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Signaling by early stage startups: US government research grants and venture capital funding



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A B S T R A C T

Entrepreneurship researchers have documented that early stage startups rely on signals to demonstrate the transitions in their identities that they must make when they cross organizational life cycle thresholds. However, early stage startups in emerging industry contexts tend to have few good signals upon which to rely. Public agencies can play a valuable role in this process, but prior research has not sufficiently examined how startups effectively leverage this support. In this paper, therefore, we develop a framework to investigate the role that signals can play for early stage startups when they win prestigious government research grants. We test this framework in the setting of the emerging U.S. clean energy sector and find that in comparison to a matched sample of clean energy startups that have not won prestigious research grants, startups with these grants were 12% more likely to acquire subsequent venture capital (VC) funding. Another significant result is that the value of this signaling is greater for startups that have fewer patents. The important contribution of this finding is that it shows that signaling has the potential to *redistribute* benefits rather than just provide an additional accrual of advantages to the already high status actors. Together these results highlight the advantages for startups in emerging industries of pursuing signaling strategies with public agencies when they attempt to make important transitions through the stages of their organizational life cycles.

Executive summary: Early stage startups seeking to acquire resources struggle to demonstrate the legitimacy they need to transition from conceptualization to commercialization. They must efficiently cross thresholds over the organizational life cycle to assure their survival and growth. Earlier work in entrepreneurship has demonstrated that the strategies startups use to cross these thresholds involve costly efforts to signal the quality of their ventures. In this paper, we study the value that signals have for startups in an emerging technology industry by examining the impact of government research grants on the recipients' ability to attract subsequent venture capital (VC) funding. Governments around the world are establishing larger pools of funds to catalyze innovative efforts and support early stage startups. This is especially the case in the area of clean technology where the proceeds of carbon taxes or cap-and-trade schemes are being directed towards promising technologies that lower greenhouse gas emissions. We show that the VC community picks up on the signals that underlie these types of government grants and startups can use these as proof points to demonstrate their potential to transition across life cycle stages. In comparison to a sample of U.S. based clean energy startups that have not won prestigious research grants, those startups that have been awarded these grants from federal agencies were 12% more likely to acquire subsequent venture capital (VC) funding. Interestingly, the effect is only present for the six months following receipt of a government grant and not for later

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windows. This suggests startups are likely to use these grants expeditiously in their advancing their relationships with VCs and that the cachet that comes from these awards may decay over time.

Significantly, these proof points appear to compensate for a weakness that startups otherwise may have. That is, we find that startups with fewer or even no patents are likely to benefit from additional VC funding in comparison to startups with more patents. The signal sent by the grant then has the important effect of redistributing the benefits of VC funding rather than to simply advantage already well-endowed actors with many patented technologies. The role that the government can play in tipping the balance in the direction of less well-endowed startup ventures is an intriguing finding that deserves follow up for it points to an alternative strategic route that startups can take to move through the organizational life cycle.

Our study makes several contributions. First, we identify a strategy that early stage startups adopt as they struggle to transit their identity from the conception to commercialization stages. We show how signals that startups establish through government research grants can distinguish them from non-grant recipient startups in a way that allows them to overcome information asymmetries and catalyze their efforts to establish ties with VCs. We further argue that for an early stage startup these grants have value beyond the monetary award if they can be used as an identity transforming event to avoid languishing in the well documented *valley of death*. Second, our focus on an emerging technology sector context shines light on how identity transitions differ based upon gradations in industry development. In this type of industry, the threshold external resource providers confront is more opaque and therefore it is greater than it is in mature industries, leading to wider identity transition gaps. Third, the dynamic aspect of the signaling strategy that we study about the early stage startups contributes to our understanding of when such firms extract value from signals. Finally, our findings offer interesting implications for policymakers responsible for designing research grant programs. We demonstrate that government grants have positive impacts on startups obtaining VC financing. Given the signaling value of grants, policymakers may consider involving VCs in the design of these programs.

1. Introduction

Early stage startups seeking to acquire resources struggle to demonstrate the legitimacy they need to transition from conceptualization to commercialization (Kazanjian and Drazin, 1990; Fisher et al., 2016). They must efficiently cross thresholds over the organizational life cycle to assure their survival and growth. Entrepreneurship researchers have demonstrated that the strategies they use to cross these thresholds involve costly efforts to signal the quality of their ventures (Plummer et al., 2016; Rao, 1994; Stuart et al., 1999). They must take initiatives that demonstrate their technology and market potential in order to overcome informational disadvantages and to distinguish themselves from their peers (Marcus et al., 2013). However, the strategic use of signals is nuanced and depends upon the resource requirements at particular stages of development. Early stage startups that have yet to commercialize a technology or secure clients have few signals available to them. As a result, it is not surprising that much of the academic attention has been placed on signaling strategies by later stage startups that are frequently found in mature industries. Such firms are more likely to have attained signal-worthy accomplishments and have a willing audience of knowledgeable resource providers to interpret and respond to such signals. This paper departs from this literature by advancing the notion that early stage startups in emerging sectors also have signal-worthy options. These signals are founded within their affiliation with third-party institutions. These institutions bestow upon selected startups the tangible and symbolic resources they need to transform their identities and promote the legitimacy they seek.

The strategic use of signals by startups can be based more upon the prominence of the third-party institution they affiliate with than the on-going support or monitoring that these institutions provide (Higgins and Gulati, 2003, 2006). For early stage startups, these institutions are increasingly public agencies that tend to hold broader social and economic objectives than the commercial success of a particular startup. The startups that public agencies choose to support reveal the agency's policy preferences and priorities. In the past, these preferences and priorities shaped the trajectory of emerging technology industries such as semiconductors and flat-panel displays (Murtha et al., 2001; Lerner, 2009).

In this paper, we study the value that signals have for startups in an emerging technology industry by examining the impact of government research grants on the recipients' ability to attract subsequent venture capital (VC) funding. Competition among research proposals is substantial with leading experts drawn from academia, public and private domains to make the assessments.¹ Startups that prevail in this competition typically are funded for well-defined technical projects that have clear guidelines on how to use the funds awarded. Winning such a grant is an important and highly sought after recognition that is well-publicized and elevates the startup's status.

¹ For instance, the initial grant solicitation by the Obama Administration's Advanced Research Projects Agency-Energy (ARPA-E) in 2009 received 3700 applications for its first round of 37 grants. Its assessment team included a thermodynamics expert from Intel, a Massachusetts Institute of Technology electrical engineering professor, a clean-tech venture capitalist, a nanotechnology professor from the University of California, Berkeley, and a biochemistry professor from Duke University.

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