NOVEL BUSINESS MODELS AND RADICAL TECHNOLOGIES UNDER CAPITAL CONSTRAINTS: COMPLEMENTS OR LIABILITIES?

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NOVEL BUSINESS MODELS AND RADICAL TECHNOLOGIES UNDER CAPITAL CONSTRAINTS: COMPLEMENTS OR LIABILITIES?

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ABSTRACT

Resource-based theory contends that the manner in which firms are organized plays a critical role in determining whether resources can be leveraged to create wealth. Although numerous factors influence organizing decisions, prior research in the heterogeneous resource approach contends that individual resources are the causal driver in the process of establishing competitive advantages. In this study, we test this assumption by examining the impact of novel business models on resource-based weaknesses. Our analyses find that novel business models attenuate the potential limitations of two critical resource-based weaknesses—radical technologies and capital constraints—thereby increasing the performance of new firms.

INTRODUCTION

Resource-based theory contends that resources play a central role in determining the ability of firms to create competitive advantages and generate wealth (Barney, 1991; Lippman & Rumelt, 2003a; Townsend & Busenitz, 2008). Under the heterogeneous resource approach, owning superior resources is theorized to explain the differences in performance between firms (Barney, 1991; Peteraf, 1993; Crook, Ketchen, Combs, & Todd, 2008). New technology-based ventures, however, often initiate operations with several potential resource-based weaknesses (cf. Arend, 2004). First, to compete with entrenched incumbents, new technology-based ventures often attempt to introduce radically new technologies in order to disrupt the status quo in industries (Zahra & Bogner, 2000). While some innovation is important for competitive reasons, innovation which is too radical is often detrimental to a venture’s chances of survival (Hannan & Freeman, 1981; Heely & Jacobson, 2008). In addition, new technology-based ventures often must contend with significant capital constraints given the lack of operational cashflows and the growing scarcity of external capital (Audretsch & Keilbach, 2003; Blanchflower & Oswald, 1998; Westhead, 1995). As such, many ventures struggle to establish a foothold in markets and fail with considerable frequency (Headd, 2003).

While these constraints undoubtedly contribute to the high failure rate among early-stage ventures, some ventures appear to thrive under these conditions (Zahra & Bogner, 2000). In this study, we explore the extent to which a firm’s choice of business model affects the ability of new ventures to contend with resource-based weaknesses. Recent research on business models suggests that highly novel business models positively impact the performance of established firms (Zott & Amit, 2007). The exact impact of novel business models, however, on both the efforts to commercialize radical, new technologies and to contend with capital constraints is unknown. Based
on prior research, several possible outcomes exist. First, one possibility is that linking highly novel business models to radical technologies exacerbates some of the challenges inherent in attempting to commercialize these types of technologies (Amit & Zott, 2001). The potential challenge here is that too much novelty increases the uncertainty for key stakeholders and customers thereby increasing the legitimation risk for the firm (Dougherty, 1994; Zuckerman, 1999). As such, these groups limit or even possibly withdraw from transactions with the new venture.

A second possibility is that novel business models leverage unique configurations between internal and external constituencies to create new value (Zott & Amit, 2008). In these situations, novel business models help to establish barriers against competition due to high switching costs and a lack of alternative options to receive the same value (Zott & Amit, 2007). Such relationships provide a greater level of acceptance of highly innovative technologies that would otherwise suffer from challenges associated with legitimacy. Furthermore, novel business models may enable firms to leverage unique resource configurations to enhance the value of resources through specific complementary relationships (Adegbesan, 2009; Lippman & Rumelt, 2003 a). In these situations, firms can acquire the services of critical resources at a cost lower than the revenue-generating potential of a resource (Barney, 1986). Based on these arguments, we contend that novel business models can possibly attenuate the negative effects of radical technologies on performance while also enabling these early stage startup firms to contend with capital constraints.

To address these questions, we build upon an organizing framework in resource-based theory to explore how novel business models affect both the capital constraints and the downside of introducing radical new technologies. We test our hypotheses with a sample of 114 technology-based ventures started between 1999 and 2007 in the Southwest U.S. Based on the analyses of the secondary moderating effects (i.e., Bowen, 2010 a; b) of novel business models on these two factors, we find that more novel business models do successfully attenuate the challenges associated with introducing radical, new technologies and operating under significant capital constraints.

