation of new business model attention into action. First, we suggest that managerial attention to an emerging business model is less likely to lead to its adoption in firms that also pay a greater amount of attention to the legacy business model, as attention towards the old business model indicates extensive investment in the current technological trajectory and/or a cognitive frame entrenched in the existing way of doing business (Dosi 1982, Eggers and Park 2018, Tripsas and Gavetti 2000). Second, drawing on the literature of organizational inertia (Gilbert 2005, Hannan and Freeman 1984), we suggest that firms with more complex structures will struggle to convert managerial attention into adaptation, as complex organizations face higher coordination costs which can hinder the translation of managerial vision into action and lead to both routine and resource rigidity (Chen et al. 2019, Rawley 2010). Third, firms must adapt how they operate internally to implement a new business model, meaning managers must also pay attention to internal changes that will both enable the creation of suitable new routines and facilitate resource redeployment (Ahuja and Novelli 2016, Eklund and Kapoor 2019).

We study these questions in the context of the US electric utility industry. This industry faces significant change, as the legacy centralized business model of generation and delivery is challenged by a new decentralized model enabled by novel technologies. For example, home rooftop solar photovoltaic systems can reduce consumers' reliance on electricity generated by large, centralized power stations and force incumbents to adopt a decentralized business model. Using text analysis of conference call transcripts for 70 firms from 2003 to 2019 to capture managerial attention, we find support for the moderating role of attention towards the legacy business model, organizational complexity, and attention to internal organization on the relationship between attention towards the new decentralized business model and its adoption, though the relationship with the abandonment of the existing business model is less clear. We then use additional qualitative and quantitative analyses to illuminate how these internal barriers alter the translation of managerial attention into adoption of a new business model.

Our core contribution is to extend research demonstrating the impact of managerial attention on incumbent adaptation (Eggers and Kaplan 2009, Kaplan 2008, Kaplan et al. 2003) by highlighting the role of internal barriers to change in the relationship between attention and adaption. In doing so, we join an

emerging discussion regarding the management of multiple business models during periods of industry change (Ahuja and Novelli 2016, Eklund and Kapoor 2019). We show that managers must carefully divert attention away from the existing model and successfully manage the internal resource allocation process to adopt the new model. We also highlight how managing organizational complexity and internal organizational change are both critical to firms' adaptation in response to large scale industry change (Ahuja and Novelli 2016, Kaul 2012). Finally, our findings suggest that the internal challenges associated with the transition to a new business model can come from multiple sources, however effective management of organizational change can help to mitigate the adverse effects of such challenges.

THEORY AND HYPOTHESES

To respond effectively to a changing industry landscape, managers must observe and recognize the emerging change. Firms' responses to industry change often depend upon where decision-makers focus their attention (Cho and Hambrick 2006, Ocasio 1997). This may especially be the case when organizational change requires risky and large investments (Barr 1998), such as when firms are considering investing in a new technology or business model. Accordingly, a line of literature examining the effect of managerial attention on incumbent adaptation to technology-led industry change has found that attention towards emerging technologies is associated with faster strategic action in the face of a changing external landscape (Eggers and Kaplan 2009, Kaplan et al. 2003). This represents a baseline hypothesis in this study – that increased attention to the new business model is associated with greater adoption of that business model.

However, while attention towards the new business model may be necessary to respond to the changing industry landscape, it does not guarantee adaptation (Tripsas and Gavetti 2000), which relies on the re-configuration and re-deployment of organizational resources to appropriately capture value from the new opportunity through an appropriate business model (Christensen 2006, Karim and Mitchell 2000, Massa et al. 2017, Sirmon et al. 2007). The question is why, despite all the attention paid to industry change, does a firm like Polaroid or Blockbuster not appropriately adapt and successfully adopt the emerging business model? The answer may lie with a number of internal "barriers" that can impede a firm's ability to re-configure or re-deploy their existing resources and routines to take advantage of new opportunities

(Eggers and Park 2018). These barriers represent frictions that can prevent the translation of managerial attention towards the new business model into its adoption. Overcoming these barriers is essential to ensure successful incumbent adaptation.

To systematically identify the internal barriers that firms face in translating managerial attention to a new business model into increased adoption, we draw on the emerging literature on business model transitions (Ahuja and Novelli 2016, Zott et al. 2011) and the more established literatures on organizational inertia and rigidity (Gilbert 2005, Hannan and Freeman 1984). Firms transitioning towards a novel business model enabled by innovation often simultaneously manage both the new and existing business models, as the transition to the new model can take a significant period of time and firms may simultaneously utilize both models in the short or long run (Ahuja and Novelli 2016). Thus, managers must balance their attention between the existing and the new business models. However, attention alone does not solve this problem. Firms are often complex consisting of many moving parts and in ensuring that attention to the new model by top management translates to adoption of this model at the lower levels of the organization, organizational complexity must be successfully navigated (Simon 1962). Further, changing a business model requires firms to develop new, suitable routines and reconfigure their resources appropriately to ensure that employees have the requisite skills and are organized appropriately (Eklund and Kapoor 2019, Gilbert 2005, Nelson and Winter 1982). Thus, managers must adjust many organizational attributes to ensure that a novel business model is adopted. In developing our hypotheses, we focus on three hurdles to translating increased attention to the new model to its adoption. Specifically, we consider how attention to the existing business model, organizational complexity, and attention to internal organization can moderate the relationship between attention towards a novel business model and its adoption.

Managerial Attention Towards the Legacy Technology

In considering whether and how managerial attention impacts firm adaptation to a changing industry environment, it is important to remember that attention is a limited resource and that firms must attend to a number of different issues (Cyert and March 1963, Eisner and Shapira 1997, Eklund and Mannor 2020). This challenge is magnified for firms responding to a changing industry environment in which

managers must balance attention to both old and new business models (and associated technologies). This balancing act can pose significant challenges and cause firms to lose focus on the emerging technology and business model (Christensen and Bower 1996). Firms whose managers attempt to pay attention to both models may be hindered by organizational inertia due to the sheer complexity of managing two models and sets of routines (Gilbert 2005, Hannan and Freeman 1984). Split focus can reflect split priorities in how resources are allocated across these two models (Bardolet et al. 2010, 2011). Split priorities may lead to high indirect adjustment costs and internal conflict between managers responsible for each respective business model (Eklund and Kapoor 2019), which, in turn, may hinder the adoption of any new business model as insufficient resources may be applied to the model or vital effort is diverted from execution of the model to internal lobbying for resources (Cyert and March 1963). Beyond dividing attention, a cognitive frame emphasizing the old business model may also indicate extensive investment in the current technology trajectory (Dosi 1982) and a reluctance to reconfigure to fit the new business model facilitated by the new technology (Tripsas and Gavetti 2000). This inability or unwillingness to re-organize existing resources and routines will ultimately hamper the adoption of a novel business model and may limit the effects of managerial attention towards the new business model.

For firms navigating a changing industry landscape and paying attention to both the legacy and new business models, excessive attention to the old business model may also contribute to a distorted view of the new business model, and accordingly, an inappropriate response to industry change (Wu et al. 2014). For example, Kodak was active in its pursuit of digital photography, however it pursued ineffective technical trajectories. The focus of these trajectories was to leverage digital photography as a tool to sell more chemical film (e.g., Kodak Picture Kiosks). Such "hybrid" trajectories, which combine elements of the old and new business model, are often suboptimal fits for both the old and new model and reflect a lack of conviction regarding the future of the industry (Suarez et al. 2018). These kinds of approaches may lead to firms being hindered in the adoption of new business models (e.g., in the case of Kodak selling digital cameras and associated peripherals). Thus, although managers pay attention to the new business model, their parallel focus on the existing business model can hamper their ability to effectively adopt the new

business model. Relatedly, previous literature has found that while attention towards new technology may accelerate entry into a novel market, CEO attention to the legacy technology is associated with later entry (Eggers and Kaplan 2009).

Together these arguments suggest that increased attention to the legacy technology will reduce the impact of increased attention to the new business model on its adoption. Thus:

> ***Hypothesis 1:*** *Attention towards the legacy business model negatively moderates the relationship between attention towards a new business model and adoption of the new business model.*

Organizational Complexity

Because the design and structure of a firm affects the cost of coordination within a firm (Burton and Obel 2018), we can expect that a firm's structure may have a meaningful effect on its ability to adopt a novel business model (Jospeh and Ocasio 2012). Successfully integrating a new technology and rolling out a novel business model requires coordination across a variety of different activities at different levels of an organization (Kapoor and Adner 2012). However, little empirical research has focused on the link between structure and incumbent adaptation to technological change (Eggers and Park 2018), and that which has largely only focused on vertical integration (e.g., Afuah 2001, Kapoor and Adner 2012).

In order to overcome inherent inertial tendencies (Hannan and Freeman 1984), firms and managers must coordinate a variety of actors to translate a managerial vision into strategic action (Argyres et al. 2015, 2019). As a firm becomes more organizationally complex, coordination across different business lines or units becomes more difficult and costly (Foss 2001, Zhou 2011), and these increased coordination costs can become a source of rigidity (Chen et al. 2019, Rawley 2010). While firms with such decentralized structures can be more responsive to external change, this comes at the cost of weaker coordination across units (Siggelkow and Levinthal 2003). Such organizational complexity can lead to silos within a firm such that knowledge cannot flow easily between different units, which is critical for the execution of a new business model (Eklund and Kapoor 2021, Szulanski 1996). Within more complex organizations with a large number of subsidiaries or business units, some units may be resistant to adopting the new business model and it may be difficult for senior managers to enact coordinated change across the organization

(Christensen and Bower 1996). Accordingly, in more complex organizations, managers may struggle to translate their strategic vision into action at the lowest levels of the organization. A greater number of subsidiaries and increased organizational complexity may even lead to increased internal competition and conflict which is likely to further draw attention and effort away from adopting the new business model (Birkinshaw 2001, Birkinshaw and Lingblad 2005).

