Organization Science
Vol. 18, No. 4, July–August 2007, pp. 578–594
ISSN 1047-7039 | EISSN 1526-5455 | 07 | 1804 | 0578
DOI 10.1287/orsc.1070.0300

From Plan to Plant: Effects of Certification on Operational Start-up in the Emergent Independent Power Sector

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In this paper, we study the transition from planned venture to operational start-up in the emergent independent power sector. Planned ventures face tremendous obstacles in assembling the resources necessary to begin operations; we hypothesize and show that formal certification from authorized actors increases the likelihood of making this transition. Moreover, we find that the effects of certification are contingent on the legitimacy of the sector as a whole: Certifications have a stronger effect on start-ups when sector legitimacy is low than when it is high. This research helps us understand a rarely studied organizational transition—from entrepreneurial intention to actual operations—within nascent sectors. It directs attention to the legitimating effects of formal certification, highlights the importance of a multilevel approach to legitimacy, and contributes to the growing rapprochement between entrepreneurial studies and institutional theory.

Key words: entrepreneurship; institutional theory; legitimacy; certification; new organizational forms; alternative energy

Introduction

Research on the failure and success of preoperational new ventures in nascent sectors is sparse. Understanding the obstacles that impede planned ventures from reaching operational start-up is particularly important because the failure or success of early pioneers can have a lasting impact on the evolution of emergent sectors (Stinchcombe 1965, Tushman and Anderson 1986, DiMaggio and Powell 1991). Yet empirical research on entrepreneurship in new sectors typically focuses on organizations that are already operational, overlooking the transition from business plan to start-up (see Carroll and Khessina 2005, Kuilman and Li 2006, for notable exceptions). Past theoretical work on new sectors suggests that planned ventures face tremendous obstacles in assembling the resources necessary to begin operations, i.e., in going "from plan to plant." In particular, the legitimacy deficit of planned ventures in new sectors impedes their ability to acquire and organize the resources necessary to produce and distribute a product or service (Hargadon and Douglas 2001), resulting in a high rate of failure to commence actual operations (Aldrich and Fiol 1994, Aldrich 1999).

In this paper, we study the transition from planned venture to operational start-up in the emergent independent power sector and explore the role of legitimacy at the level of both the individual organization and the organizational form. In his influential analysis of legitimacy, Suchman (1995, p. 572) distinguished between *strategic* legitimating actions, in which organizations "instrumentally manipulate and deploy evocative symbols in order to garner societal support," and *institutional* processes that transcend the actions of any single organization and affect entire sectors, or forms of organizations. Strategic legitimating actions include ceremonially adopting legitimated formal structures or obtaining endorsements from central institutional actors. Institutional or sector-level processes include increasing density (e.g., availability) and integration into existing legal orders that make organizational forms seem more natural and taken for granted. In this paper, we examine how these two types of legitimating processes affect a new venture's ability to reach operational start-up in a nascent sector.

At the organizational level, we focus on a specific type of strategic legitimating action: Obtaining external certification. We define certification as a process in which a central institutional actor with authority or status *formally acknowledges* that a venture meets a particular standard. Past research on the relationship between certification and venture performance largely ignores preoperational ventures in new sectors and pays little attention to the legitimating impact of certification. Instead, research on certification generally focuses on the information it provides about individual or organizational quality. For instance, Spence (1974) linked the signaling ability of certification to its cost, such that

those unlikely to meet the certification criteria are also unlikely to bear its costs. Others argue that certification reveals "information about otherwise *hidden* [emphasis added] organizational attributes and behaviors" (King et al. 2005, p. 1092). This line of reasoning suggests that the value of a certification is fundamentally derived from its ability to provide information about organizational quality that would otherwise be difficult to observe. In addition to its information value, we believe that there is also significant *symbolic value* to certification that does not depend on its information content (Zott and Huy 2007). In the case of preoperational new ventures that have little in the way of observable production processes and that lack a performance track record, we reason that the symbolic value of certification and the legitimacy that it imparts can in fact be more important than the information it provides about actual organizational attributes.

In their discussion of the emergence of new sectors, Aldrich and Fiol (1994) distinguish between cognitive legitimacy, or the degree to which knowledge about an organizational form is widespread, and sociopolitical legitimacy, which refers to the extent to which key stakeholders, opinion leaders, government officials, and the general public accept a new organizational form as appropriate and right (see also Scott 1995 and Suchman 1995). The legitimacy of new organizational forms has also been of central concern in organizational ecology. Focusing on cognitive legitimacy, Hannan and Freeman (1989, p. 133) argue that the "rarity of a form poses serious problems of legitimacy" and that legitimacy increases as a form becomes more common. Baum and Powell (1995, p. 530), meanwhile, emphasize the importance of sociopolitical legitimacy at the form level and call for analyses that take into account how "embeddedness in relational and normative contexts influences an organizational form's legitimacy by signaling its conformity to institutional expectations." Building on this prior work, we reason that the legitimacy of an organizational form is likely to have a significant impact on the ability of new ventures in a nascent sector to acquire the necessary resources to reach operational start-up.

Central to our theorizing is that the value of certification to a focal organization is moderated by the legitimacy of the sector to which it belongs. Past research that focuses on strategic legitimating actions at the organizational level typically pays little attention to how these actions are moderated by sector-level, institutional processes (e.g., Ashforth and Gibbs 1990, Zimmerman and Zeitz 2002). Similarly, some theorists who emphasize institutional processes control for strategic legitimating actions at the organizational level, but do not explore how the two processes interact. Thus, past research either fails to theorize about the possible interaction of legitimating processes across levels or simply infers additive effects (Singh et al. 1986, Baum and Oliver 1992). This restricts our understanding of how the effects of entrepreneurs' strategic legitimating actions change with the development of new sectors of economic activity.

Accordingly, in this paper we investigate the interrelationship between strategic legitimating action at the organizational level and sector legitimating processes. This issue strikes at the essence of the legitimacy construct, and exploring it will help us build a more comprehensive, multilevel view of the role of legitimacy in the transition from entrepreneurial intention to operational start-up.

We study these questions in the emerging independent power sector that was created by the passage of the Public Utilities Regulatory Policy Act (PURPA) in 1978. Electricity in the United States has been historically generated by public and private utilities that controlled generation and distribution in designated geographic areas. The independent power sector was created by Congress in an effort to support the generation of electricity by non-utility-owned firms using nonconventional types of technology. PURPA defined a new class of organizational actors, called qualifying facilities (QFs), for generating power and created a new market for these actors—participants declared that "PURPA created a whole new market, and a whole new opportunity for us" (Diamond 1984, p. 1). The independent power sector, the new ventures within the sector, and the alternative technology that nascent entrepreneurs proposed were initially viewed with much skepticism (Hirsh 1999). These entrepreneurs faced extensive legitimacy hurdles as they attempted to convince key constituents to support their enterprises. In this context, we investigate the direct and interactive effects of both strategic and institutional legitimating processes on the ability of nascent ventures to reach operational start-up.

Theory and Hypotheses

An organization's legitimacy, or the degree to which it is perceived to be desirable, proper, or appropriate within a social setting (Suchman 1995, p. 574), affects its ability to obtain the resources necessary for its ongoing survival (Parsons 1960). Organizations with low legitimacy may find it difficult to obtain relevant licenses, capital, labor, and partners for their ventures. This is particularly important for entrepreneurs who are commencing operations because although the declaration of entrepreneurial intentions (i.e., "founding on paper") may require little more than filing requisite documents, operational start-up requires both human and physical investment and infrastructure. We argue that cognitive and sociopolitical legitimacy facilitate start-up by easing the acquisition of necessary resources. We investigate the role of both certification at the organizational level and sector-legitimating processes that transcend the

activities of individual organizations in establishing the legitimacy of new business ventures. While certification occurs at the organizational level, we also consider how this strategic action interacts with sector legitimacy.