Based on these findings, this study makes several contributions to resource-based theory and the literature on business models. First, we find that the manner in which a firm organizes its business model determines to a great extent its ability to capitalize on the potential value from technological resources (Chesbrough & Rosenbloom, 2002) and financial capital (Lee, Lee, & Pennings, 2001). However, whereas prior research theorizes that the attributes of individual resources determine the performance differentials between firms, we find that novel business models help firms contend with resource-based weaknesses. In doing so, this study potentially creates a more expansive view regarding the types of resources firms can leverage to create competitive advantages and generate wealth.

Second, we contribute to the business models literature by discussing the logic for why various business model configurations might impact firm performance in technology based startups. In prior research, the exact mechanism through which business models impact firm performance remains largely underdeveloped (Amit & Zott, 2001). By linking the literature on novel models more closely with the organizing approach in resource-based theory, we build upon both our theoretical arguments and empirical findings to identify several ways emerging theory on business models might better incorporate an organizing logic to improve both the discriminant and predictive validity of key theoretical arguments in this literature.
THEORY AND HYPOTHESES

Theoretical Background: Business Models and Resource-based Theory

The Organizing Approach in Resource-based Theory. In resource-based theory, the heterogeneous resource approach (HRA) remains the dominant approach for conceptualizing the impact of resources on organizational performance (Barney, Wright, & Ketchen, 2001; Peteraf & Barney, 2003). However, despite some empirical support validating the link between strategic resources and performance (Crook et al., 2008), scholars argue that the causal logic for HRA is limited based on the notion that it relies upon a static link between resources and performance (Priem & Butler, 2001; Sirmon, Hitt, & Ireland, 2007). To address the perceived limitations in the original causal logic in resource-based theory, Barney (1997) augments the HRA (i.e., VRIN model – Barney, 1991) to focus attention on how the organization of firms affects the use of specific resources (i.e., VRIO model). The core causal argument in this organizing approach contends that the manner in which firms are organized determines to a large extent whether firms are fully able to leverage valuable, rare, and costly to imitate resources to generate competitive advantages.

Although the organizing approach receives significant empirical support in prior research (e.g., Newbert, 2007), the increasing awareness of the importance of a firm’s organizing context raises a key issue as to exactly what is causing performance differentials between firms: resources, the organizing context, or a combination of both? To address this question, in this study, we examine the extent to which a firm’s organizing context instantiated in a firm’s business model affects the use of two types of resource endowments typically thought to be liabilities to new technology-based ventures: radical technologies and capital constraints.

Business Models and Firm Performance. Researchers are beginning to address the role of business models in linking the organizing decisions of managers/entrepreneurs with firm performance outcomes (Zott & Amit, 2007). In this research, business models are defined as “the structure, content, and governance of transactions between the focal firm and its exchange partners” (Amit & Zott, 2001: 511). A common assumption with most business model research is that they have a significant impact on firm performance (Zott & Amit, 2007). Business models also are thought to have a critical impact on the business model/value creation relationship (Amit & Zott, 2001) because they help entrepreneurs to: “(a) conceptualize the venture as an interrelated set of strategic choices; (b) seek complementary relationships among elements through unique combinations; (c) develop activity sets around a logical framework; and (d) ensure consistency between elements of strategy, architecture, economics, growth, and exit intentions.” (Morris, Schindehutte, & Allen, 2005: 733).

The roots of the business model concept in organization theory are found in earlier research on organizational design (Miles & Snow, 1978). Design elements are central to business creation and organization and often adopt an internally-focused, economizing perspective on balancing administrative needs (Stinchcombe, 1963), resources (Alvarez & Barney, 2003; Barney, 1991), governance issues (Weber, 1946), decision making (Simon, 1976) and political pressures and needs (Zald, 1970). The business model concept augments these internally-focused design elements with an outward focus of helping to create a firm’s boundary lines with markets, customers, products, and other environmental concerns in order to compete effectively (Morris et al., 2005). In a sense, therefore, business models provide an avenue through which to address competing views on economizing and strategizing approaches within firms.
Based on these theoretical arguments, four different types of business models are identified in prior research: novelty, efficiency, complementarities, and lock-in (Amit & Zott, 2001). Although some conceptual linkages exist between these different types of business models (Amit & Zott, 2001), the organizing logic underlying these models relies upon varying degrees of an internal versus external orientation. In particular, efficiency models create value by maintaining an internal focus on generating transaction efficiencies for stakeholders thereby relying largely upon an economizing logic. On the other hand, novelty centered models create value through unique links, incentives, and outcomes between a business and its exchange partners and incorporate more broadly a strategizing logic (Zott & Amit, 2007). Building upon this approach, researchers have examined the performance effects of these two business model designs on post-IPO entrepreneurial ventures. Based on the results of their analysis, novelty centered business models appear to positively enhance the performance of post-IPO firms while efficiency models do not appear to have the same impact on performance (Zott & Amit, 2007).