Together these arguments suggest that organizational complexity, in which the organization is divided into an increasingly large number of autonomous units, will be associated with higher coordination costs and a greater likelihood of internal conflict. These are both likely to hamper a firm's ability to re-configure or re-deploy resources to successfully adopt a novel business model once they are aware of the emerging business model and senior managers have demonstrated internal support for the new model. Accordingly, we suggest that attention to a new business model may be less likely to lead to its successful adoption in more complex firms.

> ***Hypothesis 2:*** *Organizational complexity negatively moderates the relationship between attention towards a new business model and adoption of the new business model.*

Managerial Attention Towards Internal Organization

In adopting a new business model, firms are likely to need to undergo significant internal change to resources and routines to take advantage of the opportunity. Successful adaptation requires linking external changes to corporate strategy and internal organization (Barr et al. 1992), as innovation must match the organizational form (Teece 1996). When navigating a technology-led transition, firms face the challenge of exploiting existing resources to support or exploit the new technology and business model (Taylor and Helfat 2009).

Such internal change in support of adoption of the new business model will require the development of new routines that are consistent with the new business model (Nelson and Winter 1982). For example, salesforce compensation structures can shape how effectively a firm adopts a new business model. Taylor and Helfat (2009) illustrate the examples of IBM and NCR responding to the rise of electronic computing. IBM was more effective in managing the transition as it aligned salesforce incentives to enable adoption of

the new technology. In contrast NCR struggled in part because competing salesforces would work against each other selling mechanical and electronic machines respectively. Salesforce incentives are an example of just one of the many routines that a firm needs to adapt as they transition to a new business model. Thus, without a keen eye on managing internal change to ensure appropriate routines are developed to support the new model, firms will struggle to adopt the new model effectively.

As well as adapting their routines, firms must reallocate existing resources towards the new business model (Christensen and Bower 1996). Such resources facilitate the effective execution of the new routines associated with the new business model. The challenge of balancing the allocation of resources to the new and existing business model is at the heart of the exploration-exploitation challenge that firms face (Lavie et al. 2010, March 1991). Without sufficient attention to changing an organization internally, firms are likely to allocate insufficient resources to adoption of the new business model (Adner and Levinthal 2008). Such resources can be deployed to build capabilities associated with the new business model as well as to adapt the organization more broadly so that the firm can successfully capture value from the new business model (Helfat and Eisenhardt 2004).

Given the need to adjust internally, simply increasing attention to the new business model is unlikely to be enough for firms to guarantee successful adoption. Thus, increased attention to internal organization-oriented strategies should help amplify the impact that increased attention to the new business model has on its adoption.

> ***Hypothesis 3:*** *Attention towards internal organization positively moderates the relationship between attention towards a new business model and adoption of the new business model*

METHODS

Research context

> *"Now utilities nationwide are casting a long shadow over Americans who are going solar with net metering. For over a century, these monopoly interests have made money from building big, expensive power plants and transmission – and having their customers harness free sunshine and other homegrown resources is a threat to that business model."* Coalition for Solar Rights[2]

[2] http://www.oursolarrights.org/

We examine business model adaptation in the context of the US electric utility industry from 2003 to 2019. During this time period the industry has faced significant technology-led change that began in the mid-2000s. The prevalent existing business model (the "centralized" model) of electricity generation and delivery used by incumbent utilities relies on the generation of electricity using large power plants remotely located from the point of consumption (e.g., Cretys and Guccione 2015, The Economist 2013). Electricity is transported to the user via high voltage transmission and lower voltage distribution networks. Due to advances in energy harvesting and storage technology, a new "decentralized" electricity model has emerged that threatens the centralized business model.

In the decentralized business model, users consume electricity generated at or near the point of use. The decentralized model has emerged around new technologies including rooftop solar photovoltaic (PV) systems, high-capacity batteries, digital management of the electricity grid, and mini wind-turbines. The decentralized model shifts the value proposition from "electricity as service" (with metered fees based on usage) to one around the sale or leasing of equipment to consumers plus energy advisory services and infrastructure upgrades to offer smart grid technology to balance out electricity needs. These changes affect both value creation and capture and the underlying assets required to deliver the business (e.g., Zott et al. 2011). Importantly, the decentralized model is incompatible with incumbent utilities' existing centralized generation and transmission assets and places different burdens on their distribution assets. Generation and transmission assets can become stranded assets if demand for centrally-generated electricity declines significantly (Caldecott and McDaniels 2014, Joskow 2006).

As of 2018, decentralized penetration remained low, with only 1.3% of residential customers (our focus) having adopted distributed solar photovoltaic technology. But the growth of distributed or decentralized electricity for residential customers has been significant with a compound annual customer number growth rate of 39% between 2010 and 2018. By 2018, over 1.94 million US residential customers utilized some form of distributed energy system, with approximately 99% of these customers (1.91 M) being residential solar photovoltaic customers (Figure 1(a)). In parallel, investment in centralized generation assets has declined over the same period as illustrated in Figure 1(b). By means of comparison,

penetration of rooftop solar was at 14% in Australia[3] in 2020 and 2.4% in Germany in 2018.[4] As a result, it is safe to characterize the industry in the U.S. as still in the early stage of change associated with the new, decentralized model based on Energy Information Administration (EIA) estimates (IEA 2016). Thus, based on a typical s-shaped curve of customer adoption, the decentralized electricity generation model still remains at the lower plateau of this curve (Foster 1986).

----- INSERT FIGURE 1 ABOUT HERE ------

Within this industry, there is still a high degree of uncertainty as to which model will ultimately dominate (e.g., Dutt and Joseph 2019, Fabrizio 2012). Residential customers may decide not to adopt decentralized electricity generation for reasons including the up-front cost of installing the system, customers' abilities to adapt their properties (e.g., may be renters and unable to install solar PV panels on property), the perception that the pay-off associated with decentralized electricity generation is not high enough, or a lack of understanding of how decentralized electricity generation works.[5] Even for those who adopt some form of decentralized generation, customers are likely to still obtain some electricity from centralized sources to supplement their own decentralized generation (e.g., at night when the sun is not shining). However, these customers still present a meaningful disruption to electric utilities as they will consume far less electricity from centralized sources (The Economist 2013).

Managers within electric utilities also vary in their attention to the new decentralized model. Some firms are actively investigating the implications of the new model to their business and trying to identify fruitful strategies to respond to the industry change. For example:

> *"We were the first major utility to open a dialog about how to enable the continued growth of rooftop solar… By raising the net metering problem early, long before there is a financial issue for our company, [we] are in a stronger position today."* Pinnacle West Energy Services, Q1 2014 Earnings Call.

> *"The pace of the transition already means our customers are able to choose from a wider variety of clean energy options than ever before. Last year we reached the milestone of 200,000 rooftop solar connections"* PG&E CEO, Anthony F. Earley 2015 Annual Report

[3] https://www.zmescience.com/ecology/renewable-energy-ecology/australian-home-solar-energy-052343/
[4] https://qz.com/1372939/100000-homes-in-germany-now-have-battery-storage-systems-connected-to-the-grid/
[5] https://issues.solarindustrymag.com/article/the-five-main-reasons-homeowners-dont-buy-solar

However, managers in other firms appear to have largely neglected the rise of the new decentralized model of electricity generation as exhibited through minimal commentary on the model in their public communications and limited financial investment, as detailed below.

Data and sample

We focus on 70 publicly listed firms with electric utility operations in the U.S. (SIC codes 4911 and 4932) from 2003-2019. These firms represent the largest investor-owned firms with utility operations in the USA. Our unit of analysis is the firm-year for which we have 747 unique observations in our dataset. This sample of firms represented 41% of US electricity generation capacity and served 57% of US electricity customers (domestic and commercial) in 2018.

The data come from four primary sources. First, for measures of managerial attention, we use quarterly earnings call transcripts from Factiva, Seeking Alpha and Thomson One. Second, we collect data on the utilities' operations such as customer numbers, generation capacity and net meter customers from the Energy Information Administration (EIA)[6] Forms EIA-860 and 861. These data are collected via an annual survey of utilities, which they are legally obliged to complete for each of their subsidiaries, thus providing complete coverage of the industry, and includes investor-owned, public, and municipal utilities. Subsidiary data from EIA is manually matched to the parent firms in the sample using a variety of sources (e.g., annual reports, company websites, 10-Ks).[7] We also used EIA data to determine the Retail Choice status (i.e. retail electricity deregulation) of the markets in which different subsidiaries operate (Defeuilley 2009, Delmas and Tokat 2005). Third, we collected data on industry regulations and financial incentives relating to renewable energy, energy efficiency and distributed energy across different US states in the

[6] https://www.eia.gov/electricity/

[7] In order to test the robustness and completeness of our matching of subsidiaries to parent companies, we compare parent-level data on the number of customers and electricity generation capacity for a sub-sample of firms for which parent-level data is available from public sources (e.g., company annual reports and 10-Ks) to the aggregate parent-level data captured from the EIA-861 and EIA-860 data in the year 2018. The mean number of customers per firm were 2,454,000 (EIA estimation) and 2,502,000 (Company data sources), t-stat=0.48, p=0.63 (paired sample t-test). The mean generation capacities per firm were 12,460 (EIA estimation) and 12,644 (Company data sources), t-stat=0.17, p=0.87 (paired sample t-test).

electric utility industry from the DSIRE database[8] developed by North Carolina State University. Finally, we collected firm-level financial data from Compustat.