Firm-Level Certification

Generating legitimacy is critical for new ventures (Zimmerman and Zeitz 2002). Entrepreneurs must spend substantial time and energy attempting to convince key constituents of the appropriateness of their activities and of the potential benefits (Rao 1994, Aldrich 1999). They must attach names, values, and purposes to their activities in the nascent sector. This "institutional work" (DiMaggio 1988) integrates the new venture's activities into the social fabric and creates a social identity for the organization.

Past theoretical work suggests the need for entrepreneurs in new sectors to actively seek out implicit or explicit endorsements from institutional actors. Berger and Luckmann (1966) discuss how actors seek endorsements from authorized experts to embed innovative behaviors and structures into the social fabric of everyday reality (see also Meyer and Rowan 1977). Scott and Meyer (1983) argue that organizations are rewarded for conforming to the rules stemming from regulatory agencies and professional associations. Suchman (1995, p. 587) points to the need to demonstrate conformity "to the dictates of preexisting audiences" within the organization's environment. As Meyer and Rowan (1977) emphasize, signals of conformity can be largely decoupled from actual organizational operations.

Consistent with these arguments, empirical work has identified a link between external endorsement and organizational survival. Baum and Oliver (1991) found that linkages with the city's Children Services Division increased the survival rate of licensed day care centers in Toronto. Similarly, the research of Singh et al. (1986) demonstrated that obtaining a listing in a community directory or officially registering as a charity increased the legitimacy of new voluntary social service organizations, thus increasing their survival rate. More recently, Stuart et al. (1999) found that endorsements by prominent institutional actors increased the amount of capital raised by firms in their initial public offerings. David and Sine (2006) showed that the affiliations of management consulting firms to professional associations increased their likelihood of survival. Collectively, these papers demonstrate the importance of external endorsement in a wide variety of contexts and suggest that endorsements can have beneficial effects.

While most prior work in this area has focused on the survival of existing organizations, we propose that certification from legitimate actors can help entrepreneurs proceed from business plan to operational start-up. For good reasons, it is in this period of an organization's life that selection forces are extraordinarily severe (Aldrich 1999). The transition from plan to plant is one that requires active as opposed to passive support and thus has a high legitimacy threshold (see Suchman 1995, p. 575). In the absence of observable production processes and an established track record, certification can help a new venture meet this threshold by serving as a form of tangible "evidence" that the activities that an entrepreneur is proposing are consistent with prevalent rules and norms. Certification can act as a legitimating symbol that increases the confidence of constituents and thereby enhances an entrepreneur's ability to obtain the resources needed for start-up from venture capitalists, bankers, potential employees, potential partners, and community groups that naturally view the venture with a degree of skepticism. In sum, if an entrepreneur holds a certificate from an authorized institutional actor indicating that the proposed project meets all required conditions, constituents are more likely to accept the venture as a viable risk.

HYPOTHESIS 1. *Certification from an authorized institutional actor raises the likelihood of a business venture reaching operational start-up.*

Sector-Legitimating Processes

Legitimating processes operate not only at the firm level, but also at the sector level. Indeed, the legitimacy of new organizational forms is often highly contested (e.g., Rao 1998), which makes resource acquisition difficult for individual ventures. In this section and the next, we ask two questions: (1) What sector legitimating processes will increase the likelihood of new ventures making the transition from business plan to operational start-up? and (2) How will these processes interact with firm-level certification? We focus on a set of sector processes that either increase or decrease the legitimacy of the sector and argue that the effect of firm-level certification will be moderated by sector legitimacy.

First, as Weber (1947, p. 329) argued long ago, legitimacy can flow directly from the legal system. Elaborating on Weber's early ideas, Meyer and Rowan (1977, p. 345) discussed the state's role in creating "institutional rules" and how these rules facilitate the formation and expansion of organizational forms. A number of subsequent empirical studies investigated the effects of legal standing on the legitimacy of organizational structures and policies. Tolbert and Zucker (1983) showed how legal judgments at the state level—what they called "state-level legitimation"—accelerated the diffusion of civil service reforms. Edelman (1990) demonstrated how shifts in the legal environment led to the diffusion of formalized personnel procedures. Similarly, Dobbin and Dowd (1997) showed how a favorable legislative environment in the 1800s was positively related to the founding of railroad organizations. This "regulative view" of

legitimacy essentially holds that "legitimate organizations are those established by and operating in accordance with legal or quasi-legal requirements" (Scott 1995, p. 47).

In new sectors, the legal standing of organizational activities may be particularly uncertain (Aldrich and Fiol 1994). Questions about jurisdiction, responsibility, taxation, and governance may all be contested in the courts. Indeed, now-established organizational forms such as newspapers (Delacroix and Carroll 1983) and thrifts (Haveman and Rao 1997) faced strong legal challenges early in their histories. Contemporary examples include Internet pharmacies and music file sharing, both of which face an uncertain legal future.

Recent research on the independent power sector found that legal sanctioning increased the number of entrepreneurs attempting to reach operational start-up (Sine et al. 2005). This suggests that entrepreneurs are attentive to regulative changes when making entry decisions. Here, we argue that legal sanctioning of a sector will have a positive effect on the likelihood that these new ventures actually commence operations. In other words, entrepreneurs that have already entered a sector should have an easier time gaining the support of constituents once regulatory legitimacy is established. We reason that until the legal uncertainty surrounding a new sector is resolved, key stakeholders may question its long-term viability, thereby making resource acquisition on the part of any individual entrepreneur problematic. We therefore posit that:

HYPOTHESIS 2. *Legal endorsement of a sector raises the likelihood of a focal business venture reaching operational start-up.*

The media can play a key role in driving both the cognitive and sociopolitical legitimacy or illegitimacy of a new sector. The media not only raise awareness levels about a new sector, but also facilitate the process of *theorization*, or the propagation of public theories on the benefits or costs of new types of organizational arrangements (Strang and Meyer 1993). The media allow the telling of "entrepreneurial stories" about the wealth-creating possibilities or risks of new ventures (Ashforth and Humphrey 1997) and play an important role in providing "order and meaning to fields of activity" (Rao et al. 2001).

Past research suggests that the tenor of media coverage affects public perceptions (Golan and Wanta 2001) and that positive media coverage or the lack thereof can affect legitimacy (Fombrun 1996, Pollock and Rindova 2003). Positive evaluations of a new sector serve as "evidence" of the sector's viability and thus reduce perceptions of sector risk (Rao et al. 2001). However, it is not just the tenor of media that counts, but also the volume. Greater numbers of positive media evaluations of a new sector increase the probability that they will be seen by a greater number of people because the information is more available to readers who peruse the media rather than read it cover to cover. Moreover, past research suggests that repeated exposure to prescriptive evaluations increases the extent to which these evaluations are perceived to be accurate (Hawkins and Hoch 1992). Building on this research, we suggest that the amount of positive media coverage of a sector will increase the likelihood that a new venture will be able to reach operational start-up.

Although a number of theorists have explored the effects of positive media on new sectors, there has been little discussion about the impact that *negative* media attention may have on the ability of new ventures within a new sector to reach operational start-up. Because media shape how important potential constituents of new ventures in an emerging sector view the sector—as a fertile opportunity for investment, a scam, or a very high-risk investment—popular media that criticize the new sector or highlight its risks and the negative experiences of current entrepreneurs in that sector will reduce the ability of subsequent entrepreneurs to acquire the resources necessary to reach operational start-up (Rhee and Haunschild 2006). In summary, we theorize that negative media will decrease and positive media will increase the likelihood that new ventures will succeed in reaching operational start-up.