Novel Business Models and Radical Innovation

The ability to acquire resources which are heterogeneous, rare, hard to imitate or transfer, and which help produce value for the focal firm is foundational for firm performance at any stage of a firm’s existence (Penrose, 1959; Wernerfelt, 1984). For new ventures, the acquisition and development of critical resources comprises one of the central managerial tasks since both the survival and future performance of the venture is at risk (Lee et al., 2001). In dealing with these startup challenges, many entrepreneurs build on intangible resources such as their ability to develop their insights and experience to conceive of new opportunities (Alvarez & Busenitz, 2001; Baron, 2008; Kor et al., 2007), make decisions in a way that helps them navigate down their uncertain roads (Busenitz & Barney, 1997), find ways to bootstrap together limited resources to build a viable venture (Baker & Nelson, 2005), and to “connect the dots” (Baron, 2006) on business concepts in order to effectively reach potential customers. In so doing, some ventures are able to survive and even gain a competitive advantage.

To establish a competitive advantage, however, firms must balance the need to differentiate their products and services from those of incumbent firms while at the same time establishing legitimacy in the market (Aldrich & Fiol, 1994; Etzioni, 1987; Singh, Tucker, & House, 1986). At the core of these strategies is the set of technological resources held by the venture (Lichtenstein & Brush, 2001). In the innovation literature, there is substantial evidence that too much innovation will actually be negatively related to performance (Heeley, Matusik, & Jan, 2007; Uotila, Maula, Keil, & Zahra, 2009). This is especially relevant for new ventures. As a new venture tries to establish legitimacy in the market, it must carefully consider the radicalness of the venture’s products and services developed from its set of technological resources. As Heeley and Jacobson (2008) contend, the more extreme a firm’s set of technological resources, the more likely the level of radicalness of innovation will increase, causing a negative impact on performance. In this light, one can assume that there exists a balance between the level of technological resources a firm possesses and firm performance. We would argue that there is an optimal level of radicalness in the technological resources that a new venture should develop/acquire in order to position itself to compete effectively in the market. If the level of innovation is too radical, it can be detrimental for the commercialization process and weaken firm performance outcomes. This leads to the following hypothesis:

Hypothesis 1 – There is a curvilinear relationship between the radicalness of a new venture’s technology and annualized revenues as a measure of performance.
The follow-on issue is what new ventures can do to combat the challenge presented above while not losing the desired outcomes of technological innovation. As discussed earlier, the business model is a mechanism used to connect the business to the market (Amit & Zott, 2001). Zott and Amit (2007) examined different types of business models among post-IPO ventures. Their conclusion was that a novelty centered business model, or one that created unique links, incentives, and outcomes between a business and its exchange partners, was positively related to the performance of the venture.

These studies examined the relationship between established ventures and market performance. A key element of entrepreneurship research not yet addressed is the startup implications of business model choice and the commercialization of innovation. The startup phase of a technology venture encompasses a unique set of challenges associated with commercialization tasks, one of which is the balance of differentiation through new technology and market acceptance. Based on the above discussion regarding the challenges of commercializing radical, new technologies, one could assume that adding a highly novel business model to a very strong set of technological resources could increase the level of radical output and have an even stronger negative relationship on performance. However, we suspect that this is not the case and propose an alternative view of this relationship. A novel business model creates unique touch points between a business and its exchange partners which can yield unique relationships, incentives, and outcomes (Zott & Amit, 2008). These unique touch points can actually create value in and of themselves.

Value creation occurs when a firm exceeds a competitor’s ability to provide solutions for a customer’s needs while maintaining or improving profit margins. This process of value creation through the unique touch points created by a novel business model helps to establish barriers against competition due to high switching costs and a lack of alternative options to receive the same value (Zott & Amit, 2007). Such relationships provide a greater level of acceptance of highly innovative technologies that would otherwise suffer from challenges associated with legitimacy. Thus, we contend that novel business models actually will enhance performance thereby attenuating the negative impact of radical technologies on firm performance.

Hypothesis 2 – Novel business models attenuate the negative effects of radical innovation on the performance of entrepreneurial ventures such that ventures attempting to commercialize radical technologies with more novel business models will generate more revenue than ventures with less novel business models.