Measures

Dependent variables: We use two dependent variables to examine the transition to the new business model of decentralized electricity generation. First, focusing on adoption of the new decentralized model, we measure the proportion of residential customers that have net meters. Net meters enable customers to both receive electricity from the centralized electricity grid and deliver excess electricity generated by their decentralized systems back to the grid for credit (Hughes and Bell 2006). Net metering as described by the US Congress is defined as:

> *"Net metering is a policy that allows electricity customers with their own generation capacity to be financially compensated for the energy they produce. Net metering is widely regarded as having an important role in deployment of distributed generation (DG), especially solar energy."*[9]

To measure adoption of the decentralized model, we calculate *Decentralized Penetration* as the natural log of the proportion of residential customers with net meters plus one and then multiplying this value by 100.

Second, as well as adopting the new business model, a transition to the new business model also involves a departure from the existing business model. This is likely to manifest through reduced investment in the existing business model, which we measure through data from EIA Form 860. This form provides the amount of centralized electricity generation capacity that has been retired and centralized capacity that is planned to be created at the subsidiary-level. To calculate *Centralized Capacity Addition,* we subtract the electricity generation capacity (in 1000s MW) that has been retired in the previous ten years from the planned additional generation capacity planned in the next ten years. The more positive the value, the more a firm is investing in the existing business model, while negative values indicate a departure from the existing business model. We illustrate how the average *Centralized Capacity Addition* changes over time in Figure 1b. As can be seen the value is initially positive and then declines over time to increasingly

[8] Database of State Incentives for Renewable Energy (https://www.dsireusa.org/)
[9] US Congressional Research Service https://crsreports.congress.gov/product/pdf/R/R46010

negative values thereby indicating a departure from the centralized generation model in parallel with an increasing adoption of the decentralized model as illustrated in Figure 1a.

Independent variables - attention. We develop three managerial attention variables following the general approach to computer-aided text analysis described by Short, Broberg, Cogliser, and Brigham (2010), McKenny, Short, and Payne (2013), and Rhee, Ocasio, and Kim (2019). For each domain of attention that we measure, we develop associated dictionaries of terms. For the dictionary used to develop the variable *Internal Organizational Orientated Strategies*, we utilize the dictionary on "*Internal Organizational Oriented Strategies*" developed by Eklund and Mannor (2020). Our other attention variables required us to develop two new dictionaries. To develop the set of keywords pertaining to the variables *Centralized Attention* and *Decentralized Attention*, we build on the list of industry keywords developed by Eklund and Kapoor (2019) relating to various attributes (e.g. technologies) of the centralized and decentralized models of electricity generation. We reviewed a variety of industry reports and websites to supplement the dictionaries with additional terms. This involved reviewing a sub-sample of the quarterly analyst call transcripts to further identify the specific terms used by firms in our empirical sample. The dictionaries were then iteratively revised by the authors as well as through consultation with an industry practitioner. These dictionaries are all presented in the accompanying online appendix.

These three dictionaries enabled the use of Linguistic Inquiry and Word Count (LIWC) software to count the words associated with each measure in earnings call transcripts (e.g., Mannor et al. 2016, Pennebaker et al. 2001, Pfarrer et al. 2010). As the content of the question-and-answer portion of the call are highly idiosyncratic to the questions asked by analysts, we follow other researchers and focus only on the opening prepared remarks in our word counts. In total we examined 2,692 transcripts for the 70 sample firms over the period 2003-2019. Specifically, we measure the average number of words per attention topic across the four quarterly earnings calls in a year to create an average word count per year (*Internal Organizational Oriented Strategies, Decentralized Attention,* and *Centralized Attention*). We then normalize the mean call word counts associated with each dictionary for each observation in our data set (at the firm-year level) by subtracting the mean of the word count for all firms across the sample and

dividing by the standard deviation of the word count across the entire sample.

Figure 2 illustrates the temporal variation of these three attention variables. We observe that all three variables generally increase over the study time period, but the time frame over which the variable rises differs. *Centralized Attention* rises 2003-2006 and then plateaus; in contrast *Internal Organizational Orientated Strategies* rises steeply 2011-2014, and *Decentralized Attention* rises steeply 2013-2018. These observations are consistent with firms diverting attention from the existing business model to the new decentralized model during the course of this study.

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Independent variables – Organizational complexity. To measure organizational complexity, we utilize the number of subsidiaries associated with each individual firm that sells or generates electricity (*Subsidiary Count*). We suggest that managers within firms with a greater number of subsidiaries will face greater organizational complexity in managing the transition to the new business model. This is because managers are likely to face a wider variety of different challenges in making this transition as each subsidiary faces its own unique set of circumstances, priorities, and strategic challenges. For example, within our empirical context each subsidiary will generally operate in different US states which will have different regulations with respect to the centralized and decentralized models thereby adding to the complexity of managing a transition from one business model to the other. Further, firms with a greater number of subsidiaries are more likely to have complex unobservable interdependencies that will further drive-up organizational complexity.

Control variables. We include five groups of control variables. First, we control for the overall size of each firm through the total number of customers (residential, commercial and industrial) and centralized electricity generation capacity. Second, we control for the average quality of a firm's existing centralized generation assets using the age of the generation assets. Third, we control for the operational scope of each firm, namely whether firms participate in different parts of the electricity value chain. Fourth, we control for a variety of financial attributes of each sample firm such as return on assets (ROA). Finally, we control for the extent of government incentives available for customers to adopt the decentralized electricity

generation model. Table 1 provides variable descriptions.

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Statistical analysis

All the independent variables are all lagged one year relative to the dependent variable in our main analyses. Hypotheses are tested using Ordinary Least Squares (OLS) regression with *Decentralized Penetration* or *Centralized Capacity Addition* as the dependent variables. We employ year and firm fixed effects to account for industry-level time-varying and firm-level time-invariant unobservable variables. We cluster standard errors at the firm-level to account for non-independence of errors within the same firm (Petersen 2009). We test our hypotheses through examining the coefficients of the three interaction terms: (H1) *Decentralized Attention* x *Centralized Attention*, (H2) *Decentralized Attention* x *Subsidiary Count* and (H3) *Decentralized Attention* x *Internal Organizational Orientated Strategies*. We expect the coefficients for H1 and H2 to be negative and H3 to be positive when the DV is *Decentralized Penetration* and reversed when *Centralized Capacity Addition* is the DV.

A potential concern is omitted variable bias in that unobserved attributes could be correlated with our independent and dependent variables. While we are unable to utilize an exogenous shock to firms' organizational structures or use an instrumental variable approach, we address this endogeneity risk through four strategies. First, we utilize firm and year fixed effects. Second, we utilize a wide variety of control variables that could be correlated with both adoption of the decentralized model and the independent variables. Third, as we utilize interaction terms to test our three hypotheses, the risk associated with omitted variable bias is somewhat reduced (Bun and Harrison 2019, Nizalova and Murtazashvili 2016). Finally, we undertake a variety of robustness checks. While these steps reduce the risk of omitted variable bias, they do not eliminate endogeneity concerns. As a result, we limit any claims of causality.

RESULTS

Descriptive statistics

The descriptive statistics for our primary dataset are presented in Table 2. We observe that the average penetration of the decentralized model is 0.4% ranging between 0 and 13.4%. This illustrates

significant heterogeneity in adoption of the new model. Further, consistent with Figure 1b, the average firm in our sample is decreasing its centralized generation capacity, with the mean change in capacity between 10-year forward planned additions less 10-year losses of capacity being 783 MW. Consistent with a relationship between attention and adaptation, we find that *Decentralized Attention* is positively correlated with *Decentralized Penetration* (0.26) but negatively correlated with *Centralized Capacity Addition* (-0.14).

----- INSERT TABLE 2 ABOUT HERE ------

Main analyses

Table 3 and Table 4 illustrate the results of our main analyses testing Hypotheses 1-3, where Table 3 utilizes *Decentralized Penetration* as the dependent variable and Table 4 utilizes *Centralized Capacity Addition*. Focusing initially on Model 2, we observe that *Decentralized Attention* has the expected positive sign in Table 3 and negative sign in Table 4. Thus, at least directionally, greater attention to the new model is associated with increased customer penetration into the new model and reduced investment in the existing model. The p-values, however, are relatively large (p=0.170 in Model 2, Table 3 and p=0.141 in Model 2, Table 4), which contrasts with prior published work on attention and adaptation (e.g., Eggers & Kaplan, 2009), in line with our suggestion that heterogeneity around the average effect may be quite substantial.

----- INSERT TABLES 3 AND 4 ABOUT HERE ------

For both dependent variables, the key interaction coefficients and standard errors are relatively stable across models limiting concerns of multicollinearity (Models 3-6). We also tested for multicollinearity between variables. The overall VIF (Variance Inflation Factor) for Model 6 in Table 3 is 5.4 and for Model 6 in Table 4 it is 5.4. Both VIFs are substantially below the guideline threshold of 10 (Hair et al. 1998). Thus, we can rule out multicollinearity concerns associated with our main analyses and focus our testing of hypotheses on the fully saturated models. This also allows us to focus our attention on Model 6 in both tables for interpretation of our results.

Hypothesis 1 suggests that attention to the existing business model would inhibit the translation of attention to the new business model into adaptation. We find support for H1 in Model 6, namely, the relationship between attention to the new, decentralized business model and adoption of the new model is

negatively moderated by the level of managerial attention to the existing, centralized model (p = 0.001). We observe that at the lowest decile of attention to the existing, centralized model (*Centralized Attention*), a one standard deviation increase in attention to the decentralized model is associated with a 0.37 standard deviation *increase* in *Decentralized Penetration*. In contrast, at the highest decile of attention to the centralized model, we observe that a one standard deviation increase in attention to the decentralized model is associated with a 0.07 standard deviation *decrease* in *Decentralized Penetration*.