HYPOTHESIS 3A. *Higher levels of positive media coverage of a new sector increase the likelihood of a focal business venture reaching operational start-up.*

HYPOTHESIS 3B. *Higher levels of negative media coverage of a new sector decrease the likelihood of a focal business venture reaching operational start-up.*

We argue that recent organizational successes increase both the cognitive and sociopolitical legitimacy of a sector. Consistent with Hannan and Freeman's (1989) view of cognitive legitimacy, we expect that the number of visible start-ups will raise the general level of knowledge about a sector and its benefits among constituents. As organizations enter a sector and successfully commence operations, they provide potential founders with evidence or social proof that they can use to make their case to potential resource providers. Whereas past research has treated all instantiations of an organizational form as equally important, we instead argue that recent start-ups are likely to have a bigger impact than those established many years prior. This occurs because the strength of the effect of events is conditioned by their temporality: Recent events are more important than those more temporally distant in shaping decisions (Argote et al. 1990). Recent events are seen by entrepreneurs and their many potential stakeholders as more relevant because they share similar environmental conditions.

Recent start-ups also increase sociopolitical legitimacy. To reach start-up, entrepreneurs have to expend considerable effort educating the public, potential customers, suppliers, and professionals about the appropriateness and potential of their ventures. Although entrepreneurs undertake the activities to improve their own chances of survival and growth, their effects are felt collectively. As organizations successfully move from plan to plant, they also establish working relationships with key stakeholders. These relationships increase the sociopolitical legitimacy of the sector by engendering the development of standards, templates, and conventions for interaction within the sector and between the sector and external constituents. Again, we expect recent transitions to be the most relevant in increasing legitimacy and thus the likelihood of a new venture going from plan to plant.[1]

Finally, just as successful transitions to operational start-up increase both the cognitive and sociopolitical legitimacy of the sector, the number of *unsuccessful* ventures can decrease these dimensions of legitimacy. When entrepreneurs in a sector declare their intention to commence operations but fail to do so, they hurt the credibility of the sector as a whole. Failures to start up signal problems with technology, labor, and capital, thereby raising skepticism at large. When relationships are formed but fail to bear fruit, they make subsequent relations of the same type more difficult to establish. When a new focal venture seeks to move toward operational start-up, these factors will impede resource acquisition. As we argue for successful start-ups, recent events are more important in shaping organizational decisions than those more temporally distant. For example, the lack of success of entrepreneurs who tried to start firms in a sector 5 years ago is likely to be more salient today than that of entrepreneurs who attempted start-up 10 years ago. We thus expect the number of recent unsuccessful ventures to hurt the chances of new ventures going from plan to plant.

HYPOTHESIS 4A. *Higher numbers of recent operational start-ups within a new sector raise the likelihood of a focal business venture reaching operational start-up.*

HYPOTHESIS 4B. *Higher numbers of recent unsuccessful ventures within a new sector decrease the likelihood of a focal business venture reaching operational start-up.*

Interactions Between Sector Processes and Firm Certification[2]

In our discussion of firm certification, we offered arguments that did not explicitly consider the legitimacy of the sector as a whole. Although we expect certification from authorized actors to always be beneficial, we would also expect effects to vary with the sectoral context. Notably, Aldrich and Fiol (1994, p. 645) argued that although new organizations always face legitimacy concerns, these are most severe in new sectors—founders of new ventures in these sectors are said to navigate at best in an "institutional vacuum of indifferent munificence." Under these conditions, the burden lies mostly with individual organizations to establish their own legitimacy, and entrepreneurs must convince skeptical constituents who "are afraid of being taken for fools" that their new ventures are robust and worthy of support (Aldrich and Fiol 1994, p. 650).

If positive information and experience about a sector accumulate, however, constituents become less apprehensive and more amenable, a priori, to the benefit claims of any particular organization (Low and Abrahamson 1997). Accordingly, the hurdles faced by a focal organization are not as severe. Put another way, if legitimation at the organizational level involves explaining and justifying the organization's existence to key constituents (Scott 1991; Suchman 1995, p. 575), then this process is likely to be more difficult in a sector with questionable standing. Zucker (1983) found this dynamic at a different level of analysis: As the corporate form of organization became more understood and accepted during the early 1900s, organization names decreased in length as organizations had less need to explain themselves to constituents.

How then will firm-level certification interact with sector-level legitimating processes in our context? Following the general line of argument above, we expect that when sector legitimacy is low, certification is even more critical to a new venture start-up than when it is high. When a sector is poorly understood, has uncertain legal status, and lacks a track record of successful outcomes, skepticism among constituents toward that sector is understandably high. In this situation, the legitimacy conferred to a focal firm by external certification can provide an important comparative advantage in reaching operational start-up; indeed, certification is one of the few credible signals of legitimacy that an entrepreneur can point to when sector legitimacy is low.

Consider, for example, the doubts created by unsuccessful ventures in a sector. An entrepreneur can use certification to dissociate her organization from these prior failures; in fact, the poor track record of a sector can be blamed at least to some extent on the difficulties of uncertified ventures. A similar dynamic was well illustrated by Higdon (1969), who described how some early management consulting firms overcame charges of charlatanism in their nascent industry by creating a membership association in which member firms professed high standards of conduct and thus distinguished themselves from nonmember (and thus presumably suspect) firms. Certification by membership associations, in other words, served as an organizational response to low sector legitimacy.

As sector legitimacy increases, however, certification at the organizational level becomes less important.[3] As a sector becomes an accepted and taken-for-granted feature of the environment (i.e., its cognitive legitimacy increases), and as consensus emerges about its value and appropriateness (i.e., its sociopolitical legitimacy increases), any given organization in the sector faces fewer hurdles in convincing constituents to confer resources (Aldrich and Ruef 2006, pp. 183, 186). We would still expect certified ventures to have a higher likelihood of start-up than noncertified ventures, but even noncertified ventures possess a level of legitimacy as part of a sector that is understood and accepted. For example, if a track record of successful start-ups within a sector develops, entrepreneurs can point to this as evidence of the veracity of the sector and can benefit from increased perceptions of value and appropriateness even if they are not certified. This is similar to what Baum and Oliver (1992) called legitimacy "free-rider" effects in their study of day care centers in Toronto: As the sector as a whole became more legitimate, even organizations without institutional ties began to experience lower failure rates. In other words, as the legitimacy of a sector increases, the burden on any individual venture to demonstrate its legitimacy through certification diminishes. We thus expect that certification will have a stronger effect on operational start-up when sector legitimacy is low than when it is high.

HYPOTHESIS 5. *As the legitimacy of a new sector increases, the positive effect of certification on the likelihood of a business venture reaching operational start-up* (*Hypothesis* 1) *decreases.*

HYPOTHESIS 5A. *Legal endorsement of a new sector decreases the positive effect of certification on the likelihood of a business venture reaching operational start-up.*

HYPOTHESIS 5B. *Higher levels of positive media attention on a new sector decrease the positive effect of certification on the likelihood of a business venture reaching operational start-up.*

HYPOTHESIS 5C. *Higher numbers of recent operational start-ups in a new sector decrease the positive effect of certification on the likelihood of a business venture reaching operational start-up.*

HYPOTHESIS 6. *As the legitimacy of a new sector decreases, the positive effect of certification on the likelihood of a business venture reaching operational start-up* (*Hypothesis* 1) *increases.*

HYPOTHESIS 6A. *Higher levels of negative media attention on a new sector increase the positive effect of certification on the likelihood of a business venture reaching operational start-up.*

HYPOTHESIS 6B. *Higher numbers of recent unsuccessful ventures in a new sector increase the positive effect of certification on the likelihood of a business venture reaching operational start-up.*

Context

The setting for this study is the independent power sector from 1978 to 1992. After the passage of the Public Utility Holding Company Act in 1935 and its ensuing implementation, most electricity in the United States was produced by public or private utilities that controlled both the generation and distribution of electricity within regional geographic monopolies (Hirsh 1999). This created an environment within each region characterized by monopsony (only one potential buyer, which in this case was also a producer). Because most utilities did not want to outsource generation to local firms that would compete with their own generation units, there were virtually no nonutility power producers who generated and sold electricity to utilities for distribution from 1940 to 1978.