Novel Business Models and Capital Constraints

In addition to the challenges associated with commercializing radically new technologies, start-up ventures also must contend with significant capital constraints. In prior research, a lack of financial capital has been frequently shown to be a main cause of new venture failure (Audretsch, 1995; Headd, 2003; MacDonald, 1986). This is especially true for technology ventures since they must find a way to finance the fixed costs associated with transforming technological resources into innovative products and services, as well as construct the routines and structures necessary to stabilize early operations (Varian, Farrell, & Shapiro, 2004).

With existing research on business models focused on post-IPO firms, the challenge of capital acquisition during the startup phase and the impacts of choice of business model design requires additional focus. One of the consistent findings of the firm survival literature is that the capital base of new (or small) firms is linked directly to the firm’s survival prospects (Audretsch, 1995;
Headd, 2003; MacDonald, 1986). The higher the levels of capitalization, the greater the opportunity the venture has for survival (Audretsch, 1995). The impact of novel business models on this relationship, however, has not been directly explored in prior literature. On one hand, novel business models present some interesting challenges for capital constrained firms in that attempts to establish the legitimacy of new organizational structures and routines potentially increases the demands on scarce capital. Furthermore, to implement novel business models, firms have to invest in a variety of resources with potentially uncertain value in order to realize the value from the business model (Townsend & Busenitz, 2008). In these cases, where the functional value of these resources is not readily apparent, entrepreneurs can sometimes over-invest in stockpiles of resources thereby increasing the inefficiency of the firm (Townsend & Busenitz, 2008).

At the same time, novel business models might also potentially allow firms to acquire the services of critical resources that are undervalued by stakeholders thereby increasing the net value of these resources to firms (Hoopes, Madsen, & Walker, 2003; Peteraf & Barney, 2003). In these cases, undervalued resources provide cost advantages to firms given that the functional value of the resource is not fully priced into the resource (Barney, 1986) thereby minimizing the extent to which firms must invest scarce capital in order to build up the firm’s resource base (Lee et al., 2001). As such, we expect that the relative novelty of the firm’s business model will attenuate the effects of capital constraints thereby increasing the efficiency by which firms utilize their capital.

*Hypothesis 3 – Novel business models will attenuate the negative effects of capital constraints on the performance of new technology-based ventures such that ventures with significant capital constraints will generate more revenue when the novelty is high versus when novelty is low.*

**Methods and Data**

**Sample and Data Collection**

To test our hypotheses, we developed a sample of technology-based ventures from the archival records provided by a technology commercialization assistance agency (hereafter the “agency”) headquartered in the Southwestern U.S. Based on the availability of data on the financial performance of individual firms, our final sample totaled 114 observations based on three years of performance data for 38 individual ventures. Overall, the sample includes data on technology-based ventures from 24 6-digit NAICS with the largest groupings in NAICS 519130 (internet-based ventures—9 observations) and NAICS 541711 (biotech ventures—9 observations). The age of the firms ranges from 25 months to 81 months. Lastly, no agency employee receives any direct or indirect compensation for services provided to these ventures thereby minimizing the effect of selection bias on the overall sample.

**Measures**

**Dependent Variable Measures.** Annual data on firm revenues are collected from an annual survey collected by an outside organization on behalf of the agency based on the reported performance outcomes from a member of the top management team of each venture. The agency does not vary its services based on these reported measures. Furthermore, these data are not publically reported by the agency staff thereby minimizing any concerns with the firms to under-/over-report these outcomes for competitive reasons. Since these firms are small, early-stage, private companies, no external data sources such as Dun and Bradstreet contain these data. The total annual revenue for these firms ranges from 0 to $7.5 M—with a mean of $473,550.
Independent Variable Measures. Following Zott and Amit (2007) we coded each businesses technology resource as a measure of the radicalness of the technology. Two items were assessed in determining the radicalness of the technology, one was an overall patent count for each business and the other was the innovativeness of the technology compared to competitors and existing technology. This second measure was an item adapted from the Zott and Amit (2007) novelty scale. An example of the question asked is, “What is the extent to which the business model relies on trade secrets and/or copyrights? Radically (1), Substantially (0.66), A bit (0.33), Not at all (0).” To code this, we used business plans, websites, marketing information, and other business specific documents. This coding process was part of the novelty of business model coding and thus followed the same process for interrater reliability described below.