Hypothesis 2 suggests that organizational complexity would inhibit the translation of attention to the new business model into adaptation. Model 6, Table 3 also provides support for H2 in that the relationship between attention to the new, decentralized business model and adoption of the new model is negatively moderated by the number of subsidiaries within the focal firm (p = 0.016). We observe that at the lowest decile of *Subsidiary Count*, a one standard deviation increase in attention to the decentralized model is associated with a 0.24 standard deviation increase in *Decentralized Penetration*. In contrast, at the highest decile of *Subsidiary Count*, we observe that a one standard deviation increase in attention to the decentralized model is only associated with a 0.04 standard deviation increase in *Decentralized Penetration*.

Hypothesis 3 suggests that attention to the internal organization would facilitate the translation of attention to the new business model into adaptation. We find support for H3, as illustrated by the positive coefficient for *Decentralized Attention x Internal Organizational Orientated Strategies* in Model 6 in Table 3 when *Decentralized Penetration* is the dependent variable (p = 0.009). We observe that at the lowest decile of attention to internal organization, a one standard deviation increase in attention to the decentralized model is associated with a 0.07 standard deviation increase in *Decentralized Penetration*. In contrast, at the highest decile of attention to internal organization, we observe that a one standard deviation increase in attention to the decentralized model is associated with a 0.26 standard deviation increase in *Decentralized Penetration*. Figure 3 illustrates the three interactions associated with Hypotheses 1-3 in a graphical format.

----- INSERT FIGURE 3 ABOUT HERE ------

Moving to our analyses where *Centralized Capacity Addition* is the dependent variable, these results are illustrated in Table 4. Using this dependent variable enables us to examine the extent to which

firms are investing in technologies associated with the existing, centralized business model. For H1, while the coefficient on the interaction term *Decentralized Attention* x *Centralized Attention* is in the predicted direction, it is not significantly different from zero (p = 0.527 in Model 6). Thus, H1 is not supported when examining departure from the existing model. Namely, attention to the existing model does not positively moderate the relationship between attention to the new model and investment in the existing model.

Focusing on H2, contrary to our predictions, we observe that *Subsidiary Count* negatively moderates the relationship between attention to the decentralized model and investment in the existing model (p = 0.102 in Model 6). This provides some limited evidence to suggest firms with more subsidiaries are associated with a greater translation of their attention to the new model into reduced investment in the existing model. The inertial pressures that apply to adoption of the new model may also apply to investment in the existing model in that greater organizational inertia hinders further investment in the existing model.

H3 is supported using *Centralized Capacity Addition* as the dependent variable in that the coefficient for *Decentralized Attention x Internal Organizational Orientated Strategies* is negative (p = 0.097 in Model 6). For centralized generation investments, we observe that at the lowest decile of *Internal Organization Attention*, a one standard deviation increase in attention to the decentralized model is associated with a 0.06 standard deviation *increase* in *Centralized Capacity Addition*. In contrast, at the highest decile of attention to internal organization, we observe that a one standard deviation increase in attention to the decentralized model is associated with a 0.09 standard deviation *decrease* in *Centralized Capacity Addition*. Figure 4 illustrates the three interactions associated with H1-H3 in graphical format.

----- INSERT FIGURE 4 ABOUT HERE ------

We undertake two sets of additional analyses to test the robustness of the main results. First, we examine the robustness of our main results to the use of alternative measures for our independent and dependent variables. Second, we also undertake a variety of robustness checks using alternative model specifications such as not using firm fixed effects and testing our interactions using split sample analyses (Shaver 2019). We continue to observe similar results to our main analyses across all these robustness checks. The online appendix provides the tables and further descriptive details of these robustness checks.

Post-hoc analyses

In this section we use additional analyses to provide insight into the mechanisms through which attention to different issues can translate into greater or lesser adoption of the new business model and departure from the existing business model based on the three hypotheses in the paper.

In terms of H1, we examine how attention to both models can hinder adoption of the new model. We read the text of a sample of eight firms' quarterly earnings call transcripts in the dataset with both high and low attention to the decentralized model and high attention to the new model. In addition, we examined the letters to shareholders in the annual reports of a random sample of twenty firms in our sample over the eleven-year period 2008 to 2018 as well as press releases from these sample firms' regarding their activities associated with the decentralized electricity generation model. Firms paying attention to both the centralized and decentralized models often highlighted the risks of the new model on their existing business model. This suggests that managers paying significant attention to both models may perceive the new model as more of a threat as compared to an opportunity. For example, in the 2016 PGE annual report:

> *"A basic premise of PGE's business is that generating electricity at central generation facilities achieves economies of scale and produces electricity at a relatively low price. Many companies and organizations conduct research and development activities to seek improvements in alternative technologies, such as fuel cells, photovoltaic (solar) cells, micro-turbines, and other forms of distributed generation. It is possible that advances in such technologies will reduce the cost of alternative methods of electricity production to a level that is equal to or below that of central thermal and wind generation facilities. Such a development could limit the Company's future growth opportunities and limit growth in demand for PGE's electric service".*

Similarly, in Idacorp's 2012 annual report:

> *"There is potential that power generation systems provided by third parties, whether solar generation or otherwise, and energy efficiency measures could become sufficiently cost-effective and efficient that customers choose to install such systems on their homes or businesses. This may render traditional generation sources owned by Idaho Power obsolete or decrease the need for energy supplied by Idaho Power, which would reduce Idaho Power's revenue and have a negative impact on IDACORP's and Idaho Power's results of operations and financial condition."*

In contrast, firms that focused their attention primarily on the decentralized electricity generation model tended to highlight the benefits of changing to this model. For example, Edison International (*Decentralized Attention* average= 0.553, *Centralized Attention* average= -0.228) managers stated in a 2015 analyst call:

> *"We see more opportunities for growth than we do threats in the changes occurring in our industry. Recently, we have taken steps to further position Edison Energy Group to develop those opportunities."*

These quotes highlight that attention towards the existing model may affect how managers perceive the growth of the new business model – highlighting its importance but emphasizing it as a threat to the status quo. In contrast, greater attention only to the new model appears to be associated with managers seeing this new business model as a strategic opportunity. This difference in opportunity and threat perception is likely to hinder greater adoption of the new model when too much attention is placed on the existing model. Building on the work of Gilbert (2005), firms that pay significant attention to both models may allocate some resources to the new model but suffer with routine rigidity as the firm struggles to adapt its supporting routines for the new business model.

In terms of H2, we examine how organizational complexity can hinder the translation of attention to the new, decentralized model into adoption of that model. The complexity of having multiple subsidiaries and its dampening of the relationship between managerial attention and adoption of the decentralized model is best exemplified through three large incumbent firms with multiple subsidiaries who exhibited internally conflicting behavior with respect to adoption of the new model. First, Duke Energy is one of the US's leading utilities with multiple subsidiaries in different states. Generally, at a corporate level Duke Energy is favorable to customer adoption of distributed electricity generation as illustrated from its Annual Reports:

> *"Duke Energy Renewables has expanded its investment portfolio through the addition of distributed solar companies and projects, energy storage systems and energy management solutions"* **2017 Annual Report**

> *"In February 2015, Duke Energy proposed specific initiatives to spur rooftop solar installations in the state* [South Carolina] *as well as community-scale and larger utility-scale solar facilities."* **2015 Annual Report**

However, some Duke subsidiaries encouraged customer adoption and others actively sought to hinder the adoption of decentralized electricity generation technologies by customers.

> *"Duke Energy, one of the largest electric power companies in the country, which continues to implement a key policy encouraging the growth of rooftop solar throughout the Carolinas."*[10]

[10] https://solarbuildermag.com/news/which-utilities-in-the-south-are-the-most-solar-friendly-the-southern-environmental-law-center-tells-us/

> *"Indiana's already dismal solar-policy landscape has seen legislative fights as recently as 2015 that would have been a huge blow to the state's already severely stifled distributed solar industry."* Tabuchi (2017)

> *"Duke Energy Indiana…. was among the utilities lobbying to kneecap customer-owned solar."*[11]

Second, Southern Company highlights that it is seeking to be a leading company in driving the growth of decentralized electricity generation. In fact, Southern acquired a leading distributed energy company:

> *"In 2016, for example, Southern Company acquired PowerSecure, a leading provider of distributed energy infrastructure, energy efficiency solutions and utility infrastructure services. With advanced smart grid capabilities, microgrid controls, energy storage, switchgear and service solutions, PowerSecure is helping meet the evolving, technology-driven energy requirements of commercial, industrial and institutional customers in the digital economy."* **Southern Company 2018 Annual Report**

However, some Southern Company subsidiaries actively hinder customer adoption of decentralized electricity generation. For example, while subsidiary Georgia Power is actively encouraging adoption of rooftop solar, subsidiary Alabama Power is actively trying to hinder adoption:

> *"Alabama Power, which five years ago began imposing a monthly charge on customers who install solar to power some of their energy needs. This unjust charge has put the brakes on rooftop solar by eliminating at least 50 percent of the savings homeowners would see over the lifetime of their rooftop solar system."* ***Error! Bookmark not defined.***

> *"On Atlanta's Upper West Side, Georgia Power is creating a similar townhome community, Altus at the Quarter, where power from the grid is supplemented by rooftop solar installations and in-home battery storage."* **Southern Company, Annual Report 2017**

Third, Xcel Energy highlights that it is embracing the distributed electricity generation model in its corporate communications. For example, in its 2017 Annual Report, Xcel Energy highlights:

> *"Xcel Energy's community solar program in Minnesota is the largest in the country — by far. At the end of 2017, our Minnesota program had grown to 246 megawatts of energy, which is nearly twice as large as the next largest community solar program."*

In contrast, Xcel's Colorado subsidiary sought to hinder adoption of the decentralized electricity generation model by its customers through lobbying to reduce net metering credits for residential customers with decentralized electricity generation systems.[12]

[11] https://www.renewableenergyworld.com/2019/07/15/utilities-bid-to-own-rooftop-solar-even-as-they-oppose-it/#gref

[12] https://theclimatecenter.org/portfolio-item/why-are-some-big-utilities-embracing-small-scale-solar-power/

> *"Last year, Colorado's main utility, Xcel Energy, sought to slash the price it now pays residents whose rooftop solar set ups feed power back to the grid. The company now pays 10.5 cents per kilowatt hour. It aims to pay half that price, arguing that the value of the rooftop power being generated isn't as high as once thought and that the residents of solar-powered homes should pay more to support the infrastructure set up by Xcel that provides power reliability to all, sunshine or clouds."*[13]

Such examples highlight the challenges of translating managerial vision into coordinated strategic action in firms with greater organizational complexity. Such firms require increased coordination to successfully navigate the adoption of a novel business model. Further, the greater complexity associated with firms having more subsidiaries is associated with a greater chance of fracture in that some subsidiaries hinder adoption of the new model whereas others openly embrace it. Unsurprisingly, then, these three firms demonstrated minimal adoption of the new business model throughout our sample (Figure 5).