During this time, the technologies used to produce power were homogenous, relying almost exclusively on large centralized coal, oil, natural gas, and hydroelectric generators (Hirsh 1999). In 1978, utilities generated 2,206 billion kilowatt hours (kWh) of electricity, 44% using coal, 16% petroleum, 14% natural gas, 13% nuclear, and 13% large-scale hydro (plants over 30 megawatts (MW)) (U.S. Department of Energy 2001). The amount of power generated by utilities using alternative energy sources and technology, such as solar, cogeneration technology, wind, small hydroelectric, or biomass, was insignificant at that time.

In 1978, in response to the oil embargo of 1973 and the ensuing energy crisis, Congress passed the National Energy Act, which included PURPA. PURPA required utilities to purchase all power generated by independent power plants and cogenerators that met certain size, technological, and ownership criteria at a price equal to what it would cost the utilities to produce the same amount of electricity, an amount called the "avoided cost." Firms proposing generators that met these criteria and that registered with the Federal Energy Regulatory Commission (FERC) were called QFs, and were exempt from onerous national regulations required by the Public Utility Holding Company Act of 1935. These facilities were required, however, to be relatively independent of utilities (i.e., utilities could own no more than 50%).

PURPA required that power generators seeking QF status be either small power plants or cogenerators. Small power plants were defined as generators under 80 MW[4] that used alternatives to coal, gas, nuclear, or oil (such as wind, solar, biogas, garbage, wood, sewage sludge, petroleum coke, and other low-grade fuels). Cogenerators are facilities that sequentially produce two or more forms of energy using a single fuel and facility.

For example, a cogeneration entrepreneur might contact a large hospital or hotel and offer to install cogeneration technology to provide steam to the facility at a reduced cost and at the same time sell excess power to the local utility at the avoided cost. Cogeneration plants could use either traditional, nonrenewable fuels (natural gas, coal, or nuclear power) or exploratory renewable energy sources (e.g., biomass or geothermal).

PURPA thus created a new set of opportunities for entrepreneurs to found firms that generated electricity and sold that electricity to established utilities for distribution (Sine and David 2003). PURPA resulted in thousands of new ventures using a variety of technologies to generate electricity. Data from the Department of Energy suggest that the use of cogeneration and green-fuel-based technology such as solar and wind for generating electricity for retail sale was virtually nonexistent prior to PURPA (U.S. Department of Energy 1996). Although a handful of utilities did experiment with a few different types of alternative energy technologies, these were rare events, and prior to 1978 these technologies remained strictly experimental.

The Social Construction of an Endorsement[5]

Organizations became QFs after they filed an application with FERC that described the *proposed* facility in terms of its ownership, technology, and size. FERC typically granted QF status to a proposal within 10 days. However, shortly after the initial implementation of the new regulations, several entrepreneurs approached regulators at FERC and asked them to create an "official commission certification" to demonstrate that a particular proposal to build a generator met the regulations required by PURPA. This request was initially rebuffed; regulators argued that (1) the attributes that enabled a generator to receive the status of QF were *simple* and easy to understand; (2) *most facilities were not yet built* and FERC could not guarantee that the actual facility, once built, would meet PURPA requirements; (3) commission certifications were *redundant* because interconnecting utilities typically evaluated QFs, once they were operational, to determine compliance, and if facilities were not compliant, they refused to interconnect; and (4) commission certifications would not provide protection from legal challenges by disgruntled utilities (the buyers of the proposed generators). In any court action, a facility's status as qualifying, and therefore its ability to claim the benefits provided under PURPA, would be determined by the facility's compliance with the size, ownership, and technology requirements of PURPA, not by any certification obtained prior to construction.

Informants who were directly responsible for creating the commission certification at FERC in the early 1980s maintained that at the time this certification was useless and that it provided no new information to investors. The entrepreneurs persisted in their request and argued that a commission certification would provide credibility to proposed project plans and the new independent power sector as a whole. Eventually FERC relented and, with input from interested parties, created a process for organizations to receive a commission certification for a particular proposal to build a generator. Nonetheless, some officials found it odd that entrepreneurial teams that were struggling to assemble the necessary resources to build a plant would waste hundreds of dollars on a commission certification.

A *commission certification* was differentiated from simply filing a notice of registration with FERC by the fact that in the former case FERC acknowledged through a letter on official FERC letterhead to the applicant that the planned generator was congruent with PURPA regulations; in the latter case, applicants were only sent back a copy of their *own* application with a stamp by FERC and their docket number at the top of document, often written by hand. Interviews[6] with both entrepreneurs and regulators suggest that entrepreneurs felt that commission certifications increased the extent to which their proposal was perceived by external constituents to be a legitimate endeavor. Although registering with FERC indicated a facility's *intended* compliance with federal regulations, external constituents felt reassured when an authorized expert officially endorsed the proposal.

There was little actual difference between simply filing a notice of registration with FERC and filing a notice and requesting commission certification. In both cases applicants were required to provide FERC with the same information about the proposed facility: size, fuel type, address, and ownership. In a cover letter, applicants were required to indicate whether they wanted a commission certification. If applicants chose commission certification, they also included a check to cover the fee for that service. Either way, if the projects were constructed according to the stipulations of PURPA, they would be eligible for the benefits PURPA entailed. Commission certification of a project proposal thus provided no legal benefits over registration, and letters granting commission certification typically ended by making the commission certification contingent on the facility being constructed and operated "in the manner described by the application."

Methods

Data

The data for this study include all ventures in New York and California that registered with FERC from 1978 to 1992 their intention to build independent power plants and cogenerators (or in other words, become QFs). FERC required all ventures seeking qualifying status to file a notice reporting basic facts about the proposed project. A project *automatically* received qualifying status if the proposed facility met the ownership

and technical requirements outlined by PURPA. Beyond this, applicants could, if they chose to, also request and pay a fee for commission certification. FERC maintains and publishes a database of these filings.

Although PURPA was passed in 1978, the regulatory environment changed dramatically in 1992 with the passage of the Energy Policy Act, which created a new category of electricity producers that were not subject to the constraints of PURPA and were not required to register with FERC. Thus, after 1992 many organizations that would previously have been classified as QFs were no longer classified as such (U.S. Department of Energy 2002). Because of this abrupt change, we include in our sample only those ventures that registered with FERC prior to the implementation of the Energy Policy Act at the end of 1992.

Unlike most states, New York and California actively maintained records concerning the avoided costs paid by the utilities to QFs and which QFs reached operational start-up. Thus, we narrowed our sample to these two states, for a total of 2,131 QFs, which accounted for nearly half of the QFs in the country from 1978 to 1992.

Dependent Variable

Operational Start-up. Our dependent variable is the hazard of reaching operational start-up. The risk set includes all ventures that have registered with FERC their intention to build an independent power generator. Although the organizations at risk come from FERC, data on operational start-up were gathered in California from individual utilities that were required by the California Public Utility Commission to maintain records on electricity purchased from QFs, and in New York from the Public Service Commission. The mean time between registering with FERC and becoming operational was approximately 2 years.

Independent Variables

Certification. FERC kept records of all applications for commission certification and date of certification. With the exception of 10 firms that proposed plants that did not meet PURPA guidelines, which we dropped from the sample, all the firms that paid the fee and applied for certification during this time period were certified. This is a dichotomous variable, where a value of 1 indicates that an organization requested and received a commission certification and 0 that it did not. About 38% of the firms in our sample opted for commission certification.