The novelty of the business model was evaluated based on an analysis of the business plans, corporate website, investment prospectuses, and other proprietary corporate documents, utilizing the 13-item scale developed and validated by Zott and Amit (2007). Information about each business was gathered, analyzed, and then coded using the novelty scale referenced above. To validate interrater reliability, we had two different raters independently rate randomly chosen businesses. Each rater was provided with written documentation on how to code the novelty items and in person training on how to analyze a set of business documents (those listed above) in order to code effectively. Once the training was complete, each rater coded five sets of business documents and then compared results to calibrate coding. Initial results yielded 80% agreement for the set of five plans. An additional set of 15 businesses were selected and independently coded yielding agreement of 94.4%. Finally each coding was recoded independently to ensure rater reliability yielding a Cronbach alpha of .95 and an overall agreement score of 91%. Any differences in codings were then discussed and agreed upon using the written novelty items from the scale to determine an agreed upon coding.

Total capital raised is measured directly from the records compiled by the agency for each venture in the sample and included any investment made by external investors in exchange for an equity stake in the venture. Specifically, the three types of equity-based capital investments were included in this variable: 1) “angel” investments; 2) venture capital investments; 3) corporate investments made by external organizations. Since new ventures tend to seek capital from a variety of sources, we aggregate the capitalization outcomes from the three sources of equity-based capital to account for the presence of co-investment (Denis, 2004).

Control Variables. To rule out alternative explanations, we include several control variables based on the results of prior research. First, we include an aggregate measure for the quality of the firm’s management team to rule out the possibility that managerial skill and not the business model, capital, or attributes of the technology explain the performance outcomes for the venture. Consistent with top management team research, this measure was developed through a due diligence process where agency consultants evaluate the background and skill sets of the top management team and boards of directors (Amason, Shrader, & Thompson, 2006; Cannella, Park & Lee, 2008; Carpenter & Fredrickson, 2001). This measure includes the following dimensions: 1) The management team has a proven track record based on prior industry/start-up experience; 2) The management team is complete, covering the major operational areas of the company; 3) The management team has a proven track record of achieving major milestones in previous endeavors; 4) The compensation scheme for the management team is appropriate to ensure both short and long-term performance; 5) The management team has access to an adequate board of advisors/
directors to provide mentoring. The agency consultants rate the management team on all six dimensions and generate a score scaled between 0 and 100.

We also include a measure of Demand Uncertainty to rule out the possibility that the firm’s ability to generate revenue is enhanced/limited by the attributes of the market in which the firm operates. To calculate demand uncertainty, we utilize the services of two independent coders who were not a part of the research team to conduct a content analysis of a professional research report developed by an independent, outside entity. These reports are purchased by the agency from an external professional market research firm and contain an extensive analysis of the market-based, competitive, and technological dynamics of the specific environment within which the venture will operate. The researchers compiling the report often use both public and private information gathered through searches of databases and interviews with industry experts to develop a clear set of factors shaping the environment surrounding each venture.

Based on these reports, the coders analyze the information from the market section to score a set of indicators for demand uncertainty using 7-point Likert scales adapted from Gatignon & Xuereb (1997). For demand uncertainty these questions consist of the following: 1) Consumer preferences are difficult to assess for this technology? 2) Demand is difficult to forecast for this technology? 3) Changes in consumer preferences are difficult to predict for this technology? Following Gatignon & Xuereb (1997) the anchors of the scale were ‘inaccurate’ and ‘accurate’ with a neutral middle choice. Upon completion of the coding process, to assess the reliability of the content analysis, inter-rate reliability statistics were calculated—Cohen’s Kappa for demand uncertainty is .67 [Landis and Koch (1977) argue that any score over .61 represents substantial agreement].

In addition, we correlate the start year for all the firms with total revenue. Based on this analysis, ventures started in 2002 appeared to significantly raise more capital than firms started in the other years. As such, we use a dummy variable identifying firms started in 2002 as a control variable. Lastly, we control for the age of the firm to rule out the possibility that older firms would have had more time to construct routines and/or structures to enhance the firm’s ability to generate revenue.

Analytic Strategy

Since a portion of the firms in the sample had not yet generated revenue, we utilize a single-limit tobit regression model to account for any potential bias introduced to the analysis by the clustering of observations at zero (Tobin, 1958). Furthermore, consistent with our focus on the interactions among key variables, we utilize the procedures recommended and developed by Bowen (2010 a; b) for calculating and testing secondary interaction effects in limited dependent variable models. According to Bowen (2010 a), secondary interactions are calculated by subtracting the structural effect of the predicted distribution of the dependent variable from the observed distribution of the total moderating effect. In doing so, this calculation yields the “true” secondary moderating effect generated by the interacted variables (Bowen, 2010 a). These calculated secondary moderating effects serve as the basis of our tests of the hypotheses in the study.