----- INSERT FIGURE 5 ABOUT HERE ------

Finally, focusing on the moderating role of attention to internal organization (H3), utilities vary in their recognition of the need for substantial internal reorganization to facilitate adoption to the decentralized model. Edison International is one of the leading adopters of the decentralized model in our dataset (see Figure 5). Close examination of the quarterly earnings call transcripts indicates that CEO, Theodore Craver, highlighted this point in a 2013 call: *"It would be foolish to dismiss the potential for major changes in the utility business model."* Similarly, in a 2015 call, senior Edison International managers highlighted the importance of being able to integrate customers using the decentralized model into their regular operations:

> *"To meet these needs, we need to be able to integrate more distributed energy resources, such as rooftop solar, energy storage and electric transportation charging."*

This also involved being proactive in shaping internal organization when responding to regulators' requests regarding Edison International's perspective regarding their adaptation to the rise of distributed energy resources:

> *"We endeavored to not simply answer the commission's initial questions about integration of distributed energy resources but also to lay out our vision for how the grid of the future will facilitate customer choice of new technologies and support California's policies to move to a low-carbon economy."*

[13]https://www.coloradoindependent.com/2014/02/05/xcel-battle-to-pay-less-for-rooftop-solar-heats-up/?fb_comment_id=1458352154383588_282133

Edison signaled that it was committed to finding ways that it could apply its existing resources to take advantage of the new opportunity:

> *"We are focused on finding those areas where customers' needs are unmet, that match well with our competitive advantages, and that hold promise for scaling-up sufficiently. Edison energy group continues to expand into businesses that meet this profile, including distributed solar generation, energy services for commercial and industrial companies, providing new sources of water, and competitive transmission… We believe we possess several competitive advantages to succeed with customers in this new and quickly evolving power environment."*

As the novel technology and business model emerged, Edison, relative to many of its peers appeared to not only actively pay attention to this new area, but also considered how it would re-organize itself to reconfigure its resource and routines to best fit this new area. This focus on internal configuration and resource redeployment enabled Edison to become an industry leader in the decentralized energy space.

Increased attention to internal organization may also be able to limit the negative impact of increased attention to the centralized model and organizational complexity on the relationship between attention to the decentralized model and adoption of the decentralized model. This is because such attention to internal organizational issues may allow firms to re-organize and redeploy their existing resources more successfully thereby facilitating adoption of the decentralized model. We evaluate this through a split sample regression analyses in which we examine the interactions *Decentralized Attention* x *Subsidiary Count* and *Decentralized Attention* x *Centralized Attention* at high and low levels of attention to internal organization (effectively a three-way interaction). If greater attention to internal organization can help overcome the barriers of organizational complexity and attention to the existing model, the interaction term coefficients will both be less negative at higher values of *Internal Organizational Orientated Strategies*. Consistent with these arguments, we observe that the interaction term coefficients are both significantly greater for the sub-sample in which *Internal Organizational Orientated Strategies* is in the top decile as compared to the bottom nine deciles as illustrated in Table 5. Thus, our data suggests that greater attention to internal organization can help overcome the barriers of organizational complexity and attention to the existing model which curb the translation of attention to the decentralized model into greater adoption of the decentralized model.

----- INSERT TABLE 5 ABOUT HERE ------

DISCUSSION

In this study, we examine how a key antecedent of adaptation for firms facing business model and technology change – managerial attention to the new business model – is affected by internal barriers within the firm. First, realizing that the transition from an existing to a new business model does not occur instantaneously and there is often an extended period when both models co-exist, we argue that greater managerial attention to the existing business model will lower the impact of increased managerial attention to the new model. Second, increased attention to the new model will be less effective in translating into adoption of the model in more complex organizations and in cases where managers do not pay sufficient attention to adjusting organizational routines and delivering suitable internal organizational changes. We find support for these arguments in the US electric utility industry which is undergoing a transition from a centralized to a decentralized model of electricity generation, though the results for adoption of the new business model are much more consistent than those for abandonment of the existing business model. Additional analyses highlight that greater attention to the existing model is associated with firms seeing the new model being a threat rather than an opportunity, and greater organizational complexity is associated with firms having conflicting internal perspectives regarding the utility of the new model. Further, we observe that greater attention to internal change can help firms overcome the negative impacts of greater attention to the existing model and organizational complexity.

Overall, this paper makes three primary contributions to the extant strategic management literature. First, we contribute to an emerging discussion regarding the management of multiple business models during periods of industry change (Ahuja and Novelli 2016, Eklund and Kapoor 2019). Often as one new business model emerges and the existing model becomes less popular, there is an extended period of co-existence, and even in the long run both business models may co-exist. Thus, a challenge managers face is managing their attention. On the one hand, paying too much attention to the existing business model may hinder adoption of the new model. On the other hand, paying insufficient attention to the existing model may lead to firms failing to capture significant value from their resources associated with the existing

business model. Thus, we cannot simply portray firms as uniformly switching from one business model to another. Ultimately, managers must carefully divert their attention away from the existing model and successfully manage the internal complexities required to successfully execute the new model simultaneously with the existing model. Ultimately, one business model is unlikely to fully displace the other with a significant period of co-existence being the most likely outcome.

Second, we draw attention to key internal barriers to firms translating increased managerial attention into adoption of a new business model. We highlight how managing organizational complexity and internal change are both critical to firms' adaptation in response to large scale industry change (Ahuja and Novelli 2016, Kaul 2012). In doing so we provide insight into how firms' organizational structures can shape how effectively they respond to technological change (Eggers and Park 2018). Namely we highlight an organizational dilemma. On the one hand, having multiple subsidiaries can help to diversify away risk with some units actively adopting the new model earlier thereby providing learning benefits. On the other hand, the increased organizational complexity associated with more subsidiaries can hinder adoption of the new model. This is because of both the difficulty in coordinating cross-organizational action and the increased likelihood that the firm will form fault lines such that while some units actively engage in the new model, others may actively resist it.

Finally, we contribute to the discussion on the role and impact of conflict arising from firms having multiple goals (Joseph and Gaba 2020). We highlight that conflict can arise through firms having different attentional lenses (existing versus new business model) and between different units within an organization which may face different internal and external environments. Further, we illustrate that if managers pay attention to managing internal change appropriately these conflicts can be effectively managed to help ensure a firm can adapt to a changing external environment. Thus, firms can face multiple forms of internal conflict when seeking to adapt to a changing external, industry environment. However, recognizing that conflict is likely to arise, firms can limit some of its adverse consequences through actively managing internal change through, for example, limiting direct and indirect adjustment costs such as reorganizing appropriately or ensuring suitable internal capabilities are developed (Helfat and Eisenhardt 2004).

As with any study, this study has several limitations than can provide avenues for future research studies. First, our context features cross-market regulatory heterogeneity that may affect generalizability. For example, incumbent electricity utilities may be local monopolies and can halt customer adoption of the new model through unfavorable electricity pricing regimes and can effectively lobby for legislative relief. Future studies could investigate less regulated industries in which incumbent firms may have fewer levers to pull regarding hinderance of adoption of the new business model. Second, our key dependent variable, (*Decentralized Penetration*) captures both actions of the firm and actions of consumers, raising questions about which force reflects our results. We have sought to control for factors affecting consumer incentives to adopt, but again future research would ideally take place in a context with a more direct measure of company adoption. Third, while we raise three different internal barriers to the translation of managerial attention into adoption of a new business model, it is important to note that these factors are not necessarily orthogonal to each other. Future research could consider the interplay across these moderators to better understand the processes by which internal structures and characteristics moderate the effect of managerial attention on business model adoption. Finally, as with many studies examining important managerial decisions our findings are subject to endogeneity. Namely, attention to the new business model may be correlated with an unobserved attribute of the firm such as attitudes to new technology of the senior management team. We attempt to limit the risk of endogeneity bias through a variety of approaches but cannot claim to fully eliminate this risk. Ideally, some form of experiment would be undertaken where attention to a new technology is exogenously determined and manipulated.

Despite these and other limitations, this study helps to illustrate that managerial attention is necessary but not sufficient to facilitate adoption of an associated new business model. We highlight that excessive attention to the existing technology can hinder increasing attention to the new technology translating into adoption of the new model. Even if sufficient attention is dedicated to the new technology, internal organizational complexity and a lack of attention to changing internal routines can lead to increased attention to the new model failing to yield an equivalent increase in adoption of the new business model.