Although we cannot rule out a correlation, we do not believe that commission certification is a proxy for resources or knowledge. Interviews with a sample of these ventures suggest that those new ventures using novel green technologies such as wind, biomass, biogas, and geothermal faced greater resource constraints than firms using more established cogeneration technology and brown fuels. In analyses not reported here, we found that those firms using novel technologies and thus facing the most resource constraints were *more* likely to purchase a commission certification. Moreover, the cost of certification was relatively low, less than $800 in 1982. Finally, as we show, the effects of certification on start-up are contingent on sector legitimacy. If certification were merely a proxy for having sufficient resources or knowledge to build a generator, the effect of these resources would not likely vary with the legitimacy of the sector as a whole. Together, this evidence suggests that certification is not a proxy for having the most resources.

Supreme Court Ruling. Five months after the passage of PURPA, as QFs attempted to interconnect with utilities, a consortium of utilities legally challenged the constitutionality of PURPA's provision, which mandated that utilities purchase the electricity generated by QFs at the utilities' avoided costs. While this law was being challenged in court, potential resource providers such as employees, investors, and lending institutions were wary of QFs. This variable captures the effect of the Supreme Court decision of May 16, 1983, which upheld PURPA's mandatory-interconnection and avoided-cost provisions. This court ruling removed much of the legal uncertainty surrounding the implementation of PURPA and legitimated the activities of entrepreneurs in the nascent sector (Hirsh 1999). This variable was set to 1 after the Supreme Court decision and 0 before.

Recent Unsuccessful Entrepreneurial Activity. This measure captures the recent amount of unsuccessful entrepreneurial activity in the new sector in a given state. We created this variable by counting the total number of ventures that had registered but had not yet started operations between 2 and 7 years prior to the focal firm's application for qualifying status. This variable is then updated yearly. We did not count ventures that applied for QF status but had not reached operational start-up within the 2 years preceding the focal firm's application, because 2 years was the average time required to reach operational start-up (such that firms that had obtained QF status but had not started operation within this time could not yet be considered unsuccessful). For example, a venture that had been trying to acquire the necessary resources for 6 months would not be counted as unsuccessful, whereas a venture that had not reached start-up after 3 years as a QF would be. We also tried windows of 2.5, 3, and 4 years and obtained similar results. Finally, we also tried counting unsuccessful ventures all the way back to the inception of the sector, and results were the same.

Recent Operational Start-ups. This measure sums the number of ventures that have become operational within

the last 2 years in a given state. We experimented with counting start-ups at various time intervals ranging from 6 months to 3 years and found similar results. We also tried measures of total operational start-ups; this measure did not significantly affect the hazard of operational start-up.

Media. We assessed media coverage by searching the Lexus Nexus online database for articles that discussed the emerging independent power sector. We used the following search terms to identify relevant articles: independent power, qualifying facility, QF, PURPA, cogeneration, cogenerator, solar, wind, biomass, biogas, and Public Utility Regulatory Policies Act. Including only those articles in the sample that directly discussed the emerging sector, we assessed the overall tone of each article. Negative articles focused on the problems associated with the sector and spent relatively little time reviewing its positive aspects (such as successful start-ups); positive articles emphasized opportunities and growth within the new sector. We created a measure of positive and negative press by counting all articles that were either negative or positive in a given year. Each article was coded by two different people, and a Cohen's Kappa of 0.82 indicated high interrater agreement.

Control Variables

Alliance. This is a dichotomous variable that measures whether a utility owned a portion of a particular QF. FERC required that applicants for qualifying status indicate whether utilities would own equity in the venture and affirm that the proposed project would meet FERC ownership requirements, which entailed that ownership by incumbent utilities be less than 50%. This variable provides a control for resources available through dedicated stakeholders.

Natural Gas Price and Wind Availability. The most common type of cogenerator was fueled with natural gas, and the most common type of small power plant used wind power. Thus, we controlled for the average price of natural gas and the availability of windy land during the year prior to application.

The quality of the wind is typically judged by its average speed. Class 1 wind, the weakest class, has an average speed of 4.4 meters per second (9.8 miles per hour [mph]) or less at a height of 20 meters. Class 7 wind, the highest class, blows at a minimum of 7 meters per second (15.7 mph) at a height of 20 meters. Wind classes of 3 or higher provide rich opportunities for exploitation by wind entrepreneurs. We controlled for the number of acres of available land in each state that had wind quality rated at a wind class greater than 3. We obtained these data from the U.S. Department of Energy.

Avoided Costs. This is the price at which utilities purchased electricity from QFs. We gathered data on avoided costs from the California Public Utility Commission and the New York State Energy Research and Development Authority. For each state, we calculated the average avoided costs paid by utilities during the year prior to a venture's application for qualifying status.

Capacity. We controlled for proposed plant capacity because larger plants likely require more resources and take more time to construct. We obtained this information from FERC.

Density. This measure was a count of all operational facilities, lagged 6 months from the date of application.

Federal Tax Credits. We controlled for federal tax credits because these could influence the likelihood of new ventures reaching operational start up.

State Net Electricity Imports. Because net demand or inability to produce sufficient electricity may lead to support for this new sector, we control for the net electricity imports (state electricity consumption less electricity generated within the state in kWh).

Sector Age. To control for possible time trends in our analysis, we include a measure of the number of days from the passage of PURPA.

State Political Orientation and Alternative Energy Regulations. Because the state political and regulatory climate may affect the ability of new ventures to reach operational start-up, we controlled for both state regulatory policies as well as the political orientation of elected politicians. Our measure of *state alternative energy regulations* captures the number of state regulatory policies that promoted renewable energy and energy conservation (the independent power sector was seen as an important source of energy conservation). We included the following policies in our measure: tax incentives for investment in alternative energy; use of a standard contract; inverted rates; lifeline rates; flat rates; marginal cost pricing; energy audits of residential, commercial, and industrial users; solar and waste heat utilization policies; load management; conservation policy; and advocacy of insulation. If a state had a given policy in place, it received a 1 for that policy. These scores were then totaled across the policy categories to provide a comprehensive measure of the regulatory climate within a state. These data come from surveys conducted by the National Association of Regulatory Utility Commissioners.

We also controlled for *state political orientation*. This variable measures the extent to which state congressmen have a history of supporting proenvironmental legislation. The League of Conservation Voters (LCV) annually tracks voting records of individual congressmen on environment-related legislation. Congressmen receive scores based on the frequency with which they vote

in favor of legislation intended to protect the natural environment. This organization explicitly tracks energy-related legislation that might affect the environment. A higher LCV score indicates a voting record that is more supportive of environmental conservation and renewable energy. We used the averaged LCV score of a state's representatives and senators in a given year.

Technology Type. We captured the distinction between established and novel technologies by classifying facilities into those that used "green" or renewable fuel sources and those that used "brown" or nonrenewable fuel sources. Brown fuels such as natural gas and oil were legitimate and technically advanced when PURPA was passed in 1978 and were widely used; whereas green technologies were relatively undeveloped and viewed with greater skepticism, at least from an operational standpoint. Following technology classifications within the sector, we categorized the following energy types as green: biomass/biogas, geothermal, small hydroelectric, solar, and wind. We categorized the remaining fuel types—fuel oil, natural gas, coal, waste natural gas, nuclear, other waste, and "other"—as brown. For every new electricity producer founded during the study period, we coded its technology 1 if it was "green" and 0 if it was "brown."

Model Specification

We examined the transition from QF to operational start-up using event history analysis. We chose this technique because we had registration dates for all QFs and were thus able to calculate the time from registration with FERC to operational start-up. Unlike aggregated event count models, event history analysis enabled us to use (rather than discard) this rich information in our models. Moreover, our data contain right-censored event histories; the hazard rate models we employ accommodate right-censored event history data.