Results

See Table 1 which reports the means, standard deviations, and correlations among all variables utilized in this study. Before testing the full models we conducted tests of normality for all continuous control and independent variables. All continuous variables are within the normally accepted ranges for kurtosis and skewness (Hair, Anderson, Tatham, & Black, 1998).
As we report above, a portion of the sample did not generate any revenue during the time span of the study. In these cases, the clustering of the distribution of the dependent variable at a particular boundary point can bias the slope of the regression line (Long, 1997). To account for these effects, we utilize single-limit tobit regression to test our hypotheses. Since our theory predicts several interaction effects, we follow the guidelines developed by Bowen (2010a; b) for calculating and interpreting secondary interaction effects in single-limit tobit models. Secondary interaction effects differ from total interaction effects recommended by prior research since secondary interactions subtract the nonlinear, structural effect of the single-limit tobit model from the total moderating effect thereby yielding the true (secondary) effect of the moderator variable on an independent variable. Based on these calculations, Table 2, illustrated below, reports the results of the tobit models.

In our first hypothesis, we predict that radical innovations will have a curvilinear relationship with the total amount of revenue generated by early-stage ventures (See Table 2). According to Model 1, the squared parameter estimate for radical innovation is significant thereby confirming support for Hypothesis 1. Next, Hypothesis 2 predicts that the relative novelty of the firm’s business model will strengthen the effect of radical innovation on the total revenue generated by the firm thereby mitigating some of the negative downside to introducing radical innovations. Model 2 reports a marginally significant parameter estimate thereby suggesting support for this hypothesis. An evaluation of the results of the secondary moderating effect suggests that the effect is significant at lower levels of revenue (revenue < ~$100K) thereby suggesting that early-stage ventures just starting to generate revenue enjoy the most benefit from linking novel business models with radical technologies.

Lastly, Hypothesis 3 predicts that novel business models will strengthen the effects of total capital raised on the revenue generated by the firm. Consistent with this prediction, Model 3 reports a significant, positive parameter estimate for the secondary moderating thereby suggesting support for Hypothesis 3. However, unlike the secondary effect on radical innovation, an analysis of the results of the secondary interaction of novel business models on the capital base of a venture suggests that these effects are most pronounced and significant at higher levels of revenue generated. Specifically, these effects are experienced mostly by firms generating more than $500K in revenue.

**DISCUSSION AND DIRECTIONS FOR FUTURE RESEARCH**

According to arguments based in the heterogeneous resource approach in resource-based logic, observable performance differences between firms can be directly linked with the attributes of these resources (Barney, 1991; Peteraf, 2003). While these arguments have generated some empirical support (Crook et al., 2008), research from the organizing perspective in RBT contends that the manner in which firms are organized provides the key mechanism for unlocking the value of critical resources. In this study, we find that the manner in which a firm organizes its business model determines to a great extent its ability to capitalize on the potential value from technological resources (Chesbrough & Rosenbloom, 2002) and financial capital (Lee et al., 2001). However, whereas prior resource-based logic assumes that the heterogeneous resources are the causal driver, we find that novel business models attenuate what are thought to be resource-based weaknesses (i.e., scarce financial capital and highly radical innovations) thereby increasing firm performance.

For resource-based theory, these findings make several contributions to resource-based logic. First, consistent with arguments based in the organizing perspective, we find that a firm’s business...
model plays a significant role in enhancing the ability of firms to generate revenue from critical resource endowments. In particular, whereas resource-based logic contends that the interaction of superior resources with organizational attributes affects firm performance, we find that business models can compensate for severe capital constraints and the difficulties associated with commercializing radical technologies. In a sense, therefore, novel business models help turn potential liabilities into potential assets for new ventures (i.e., Arend, 2004). So while the attributes of heterogeneous resources can certainly improve a firm’s fortunes, the ability of business models to turn liabilities into assets suggests that the organizing context of firms plays a far more central role in determining the performance of new technology-based ventures than commonly believed in the heterogeneous resource approach.

Second, we contribute to the business models literature by discussing the impact of organizing logics on business model construction in startup firms. This is particularly important since business models are conceptualized as boundary spanning structures between internal and external factors of firms. What is less clear in prior research on business models, however, is how an emphasis on either internal or external factors would influence both the choice and implementation of business models by managers. Additionally understanding the impact of business model choice during the initial startup process is an area of focus requiring continued research. Although business models have been talked about in more generic forms for some time, we believe that new theoretical insights can be developed by linking organizing logics with business model development to uncover new structures and mechanisms for enhancing firm performance. In this study, we find that novelty models enhance the ability of firms to contend with the challenges associated with commercializing radical technologies and contending with capital constraints.