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TABLES AND FIGURES

Table 1: Description of Control Variables

Control Variable	Description	Why it is used
1. Size of firm		
Total Customer Numbers	Total number of customers across all key segments (residential, commercial and industrial) per firm-year in millions.	Larger firms may have more bandwidth and can afford to manage two models simultaneously.
Total Centralized Capacity	Total centralized electricity generation capacity measured in 1000s MW.	Firms with more centralized capacity are less likely to adopt the new business model.
2. Generation asset quality		
Mean Age Centralized Generation	The weighted average age of a firm's generation asset base for each firm-year. We weight each generator's age by the generation capacity of that generator, which means that larger generators contribute more to the mean age of a firm's generation portfolio in years.	Firms with older generation assets may be more likely to depart from the centralized model.
3. Operational Scope		
Percentage Electricity Bought	This is the proportion of a firms' electricity in MWHr that is bought wholesale as opposed to being generated internally.	Firms that are less reliant on their own generation of electricity may be more likely to adopt the new, decentralized electricity generation model.
New technology attention	Attention to various forms of new technology not directly related to the decentralized model of electricity generation (e.g., artificial intelligence). We followed a similar process for the development of this variable as the other text-based independent variables. In doing so, we develop a dictionary pertaining to attention to broader new technologies that may not specifically pertain to either business model (*New Technology Attention*). We then count number of words referring to such technologies in earnings calls.	Firms with greater attention to new technology in general may be more likely to adopt the new decentralized model.
Transmission Proportion	To control for operations in transmission, distribution, wholesale and retail, we developed weighted variables ranging between zero and one, such that zero represents a firm that has no operations in that specific part of the value chain and one if all its operations are in that part of the value chain. We weight these variables by sales volume per subsidiary (millions of MWHr) and whether the subsidiary has transmission, distribution or retail operations. For example, if a firm has two subsidiaries A and B with equal sales, with unit A having operations in transmission and retail and B having operations in distribution and retail, the values of the three variables are: Transmission Proportion = 0.5, Distribution Proportion = 0.5 and Retail Proportion = 1.	Firms in parts of the value chain that may become less relevant with the new decentralized model (e.g., transmission) may be less likely to adopt the new model.
Distribution Proportion		
Wholesale Proportion		
Retail Proportion		
4. Firm level financial controls		
R&D Intensity	R&D expenditures divided by revenues (Cohen and Levinthal 1990)	Firms may invest more in R&D focused on the new decentralized model which may aid greater adoption.
ROA	Return on Assets (Richard et al. 2009)	Higher performing firms may be more able to compete in both the centralized and decentralized models of electricity generation.
Slack	Ratio of current assets to current liabilities	Firms with greater available slack resources may utilize them to participate in both the decentralized and centralized models (e.g., Nohria & Gulati, 1996).
5. Incentives to adopt new model		
Decentralized Incentives	Using the DSIRE database we count the number of incentives for distributed energy sources for each US state-year. To account for firms operating across multiple states we develop a weighted average of the various incentive measures using the proportion of a firm's sales volume (in MWHr) within each state of operations. For example, if a company operates in two states each with equal sales volumes, and state A has 50 incentive schemes and state B has 10 incentive schemes, the weighted average is 30 for firm A.	These regulations, incentives etc. may facilitate or hinder the adoption of the decentralized model thereby influencing the number of net meter customers a firm is likely to obtain.

Table 2: Descriptive Statistics (N=747)

	MEAN	SD	MIN	MAX	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Decentralized Penetration	0.433	1.267	0.000	12.553	1.00																		
2. Centralized Capacity Addition	-0.783	2.751	-21.266	7.828	-0.05	1.00																	
3. Decentralized Attention	-0.122	0.879	-0.612	7.032	0.26	-0.14	1.00																
4. Internal Org. Orient. Strategies	-0.114	0.888	-1.809	5.581	0.19	-0.15	0.05	1.00															
5. Centralized Attention	0.188	0.892	-1.656	3.838	-0.07	-0.07	-0.04	-0.02	1.00														
6. Subsidiary Count	5.450	7.782	1.000	57.000	-0.10	-0.35	0.05	0.10	0.04	1.00													
7. Total Customer Numbers	1.741	2.006	0.000	10.372	0.14	-0.44	0.02	0.17	0.01	0.52	1.00												
8. Total Centralized Capacity	10.131	12.864	0.001	66.510	-0.10	-0.50	-0.00	0.10	-0.02	0.58	0.69	1.00											
9. Mean Age Centralized Generation	29.799	11.029	0.000	76.139	-0.06	-0.05	-0.01	0.05	-0.07	-0.03	0.09	0.02	1.00										
10. Percentage Electricity Bought	0.305	0.136	0.000	0.508	0.11	0.05	-0.01	0.06	0.11	0.04	0.12	-0.20	0.09	1.00									
11. New Technology Attention	-0.091	0.767	-1.702	6.519	0.09	-0.12	0.13	-0.01	-0.06	0.14	0.10	0.05	0.05	0.04	1.00								
12. Transmission Proportion	0.797	0.359	0.000	1.000	0.15	-0.04	-0.10	-0.10	0.04	-0.10	0.09	0.12	0.16	-0.17	-0.03	1.00							
13. Distribution Proportion	0.892	0.257	0.000	1.000	0.12	0.03	-0.14	-0.11	0.10	-0.15	0.04	0.07	0.20	-0.26	-0.11	0.59	1.00						
14. Wholesale Proportion	0.646	0.429	0.000	1.000	-0.04	-0.02	-0.02	-0.08	0.05	-0.08	-0.01	-0.05	0.09	-0.39	-0.17	0.24	0.38	1.00					
15. Retail Proportion	0.206	0.347	0.000	1.000	0.01	0.00	0.07	0.00	0.04	0.03	0.12	-0.09	-0.02	0.32	0.02	-0.35	-0.35	-0.03	1.00				
16. R&D Intensity	0.001	0.009	0.000	0.162	-0.03	0.03	0.16	0.01	-0.19	-0.03	-0.08	-0.08	-0.25	-0.21	0.28	-0.22	-0.22	-0.15	-0.05	1.00			
17. ROA	0.025	0.034	-0.235	0.618	-0.07	0.06	-0.11	-0.08	0.05	-0.03	-0.03	0.03	0.08	0.06	-0.07	0.09	0.14	0.05	0.01	-0.21	1.00		
18. Slack	0.998	0.410	0.221	3.386	-0.23	0.15	-0.06	-0.07	-0.17	-0.06	-0.23	-0.17	0.15	0.07	0.02	-0.17	-0.14	-0.11	-0.02	0.05	0.08	1.00	
19. Decentralized Incentives	6.729	4.282	0.100	22.400	0.14	0.13	-0.02	-0.03	-0.12	-0.13	0.13	-0.15	-0.12	0.12	-0.10	-0.06	-0.04	0.14	0.22	0.07	-0.05	0.13	1.00

Table 3: Main OLS analyses examining Hypotheses 1 – 3 for adoption of new model

DV= Decentralized Penetration	1	2	3	4	5	6
Decentralized Attention x Centralized Attention			-0.346**			-0.279**
			(0.109)			(0.080)
Decentralized Attention x Subsidiary Count				-0.031*		-0.025*
				(0.013)		(0.010)
Decentralized Attention x Internal Organizational Orientated Strategies					0.130*	0.138**
					(0.058)	(0.052)
Decentralized Attention		0.233	0.271*	0.439*	0.245	0.438**
		(0.168)	(0.127)	(0.176)	(0.159)	(0.098)
Centralized Attention		-0.192+	-0.204*	-0.174+	-0.194+	-0.190*
		(0.106)	(0.098)	(0.099)	(0.104)	(0.091)
Subsidiary Count		0.025+	0.026*	-0.000	0.024+	0.004
		(0.014)	(0.013)	(0.013)	(0.013)	(0.011)
Internal Organization Attention		0.135	0.135	0.138	0.171	0.176+
		(0.104)	(0.103)	(0.104)	(0.106)	(0.106)
Total Customer Numbers	-0.006	-0.057	-0.042	0.010	-0.055	0.009
	(0.086)	(0.095)	(0.079)	(0.083)	(0.093)	(0.073)
Total Centralized Capacity	-0.001	-0.002	0.001	-0.002	-0.000	0.002
	(0.019)	(0.015)	(0.014)	(0.016)	(0.015)	(0.015)
Mean Age Centralized Generation	0.011	0.008	0.005	0.007	0.009	0.006
	(0.011)	(0.009)	(0.009)	(0.009)	(0.010)	(0.009)
Percentage Electricity Bought	0.116	0.122	0.029	0.378	0.118	0.246
	(1.100)	(1.350)	(1.271)	(1.245)	(1.315)	(1.165)
New Technology Attention	0.098	0.046	0.032	0.004	0.056	0.011
	(0.104)	(0.105)	(0.105)	(0.103)	(0.107)	(0.103)
Transmission Proportion	0.190	0.126	0.120	0.050	0.086	0.019
	(0.665)	(0.621)	(0.629)	(0.630)	(0.633)	(0.641)
Distribution Proportion	-0.704	-0.580	-0.601	-0.569	-0.564	-0.572
	(0.720)	(0.676)	(0.668)	(0.651)	(0.667)	(0.640)
Wholesale Proportion	0.041	-0.043	-0.071	-0.008	-0.024	-0.017
	(0.340)	(0.363)	(0.358)	(0.343)	(0.359)	(0.336)
Retail Proportion	-1.728*	-1.700*	-1.810*	-1.681*	-1.704*	-1.777*
	(0.739)	(0.765)	(0.739)	(0.734)	(0.763)	(0.716)
R&D Intensity	1.539	4.593	13.431	7.002	3.553	12.516
	(3.682)	(9.167)	(17.790)	(11.956)	(9.224)	(18.378)
ROA	-1.571	-1.559	-1.452	-1.810	-1.477	-1.584
	(1.695)	(1.510)	(1.334)	(1.557)	(1.495)	(1.371)
Slack	0.019	-0.047	-0.035	-0.016	-0.052	-0.018
	(0.144)	(0.137)	(0.130)	(0.134)	(0.136)	(0.129)
Decentralized Incentives	-0.171+	-0.161	-0.172+	-0.174+	-0.157	-0.177+
	(0.101)	(0.097)	(0.094)	(0.096)	(0.096)	(0.093)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
N	744	744	744	744	744	744
R^2	0.641	0.667	0.694	0.687	0.669	0.708

Standard errors in parentheses; + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

Drop in observations from 747 to 744 is due to the use of firm fixed effects i.e. presence of singletons.