We analyzed our data using the semiparametric Cox model (Kalbfleisch and Prentice 1980), which estimates the effects of the independent variables on changes in the hazard rate. In a Cox model, the hazard rate is the product of an unspecified baseline rate, $h(t)$, and a term specifying the influences of covariates X

$$r(t) = h(t)\exp(ßX).$$

One of the important advantages of using a Cox model is that it is flexible with respect to the form of the duration dependence in the hazard rate (Lin and Wei 1989). Incorrect assumptions about the shape of the hazard rate may lead to biased estimates of the covariates effects (Cleves et al. 2002). In a Cox model, the coefficient estimates ß measure shifts in the baseline hazard rate that are due to the covariates in X. We stratified our models by technology type (green versus brown), allowing ventures using different technologies to have separate baseline hazard rates. We also tried stratifying by state and obtained similar results. We split our data into annual spells to update time-varying covariates. Thus, we include an observation for each venture for every year that it did not reach operational start-up. We computed robust standard errors adjusted for clustering at the firm level.

Our data contained some "tied" observations—days on which two or more firms became operational. To deal with tied observations, we estimated all models using the exact marginal calculation, which approximates the partial-likelihood function by calculating the conditional probability of the tied events.

To test the robustness of our results to this specification, we also ran our analyses assuming a Weibull distribution and using piecewise models that relax assumptions of time dependence. We obtained similar results in these analyses. We analyzed 2,131 ventures (i.e., QFs) in New York and California over 13 years, resulting in 6,222 spells.

Results

Table 1 reports descriptive statistics and correlations.

Several variables in our analysis are highly correlated, resulting in high multicollinearity in the model, which can cause high standard errors and coefficient instability. To reduce multicollinearity, we orthogonalize all control variables on each other following a modified Gram-Schmidt procedure (Golub and Van Loan 1989) using the orthog procedure in Stata (Stata Statistical Software 2003). We tried various orders of orthogonalization, but results were unchanged.

Models 1 to 8 in Table 2 are results of Cox regressions stratified by *technology type* and clustered by venture. Model 1 is a baseline with only control variables. We entered *certified*, a dummy variable that indicates whether a nascent entrepreneur purchased a commission certification, into Model 2. In Models 3–8 we tested the effects of our indicators of sector legitimacy and their interactions with certification. The chi-squared value for each model is significant at the $p < 0.01$ level, suggesting the overall adequacy of model fit. Results are consistent across models, so we focus our discussion on the results from Model 8, which includes all of the independent and control variables.

Hypothesis 1, which predicts the positive effects of commission certification on the likelihood of reaching operational start-up, is supported. The coefficient of *certified* is positive and significant, suggesting that a nascent entrepreneur has a greater chance of reaching operational start-up if it obtains a formal certification from an authorized institutional actor, in this case FERC. Findings from Table 2 also provide support for Hypothesis 2, which predicts a positive association between the legal endorsement of a sector and the likelihood of operational start-up. The coefficient of *Supreme Court ruling*

Table 1 Descriptive Statistics and Correlations

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 Operational startup	0.36	0.48	1.00																	
2 Certified	0.38	0.49	0.21	1.00																
3 Supreme Court ruling	0.87	0.32	0.07	0.13	1.00															
4 Recent unsuccessful entrepreneurs	130.50	114.83	−0.17	−0.40	−0.20	1.00														
5 Recent operational start-up	8.09	14.16	0.76	0.12	0.03	−0.09	1.00													
6 Negative press	1.88	1.22	−0.06	−0.08	0.02	0.11	−0.03	1.00												
7 Positive press	3.23	1.75	−0.01	−0.18	0.08	0.26	−0.09	−0.04	1.00											
8 Alliance	0.01	0.11	0.05	0.14	0.02	−0.04	0.04	0.03	0.01	1.00										
9 Available high-quality wind	21.74	1.79	−0.16	−0.09	0.05	−0.06	0.13	0.34	−0.05	−0.04	1.00									
10 Avoided costs	4.67	1.39	0.18	0.42	0.13	−0.16	−0.01	−0.68	−0.16	0.00	−0.50	1.00								
11 Capacity	6.30	19.21	0.10	0.18	0.02	−0.01	0.11	−0.17	−0.12	0.00	−0.02	0.14	1.00							
12 Density	156.16	142.03	−0.18	−0.41	−0.19	0.13	0.01	0.68	0.13	0.03	0.50	−0.80	−0.15	1.00						
13 Natural gas price	2.78	0.57	0.08	0.45	0.23	−0.30	0.10	−0.60	−0.28	−0.06	0.17	0.62	0.17	−0.58	1.00					
14 Net electricity imports	5,805.64	5,061.74	0.08	0.03	−0.12	0.10	−0.10	−0.09	−0.05	−0.03	−0.68	0.05	−0.02	−0.07	−0.26	1.00				
15 Political orientation	61.98	4.94	0.01	−0.08	−0.05	0.05	−0.01	0.07	0.22	0.06	−0.33	−0.10	−0.06	0.16	−0.25	0.41	1.00			
16 Sector age	2,903.15	920.27	−0.09	−0.39	−0.24	0.72	−0.12	0.16	0.28	0.08	−0.23	−0.45	−0.15	0.57	−0.73	0.14	0.33	1.00		
17 State alternative energy regulations	10.60	1.01	−0.13	−0.07	0.19	−0.14	0.15	0.24	0.00	−0.03	0.70	−0.38	0.02	0.40	0.25	−0.68	−0.23	−0.21	1.00	
18 Federal tax credit	15.9	7.33	0.08	0.45	0.22	0.10	0.61	−0.31	−0.31	−0.06	0.17	0.64	0.16	−0.58	0.97	−0.25	−0.29	−0.76	0.22	1.00

Note. $N = 6{,}222$.

Table 2 Event History Analysis of Operational Start-up

Variable	1	2	3	4	5	6	7	8
Certified		0.197** [0.041]	0.225** [0.042]	0.275** [0.043]	0.277** [0.043]	0.231** [0.043]	0.260** [0.043]	0.625** [0.066]
Supreme Court ruling			1.070** [0.193]	1.335** [0.197]	1.364** [0.197]	1.807** [0.207]	1.838** [0.210]	1.851** [0.213]
Supreme Court ruling × certified								−0.099** [0.034]
Recent unsuccessful entrepreneurs				−0.002** [0.000]	−0.002** [0.000]	−0.003** [0.000]	−0.004** [0.000]	−0.004** [0.000]
Recent unsuccessful entrepreneurs × certified								0.003** [0.001]
Recent operational start-up					0.009* [0.003]	0.011** [0.003]	0.012** [0.004]	0.032** [0.004]
Recent operational start-up × certified								−0.029** [0.005]
Negative press						−0.355** [0.051]	−0.370** [0.051]	−0.404** [0.053]
Negative press × certified								0.560** [0.070]
Positive press							0.202** [0.028]	0.254** [0.035]
Positive press × certified								−0.138** [0.046]
Alliance	−0.206** [0.043]	−0.188** [0.044]	−0.189** [0.044]	−0.221** [0.044]	−0.211** [0.044]	−0.267** [0.046]	−0.303** [0.046]	−0.297** [0.046]
Available high-quality wind	−0.008 [0.038]	−0.008 [0.038]	−0.008 [0.039]	0.021 [0.038]	0.022 [0.038]	0.062+ [0.037]	0.079* [0.037]	0.049 [0.038]
Avoided costs	−0.026 [0.052]	−0.039 [0.052]	−0.036 [0.053]	−0.036 [0.052]	−0.031 [0.053]	−0.032 [0.052]	−0.066 [0.050]	−0.055 [0.054]
Capacity	−0.116** [0.029]	−0.106** [0.028]	−0.102** [0.028]	−0.102** [0.028]	−0.103** [0.028]	−0.095** [0.029]	−0.097** [0.032]	−0.095** [0.031]
Density	−0.166** [0.043]	−0.160** [0.043]	−0.156** [0.044]	−0.157** [0.045]	−0.160** [0.045]	−0.185** [0.046]	−0.275** [0.047]	−0.213** [0.051]
Federal tax credit	1.033** [0.139]	0.878** [0.143]	0.788** [0.147]	1.004** [0.146]	0.979** [0.146]	0.728** [0.152]	0.427* [0.166]	0.557** [0.169]
Natural gas price	0.298** [0.042]	0.352** [0.043]	0.377** [0.043]	0.543** [0.050]	0.544** [0.050]	0.683** [0.053]	0.840** [0.061]	0.888** [0.064]
Net electricity imports	0.044 [0.043]	0.039 [0.043]	0.028 [0.043]	0.149** [0.049]	0.139** [0.050]	0.164** [0.050]	0.210** [0.050]	0.233** [0.052]
Political orientation	−0.117** [0.044]	−0.097* [0.043]	−0.103* [0.043]	−0.137** [0.044]	−0.141** [0.045]	−0.210** [0.045]	−0.305** [0.047]	−0.301** [0.048]
Sector age	−0.001** [0.000]	−0.001** [0.000]	−0.001** [0.000]	0.000 [0.000]	0.000 [0.000]	0.000 [0.000]	0.000 [0.000]	0.000* [0.000]
State energy regulations	0.422** [0.050]	0.47^{2**} [0.051]	0.507** [0.052]	0.846** [0.072]	0.809** [0.073]	0.944** [0.073]	1.036** [0.077]	1.105** [0.079]
Chi squared	945.44	968.47	993.6	1,031.22	1,037.47	1,087.61	1,136.29	1,215.82