In addition, by linking business model development more closely to a central organizing logic, we also believe that clearer construct boundaries can develop to enhance the predictive validity of theory on business models. Prior research on business models has focused on established firms and suggests that numerous conceptual linkages can exist between different elements of the four types of business models (Amit & Zott, 2001). The challenge with this approach, however, is that it increases the difficulty of comparing/contrasting the causal impact of each business model on firm performance outcomes as well as the impact of business model choice at various stages of a firm’s lifecycle. Further investigations of the relationship between resources and the organizing context in which the firm operates will likely provide scholars with an additional set of factors with which to explore the impact of these different types of business models in empirical research.

Limitations and Future Research

Although this study provides interesting new insights into the relationships between technical resources, equity capital, business models, and revenue generation, there are some limitations to consider. First, although we are building upon a validated measure developed by Zott and Amit (2007) to evaluate the degree of novelty of the business model, and we incorporate new data gleaned from internal company records, it is possible that top managers are adapting the firm’s business model in response to emerging opportunities and threats in the firm’s environment. In future research, the use of different research methodologies (i.e., qualitative methods such as interviews, etc.) may provide additional insights into how firms construct and adapt business models in response to particular internal and external factors.

In addition, our use of the survey data gathered by the agency staff limits our models to predicting firm revenue instead of alternative outcomes such as net income or other measures of
profitability. As such, it is possible that future research may find that the positive effect of novel business models on radical technologies and capital constraints does not necessarily increase a firm’s ability to generate wealth (i.e., net income) or even the firm’s ability to survive. Extending the model developed in this paper by considering other key outcomes undoubtedly will enrich our theoretical insights into manner in which business models leverage critical resources to enhance firm-level outcomes.

Third, although we have no a priori reason to expect that the results of our study will not generalize to other locations, it is important to note that the majority of our firms are located in one state in Southwestern U.S. Furthermore, the breadth of industries in which these firms operate and differences in the ages of the firm attenuate some of the concerns regarding the generalizability of the results of this study to other geographic locations.

The findings of this study also suggest opportunities for future research. One in particular is the expansion of the types of resources considered in the study. This study addressed technology-based resources along with equity capital resources and their relationship with business models and venture performance. Future studies could be conducted on the impact of business models on ventures with either strong or weak management teams and their ability to create revenue generation and growth within early stage ventures as well as within established firms. Additional work on the relationship between business models and top management teams may help to extend our understanding of the value of management teams in new ventures when combined with various types of business models. Can an effective business model compensate for a weakness in top management team members? Or, conversely, can superior management teams compensate for weaker business models in shaping a firm’s performance? Regarding these questions, Newbert (2007) suggests that while arguments from the organizing perspective generally show a positive impact of organizational attributes on critical resources, these same effects do not seem to hold for various capabilities. Future work investigating the interaction of business models with management teams may provide an important context in which to investigate these factors.

Additionally, studies could be conducted to examine the potential of business models to substitute for other important resources. In this study, we examined the impact of novel business models in compensating for resource-based weaknesses. Each industry has critical resources that are essential to survival and success such as technology, human capital, land, or financial capital, and each depending on the context of the industry or business environment. The effects of business models in this study indicate that business models may not only be able to moderate some traditionally negative relationships with performance, but in some cases may be able to potentially act as a complete substitute for certain non-critical resources for ventures. These types of relationships would be important for investigating why some firms are more successful in diversifying into new markets versus others who are less successful.

Implications for Practice

This study also contributes to our understanding for practice. First, our findings suggest the importance of understanding the impact of an effective business model on the commercialization process. In the technology field, as an entrepreneur faces the challenges of acquiring resources and effectively commercializing those resources, the implementation of a novel business model will actually help to create unique relationships contributing to the potential revenue generation capabilities of the venture. As cash is critical for new ventures, revenue generation and/or cost controls are essential in order to sustain operations.
The difficulty faced by firms, however, is how to choose between and/or balance these competing perspectives. During the dot-com era, new start-ups frequently abandoned an economizing model in favor of a purely externally oriented business models focused on generating market share as quickly as possible; Recent events, however, resulting in a growing scarcity of capital have increasingly forced firms to consider more carefully how funds are utilized (Wadhwa, 2009). Our study, however, shows several clear benefits from adopting a novel business model by new ventures and suggests that firms may be able to attenuate the potential downside of operating with capital constraints and commercializing radical technologies.