Table 4: Main OLS analyses examining Hypotheses 1 – 3 for investment in existing model

DV= Centralized Capacity Addition	1	2	3	4	5	6
Decentralized Attention x Centralized Attention			0.041			0.081
			(0.144)			(0.127)
Decentralized Attention x Subsidiary Count				-0.019^{+}		-0.019
				(0.010)		(0.012)
Decentralized Attention x Internal Organizational Orientated Strategies					-0.257^{+}	-0.234^{+}
					(0.138)	(0.139)
Decentralized Attention		-0.058	-0.062	0.065	-0.081	0.039
		(0.111)	(0.112)	(0.093)	(0.125)	(0.118)
Centralized Attention		-0.266	-0.264	-0.255	-0.261	-0.248
		(0.178)	(0.181)	(0.175)	(0.174)	(0.174)
Subsidiary Count		0.226**	0.226**	0.211**	0.230**	0.213**
		(0.057)	(0.057)	(0.063)	(0.055)	(0.062)
Internal Organization Attention		0.003	0.003	0.005	-0.069	-0.061
		(0.144)	(0.144)	(0.145)	(0.156)	(0.157)
Total Customer Numbers	-0.933	-1.431**	-1.432**	-1.391**	-1.434**	-1.396**
	(0.659)	(0.369)	(0.370)	(0.373)	(0.364)	(0.366)
Total Centralized Capacity	-0.329*	-0.347**	-0.347**	-0.347**	-0.350**	-0.350**
	(0.129)	(0.104)	(0.104)	(0.106)	(0.104)	(0.105)
Mean Age Centralized Generation	0.005	0.004	0.005	0.004	0.002	0.003
	(0.017)	(0.015)	(0.014)	(0.015)	(0.015)	(0.014)
Percentage Electricity Bought	-3.946^{+}	-3.773	-3.762	-3.619	-3.766	-3.587
	(2.279)	(2.373)	(2.362)	(2.468)	(2.316)	(2.405)
New Technology Attention	0.049	-0.086	-0.084	-0.111	-0.104	-0.125
	(0.202)	(0.187)	(0.187)	(0.186)	(0.192)	(0.190)
Transmission Proportion	-0.564	-0.415	-0.415	-0.461	-0.336	-0.389
	(0.761)	(0.717)	(0.719)	(0.691)	(0.718)	(0.695)
Distribution Proportion	-1.068	-0.472	-0.470	-0.466	-0.503	-0.489
	(1.447)	(1.238)	(1.237)	(1.243)	(1.217)	(1.221)
Wholesale Proportion	0.678	0.294	0.297	0.315	0.255	0.287
	(0.937)	(0.676)	(0.677)	(0.686)	(0.675)	(0.688)
Retail Proportion	0.144	-0.181	-0.168	-0.169	-0.174	-0.137
	(0.676)	(0.577)	(0.574)	(0.568)	(0.572)	(0.554)
R&D Intensity	-0.096	-0.777	-1.824	0.663	1.283	0.510
	(7.225)	(5.510)	(6.872)	(4.027)	(5.855)	(6.448)
ROA	-1.622	-0.391	-0.404	-0.541	-0.552	-0.717
	(1.685)	(1.580)	(1.589)	(1.566)	(1.561)	(1.572)
Slack	0.212	0.020	0.019	0.039	0.030	0.045
	(0.282)	(0.232)	(0.229)	(0.233)	(0.229)	(0.225)
Decentralized Incentives	-0.071	-0.036	-0.034	-0.043	-0.042	-0.047
	(0.094)	(0.081)	(0.083)	(0.082)	(0.079)	(0.081)
Year Fixed Effects	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	Y	Y	Y	Y	Y	Y
N	744	744	744	744	744	744
R^2	0.655	0.688	0.688	0.689	0.690	0.691

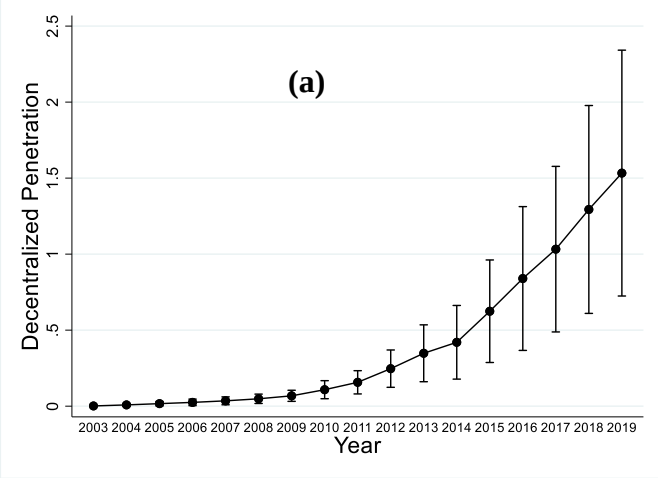
Standard errors in parentheses; $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$

Drop in observations from 747 to 744 is due to the use of firm fixed effects i.e. presence of singletons.

Table 5: Triple interaction analysis examining whether greater attention to internal change can make up for greater organizational complexity and attention to the centralized model to further enhance the translation of attention to the decentralized model into greater adoption of the decentralized model.

Hyp.	DV= Decentralized Pen. Interaction Term	*Internal Organizational Orientated Strategies*		Wald test p-value comparing coefficients
		Top Decile	**Bottom 9 Deciles**	
1	*Decentralized Attention x Centralized Attention*	0.710 SE = 0.425 p=0.112	-0.361 SE = 0.103 p=0.001	0.001
2	*Decentralized Attention x Subsidiary Count*	0.096 SE=0.034 p=0.013	-0.030 SE= 0.013 p=0.026	0.000

Figure 1: Variation of dependent variables over time



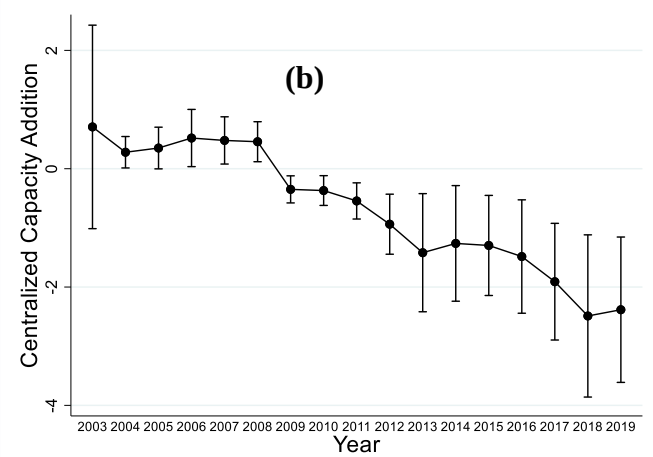
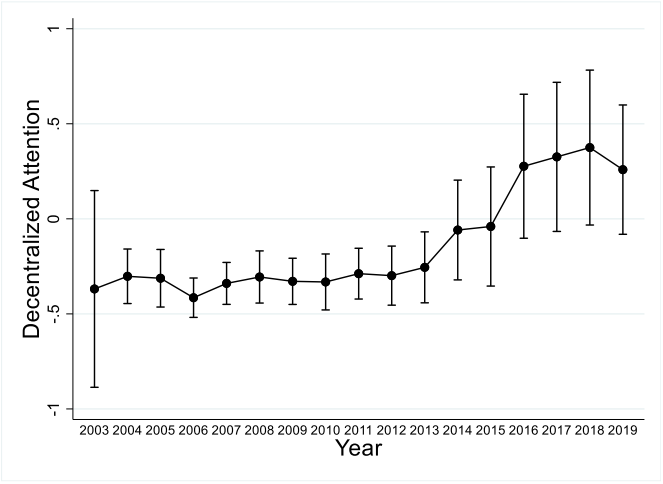
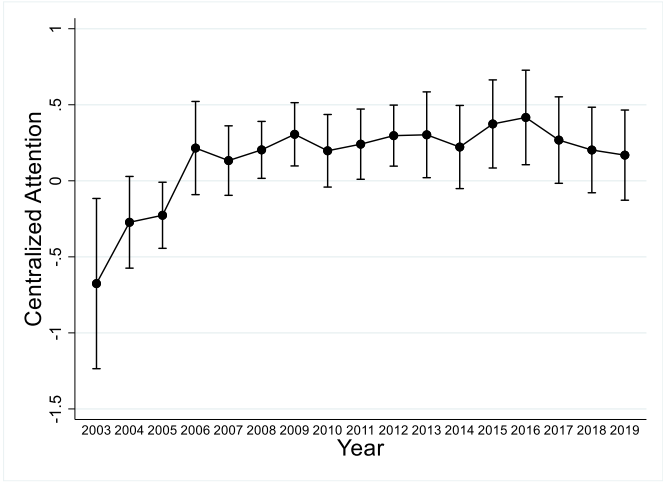
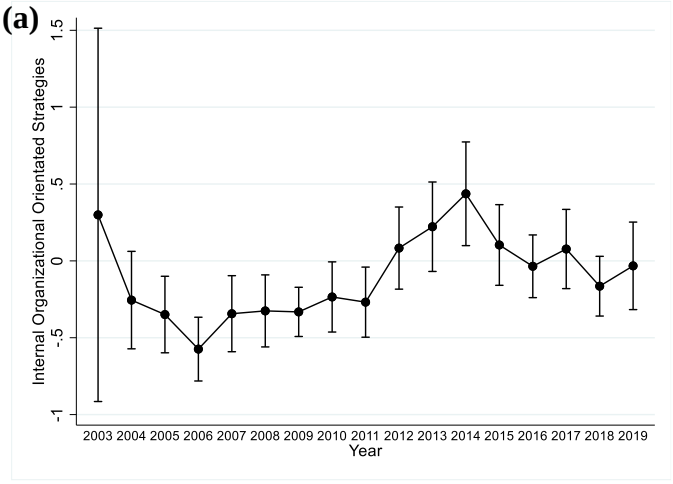