Notes. $N = 6{,}222$. Standard errors in brackets.
+Significant at 10%; *significant at 5%; **significant at 1%.

is positive and significant, which indicates that the hazard of reaching start-up for individual ventures is higher after the Supreme Court decision was made upholding PURPA's mandatory-interconnection and avoided-cost provisions.

Hypotheses 3A and 3B are also supported. The coefficient of *positive press* is positive and significant, and the coefficient of *negative press* is negative and significant. Thus, the greater the number of articles that focus on the negative aspects of the sector, the less likely it is that a nascent entrepreneur reaches operational start-up.

As posited in Hypothesis 4A, recent operational start-ups within the emergent independent power sector were found to promote the likelihood of further operational start-ups. Conversely, and consistent with Hypothesis 4B, we found that recent unsuccessful ventures in

the sector had a negative impact on the hazard of reaching operational start-up. Together these findings suggest that although successful ventures help to overcome the cognitive and sociopolitical legitimacy deficits of an emergent sector, unsuccessful transitions to operational start-up *decrease* the legitimacy of the sector, reducing the ability of subsequent entrepreneurs to mobilize resources necessary to reach operational start-up for their ventures.

Hypotheses 5A, 5B, and 5C predict that increasing sector legitimacy will decrease the positive effects of firm certification on operational start-up, while Hypotheses 6A and 6B predict that decreases in sector legitimacy increase the benefits of firm certification. All of the interactions in Model 8 are consistent with these hypotheses in both direction and significance. The positive effects of certification on the likelihood of start-up decrease after the court decision of May 1983 that provided legal endorsement to the organizational form. The positive effects of firm certification become weaker with the increase in the number of recent operational start-ups in the sector but stronger with the increase in the number of recent unsuccessful entrepreneurs. Also, certification is more helpful for nascent entrepreneurs in the face of negative press and less helpful in the face of positive press. These results support the general contention that the impact of firm certification is contingent on sector legitimacy.

We verified the robustness of our results to the possible bias that can occur if certification is related to some unobservable variable that also affects the transition to operational start-up. We did this in two ways. First, we followed an instrumental variable approach that uses the predicted values of certification in lieu of the certification dummy (Wooldridge 2002). Using predicted values of certification as a proxy parcels out unobserved components of certification that may be correlated with the error terms in our original model (see Ingram and Roberts 2000, Uzzi and Gillespie 2002). Using a Cox analysis, certification was modeled using technology type, utility alliance, proposed capacity, gross state product, state electricity consumption, the price of natural gas, and year dummy variables. We reran Model 7 with this instrumental variable for certification, and it was positive and statistically significant, and the sector-level coefficients were unchanged in sign and significance.[7]

Second, we constructed a correction variable[8] using Lee's (1983) generalization of the Heckman (1979) selection model (Katila and Shane 2005). We then divided our data into firms that were certified and those that were not certified. In each sample we ran models that included our controls, Supreme Court ruling, recent unsuccessful entrepreneurs, recent operational start-up, and negative press and included λ in these models to correct for differences between certified and uncertified firms. We compared the size of the coefficients of the predictor variables in the certified and noncertified samples using a Wald test. The coefficients for the noncertified sample were larger for the Supreme Court ruling, recent operational start-up, and positive press and were smaller for recent unsuccessful entrepreneurs and negative press. These results are consistent with our findings in Table 2. Together, these robustness checks suggest that endogeneity does not bias our results.

Discussion

These results provide strong support for our contentions about the effects of both certification and sector-legitimating processes on the ability of new ventures to reach operational start-up. Past work has shown that endorsement from authorized actors can enhance organizational survival (e.g., Baum and Oliver 1991, Rao 1994) and decrease time to initial public offering (Stuart et al. 1999). We show that it also improves the likelihood of going from plan to plant. We focus on a particular type of endorsement—certification—and argue that the value of certification does not lie only in providing information that is unavailable elsewhere, but that certifications also confer legitimacy benefits. In the setting studied here, the information contained in commission certification was publicly available and could be obtained at no cost from FERC. Moreover, commission certification provided no information beyond that provided by the notice of registration. Rather than providing information benefits, we argue that commission certification had high symbolic value that enhanced the credibility of the claims that new organizations made about the appropriateness of their proposed ventures, mitigating to some extent their legitimacy deficit and the uncertainty associated with the emerging sector.

Consistent with the idea that organizational activities are institutionally embedded (e.g., Oliver 1996, Dacin et al. 1999), we also find that processes beyond the control of any one organization shape how categories of economic activities and organizational forms are viewed and consequently the ability of individual entrepreneurs to bring their business plans to fruition. We identify sector-level legitimating processes that improve the likelihood that individual new ventures within the emerging sector will reach operational start-up. Sector legitimacy is a two-way street, however; we also identified processes that *reduce* the legitimacy of new sectors and thereby *decrease* the ability of individual ventures to reach operational start-up.

Moreover, we find that the effects of certifications at the organizational level are *contingent* on these larger, sector-level processes: Certifications have a greater impact in the face of events that decrease the overall legitimacy of a sector and a smaller effect when a sector is characterized by greater legitimacy. This suggests a more complex pattern than that found in past studies, where the effects of certification were implicitly or

explicitly assumed to be constant. Instead, the effects of certification at the organizational level change as a sector evolves. Our analysis thus not only highlights the symbolic content of formal certification, but also directs attention to temporal variation in its effects (see also Wade et al. [2006], who found that the effects of CEO certification on firm performance were positive at first but dissipated over time).

By investigating those mechanisms that drive the transition from nascent entrepreneurial activity to operational start-up in new sectors, we elucidate processes that increase the diversity of organizational forms in use (see Ruef 2000). This is particularly important in the context that we study, as the independent power sector provides alternative methods of meeting increasing energy demands in ways that typically have less impact on the environment than traditional forms of electricity generation. We find that entrepreneurs in this sector collectively played an important role in the construction of the sector's legitimacy. Entrepreneurs responded to initial low legitimacy by working to *create* an external endorsement for their ventures. Despite the perfunctory nature of these certifications, they increased the ability of nascent ventures to reach operational start-up. In other words, the certifications that were in part constructed by the entrepreneurs themselves proved to be an important mechanism for mitigating the negative impact of low legitimacy that is often associated with new sectors.