**Conclusion**

In this research, we build upon the organizing perspective in resource-based theory (Wiklund & Shepherd, 2003; Newbert, 2007) to examine how novel business models affect the ability of firms to introduce radical, new technologies and contend with capital constraints. Consistent with our theoretical approach, we find that while resource heterogeneity matters in shaping the performance of firms, novel business models do in fact successfully attenuate the challenges associated with introducing radical, new technologies and operating under significant capital constraints thereby increasing the amount of revenue firms within our sample generate. In doing so, we show that the ability of firms to leverage critical resources effectively hinges upon the type of business model utilized by the firm.

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**Selected References**

Full References Available From Corresponding Author


### Table One
**Means, Standard Deviations, and Correlations among all Variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>StdDev</th>
<th>Total Revenue</th>
<th>Novelty Biz Model</th>
<th>Radical Innovation</th>
<th>Total Capital</th>
<th>Mgt Team</th>
<th>Firm Age</th>
<th>Demand Uncertainty</th>
<th>Start Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revenue</td>
<td>473550</td>
<td>1308880</td>
<td>1.00</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Novelty Biz Model</td>
<td>22.184</td>
<td>7.178</td>
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<td>1.00</td>
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<td></td>
<td></td>
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<tr>
<td>Radical Innovation</td>
<td>0.6895</td>
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<td>0.083</td>
<td>0.097</td>
<td>1.00</td>
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<td></td>
<td></td>
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</tr>
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<td>Total Capital</td>
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<td>1.00</td>
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<tr>
<td>Mgt Team</td>
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<td>9.2486</td>
<td>0.133</td>
<td>0.051</td>
<td>-0.210</td>
<td>-0.124</td>
<td>1.00</td>
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</tr>
<tr>
<td>Firm Age</td>
<td>52.368</td>
<td>17.622</td>
<td>0.114</td>
<td>0.265</td>
<td>0.269</td>
<td>0.221</td>
<td>-0.386</td>
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<td>Demand Uncertainty</td>
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<td>-0.306</td>
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<tr>
<td>Start Year</td>
<td>0.132</td>
<td>0.34</td>
<td>0.336</td>
<td>-0.043</td>
<td>0.061</td>
<td>0.085</td>
<td>-0.242</td>
<td>0.586</td>
<td>0.156</td>
<td>1.00</td>
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</table>

N=114. *** p<.001, ** p<.01, * p<.05, † p<.10.

b Spearman rank correlations reported where ordinal data are used.
Table Two  
Single-limit Tobit Model for Total Revenue

<table>
<thead>
<tr>
<th></th>
<th>DV: Total Revenue</th>
<th>Model 1: Polynomial</th>
<th>Model 2: Interaction</th>
<th>Model 3: Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controls:</strong></td>
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<tr>
<td>Intercept</td>
<td>-8350019</td>
<td>-3.82E+06</td>
<td>-8.57E+06</td>
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<tr>
<td>Demand Uncertainty</td>
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<td>-1555248</td>
<td>-1284924</td>
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</tr>
<tr>
<td>Start Year (2002)</td>
<td>3219810 **</td>
<td>2540587 **</td>
<td>3560260 ***</td>
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</tr>
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<td>Management Team</td>
<td>5173482 †</td>
<td>4323640 †</td>
<td>6463673 †</td>
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<tr>
<td>Total Capital</td>
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<td>-47332</td>
<td>-2050792 **</td>
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<tr>
<td>Novel Biz Model</td>
<td>1015675 †</td>
<td>-5214836 **</td>
<td>-723091</td>
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<tr>
<td>Radical Innovation</td>
<td>5732255 *</td>
<td>9497033 **</td>
<td>6478552 *</td>
<td></td>
</tr>
</tbody>
</table>

| **Polynomial:**      |                   |                     |                      |                      |
| Radical Innov$^2$    | -3580499 *        | -1.12E+07 ***       | -3775069 *           |                      |

| **Interactions:**    |                   |                     |                      |                      |
| Radical Innov$^2$*NovBizMod | 1766143 †       |                     |                      |                      |
| NovBizMod*Tot Cap    |                   | 340930 **           |                      |                      |

**Model Statistics:**

<table>
<thead>
<tr>
<th></th>
<th>Model 1: Polynomial</th>
<th>Model 2: Interaction</th>
<th>Model 3: Interaction</th>
</tr>
</thead>
<tbody>
<tr>
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<td>-770.81528</td>
<td>-772.6053</td>
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<td>$Pseudo R^2$</td>
<td>0.019</td>
<td>0.051</td>
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<td>F-statistic</td>
<td>3.21**</td>
<td>3.08***</td>
<td>3.24**</td>
</tr>
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</table>

*N=114. *** p<.001, ** p<.01, * p<.05, † p<.10.