Figure 2: Variation of attention variables over time (a) *Decentralized Attention;* (b) *Centralized Attention;* (c) *Internal Organizational Orientated Strategies*





(a) **(b)**



(c)

Figure 3: Interaction Charts when the dependent variable is *Decentralized Penetration*, and the independent variable is *Decentralized Attention*. Moderators are (a) *Centralized Attention*; (b) *Subsidiary Count*; (c) *Internal Organizational Orientated Strategies*. Low = 10th percentile, High = 90th percentile.

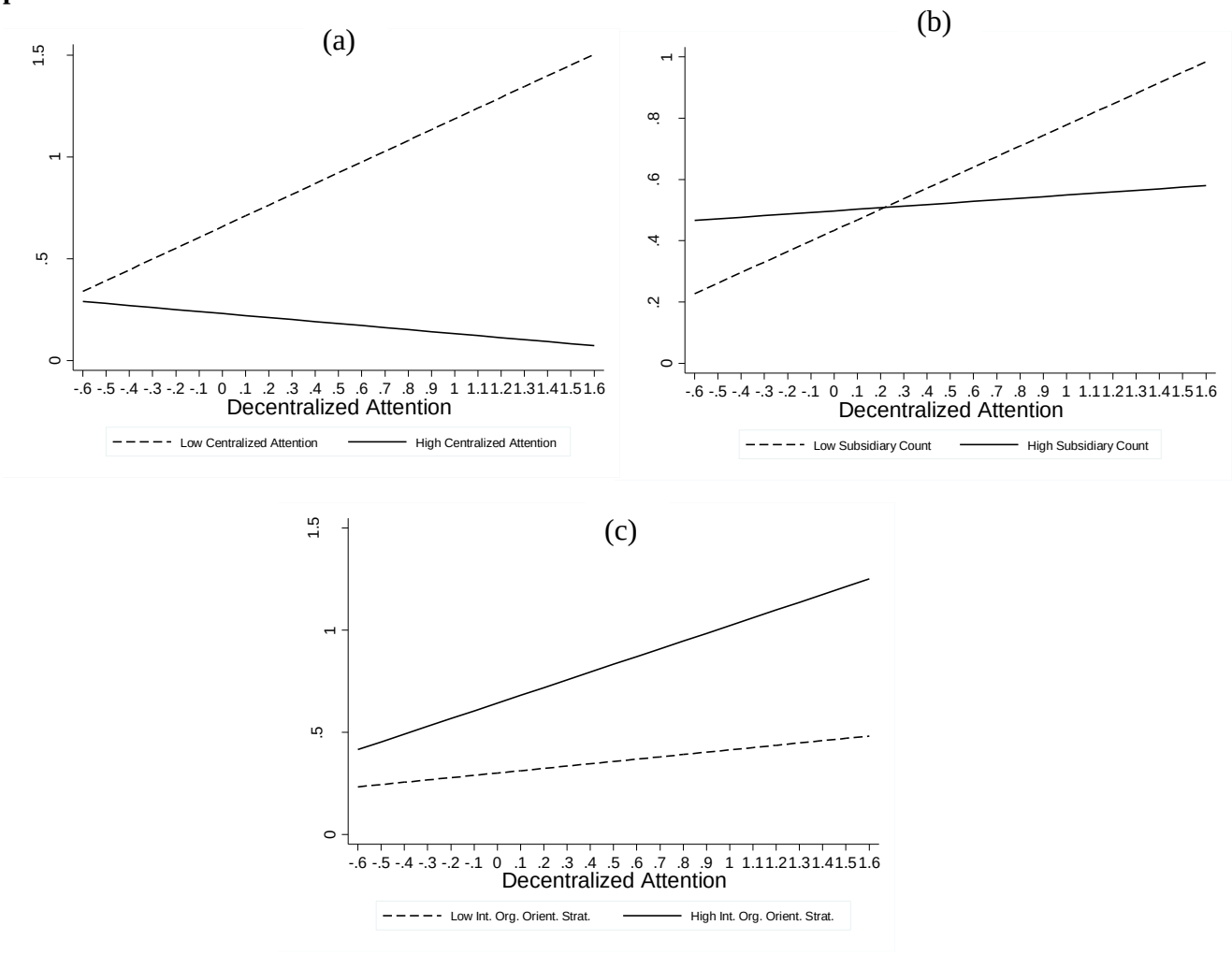


Figure 4: Interaction Charts when the dependent variable is *Centralized Capacity Addition*, and the independent variable is *Decentralized Attention*. Moderators are (a) *Centralized Attention*; (b) *Subsidiary Count*; (c) *Internal Organizational Orientated Strategies*. Low = 10th percentile, High = 90th percentile.

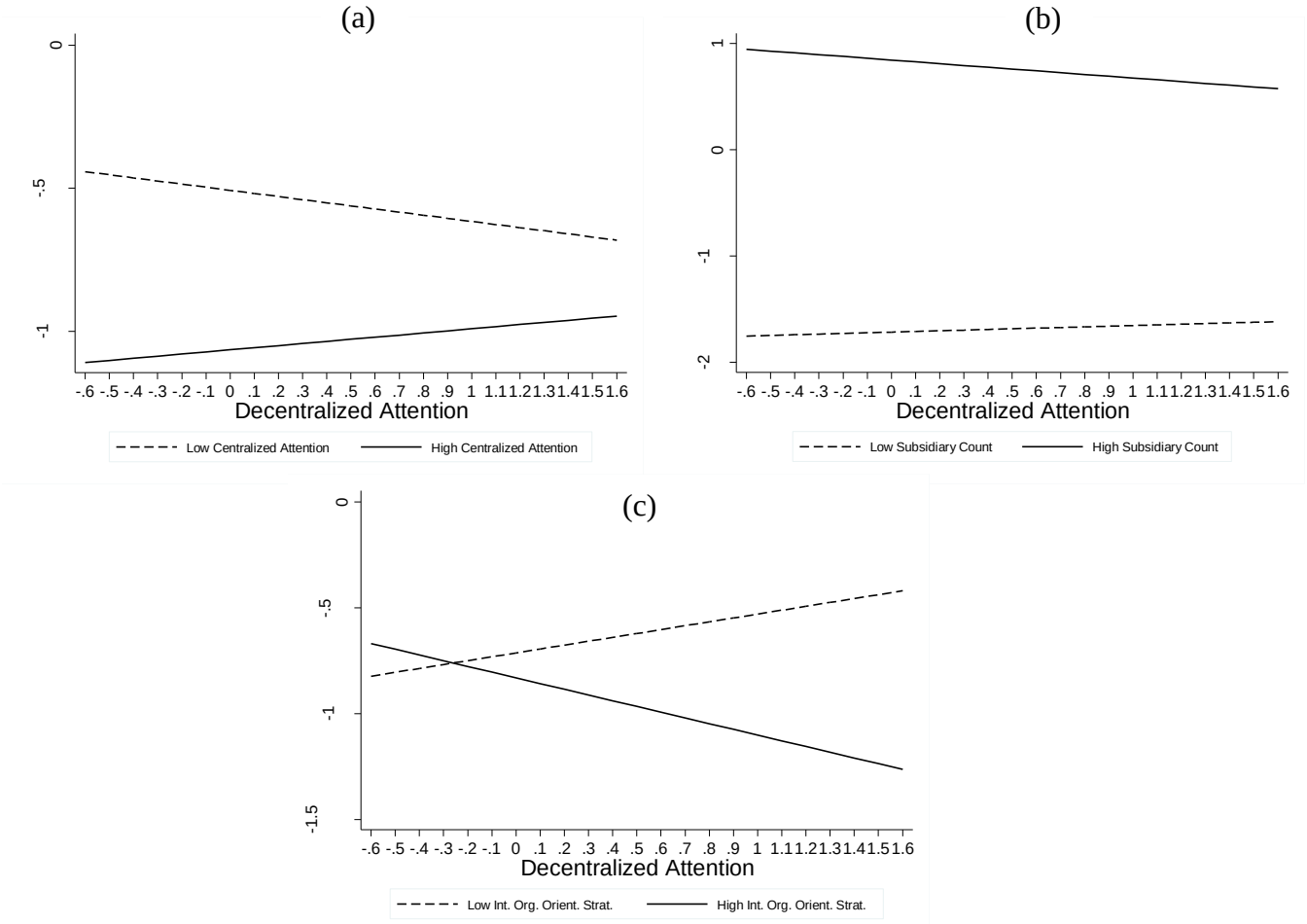


Figure 5: Comparison of adoption of decentralized model by a selection of different firms in sample