This research builds on two other papers set in the context of the emerging independent power sector. In the first, Sine and David (2003) explain how environmental jolts generated entrepreneurial opportunities in the sector. The authors argue that jolts catalyze search processes and mobilize powerful actors to reformulate existing regulatory institutions, thereby expanding entrepreneurial possibilities. The second paper, by Sine et al. (2005), builds on the first by describing how regulative, normative, and cognitive institutional forces affect the variety of preoperational firms that entrepreneurs found in this new sector. The authors find that institutional forces that reduce perceptions of sector risk affect the technological variety of firms that entrepreneurs establish. Specifically, entrepreneurs are more willing to take risks with new technology when overall sector risks decline. In this paper, we build on that prior work by studying how certification at the firm level affects a subsequent stage in the entrepreneurial process—the transition to operational start-up—and how this relationship is moderated by sector legitimacy.

Taken as a series, these papers explain the transformation of the electric power industry from an institutional perspective. Sine and David (2003) explain how entrepreneurial opportunity arose within the industry in the first place; Sine et al. (2005) are centrally concerned with the technological variety of firms that entrepreneurs found. Finally, the present paper begins where Sine et al. (2005) left off by examining which new firms in this emerging sector subsequently make the transition from founding to operational start-up. Although all three studies attend to the institutional environment of the electric power industry (e.g., regulatory developments and media activity), they contribute in different ways to understanding the industry's transformation. First, Sine and David (2003) and Sine et al. (2005) focus on the sector level (i.e., creation of entrepreneurial opportunity, founding diversity). The present paper shifts to the firm level of analysis by studying the transition of individual ventures from founding to operational start-up. Second, whereas Sine et al. (2005) focus on how the institutional environment shaped entrepreneurial decisions about the kinds of firms to found, we are concerned here with how entrepreneurs proactively create and strategically deploy symbols to overcome a lack of legitimacy and ultimately bring their plans to fruition. Third, because it takes the firm as the unit of analysis, the present paper deals with firm-sector interactions in a way that the two previous papers could not. Specifically, we show how the effects of symbolic endorsement at the firm level vary with the institutional context: As the context becomes more favorable (unfavorable), the effect of firm-level action decreases (increases).

As a group, these papers further the rapprochement between institutional theory and entrepreneurship research. Entrepreneurship scholars have lamented the lack of attention to the relationship between institutional contexts and entrepreneurial action (Eckhardt and Shane 2003). Much of the prior research on entrepreneurship has focused on the role of individual attributes and strategy on the growth or profit of firms and has paid less attention to the impact of wider institutional processes. Conversely, the institutional perspective has not sufficiently taken into account the role of strategic action (for notable exceptions, see DiMaggio 1988, Oliver 1991, Lawrence 1999, Schneiberg and Bartley 2001). This research on the emergence of independent power contributes to the institutional analysis of organizations and the entrepreneurship literature by examining the important role institutions play in entrepreneurial processes by creating opportunities, shaping what types of new ventures are founded, and influencing which ones actually reach operational start-up. Together, the articles also illustrate how entrepreneurs act to *mold* their institutional environment in ways that advance their own interests.

The present paper is nonetheless subject to limitations that suggest fertile terrain for future inquiry. First, our study is limited to one sector, independent power generation. Power generation requires considerable physical infrastructure and is closely watched by regulators. The extent to which our findings apply to other types of emerging sectors requires further investigation. Ventures in sectors such as organic farming and food production,

Internet commerce, and ecotourism may benefit in varying degrees from certification processes. Although we believe that external endorsement would help individual ventures in all new sectors of activity, it is quite possible that the *nature* of endorsement might be different across sectors. For example, in highly professionalized contexts, certification from professional associations as opposed to regulatory agencies might be more relevant (see David and Sine 2006).

Second, although we find a negative interaction between firm-level strategic legitimating action and sector-level processes, we examine only one type of firm-level action. Do other strategic legitimating actions, such as adopting taken-for-granted structures and practices, also increase the likelihood of reaching operational start-up? How do these interact with sector legitimacy? We enthusiastically call for more research that investigates firm-level strategic action, sector-legitimating processes, and the interaction between them in affecting organizational outcomes. This type of research will increase our knowledge of the processes that drive the emergence, survival, and evolution of new types of economic activity.

Conclusion

The first few years of a new sector represent a distinctive phase of its lifecycle and can have a lasting impact on its evolution. In this paper, we extend prior research by (1) examining the role of formal certification on the transition to operational start-up, (2) identifying multiple drivers of sector legitimacy and demonstrating the effects of these processes on operational start-up, and (3) exploring the interrelationship between these organizational and sector-level processes. Unlike past research on certifications that focuses on how certification *content* influences organizational outcomes (Corbett et al. 2005, King et al. 2005), we also show that certifications have important effects beyond their information value. This suggests another strategic lever for entrepreneurs to pursue in bringing their plans to fruition. In addition, we find that institutional legitimating (or delegitimating) processes at the sector level can increase (or decrease) the time to operational start-up, an organizational vital rate that has received little attention in the past. These processes can thus affect the speed at which a new sector develops. Finally, we show that strategic legitimating actions, such as certification, and institutional legitimating processes interact in interesting ways: Strategic legitimating actions can mitigate the uncertainty that surrounds new ventures in new sectors, but such actions become less important as sector legitimacy increases. Both entrepreneurs and scholars concerned with the fate of new ventures in nascent sectors would benefit from greater attention to these interrelationships.

Acknowledgments

The authors would like to thank Professor Jim Wade and three anonymous referees for their feedback and suggestions. They are grateful for comments from seminar participants at the Dartmouth Tuck School of Management, University of Wisconsin, West Coast Research Symposium on Technology Entrepreneurship, and York University. This research was funded in part by a J. Thomas Clark Professorship of Entrepreneurship and Personal Enterprise and the Johnson School of Management at Cornell University. The authors thank Brandon Lee for his research assistance. The second two authors (David and Mitsuhashi) contributed equally to this paper.

Endnotes

[1]We expect this relationship to hold only in new sectors, i.e., before competitive effects swamp the legitimacy benefits of increasing numbers of operational organizations.

[2]We thank an anonymous reviewer for the idea to explore these interactions.

[3]We distinguish our context from sectors in which certification is required by law. When certification is the norm, its absence can have deleterious consequences for an individual organization *regardless* of the sector's legitimacy.

[4]To put this in perspective, this is enough power for approximately 70,000 homes.

[5]This section is based on information obtained from interviews with various regulators at FERC in 1999.

[6]In 1999 the first author interviewed 52 founders, managers, and technical employees of QFs and federal regulators at FERC and state regulators in both California and New York.

[7]We do not include the instrumental variable in Model 8 in lieu of certification because proper interpretation of the interaction variables requires that the main effect for certification (rather than the probability of certification) be included in the model (Wooldridge 2002). Moreover, we do not interact sector legitimacy variables with the instrumental variable because interactions with the instrumental variable would not compare differences between certified and uncertified firms.

[8]In this correction, we use a Cox regression model to estimate the probability for certification. We then generate the sample correction variable λ as follows:

$$\lambda_{it} = \frac{\phi[\Phi^{-1}(F_i(t))]}{1 - F_i(t)},$$

where $F_i(t)$ is the cumulative hazard function for the firm i at time t, ϕ is the standard normal density function, and Φ^{-1} is the inverse of the standard normal distribution function (Lee 1983). Certification was modeled using technology type, utility alliance, proposed capacity, gross state product, state electricity consumption, price of natural gas, and year dummy variables.

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