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Public or private entrepreneurship? Revisiting motivations and definitions of success among academic entrepreneurs

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Abstract The choice of university faculty to engage in academic entrepreneurship—the establishment and management of a university spinoff company—is a critical component of university economic development efforts. Replicating Hayter (J Technol Transf 36:340–352, 2011), this study investigates motivations and definitions of success among academic entrepreneurs, how they evolve, and why. The results show that academic entrepreneurs are motivated by a number of distinct, yet interrelated reasons and that spinoffs are viewed as a vehicle to pursue SBIR awards and consulting opportunities that can, in turn, enhance their traditional academic teaching and research responsibilities. Several academic entrepreneurs have enjoyed commercialization success yet, as a group, near-term commercialization goals and financial motivations have become relatively less important. While these findings have important implications for policy, they also signal a new conceptualization of university spinoffs as a low-growth contract research firm and provide empirical support for the emerging theory of public entrepreneurship.

Keywords Entrepreneurship · Technology transfer · Economic development · Entrepreneurial motivations

JEL Classification 033 · Z13

1 Introduction

Academic entrepreneurship—the establishment and impact of spinoff companies founded by university faculty, students, or staff—constitutes a unique form of what Leyden and Link (2015) term *public sector entrepreneurship*. Discussed below, public sector

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entrepreneurship occurs when a government or non-profit agent recognizes an opportunity and takes, depending on the context, direct or indirect action, that leads to robust social networks and creates positive economic activity.[1] Specific to spinoffs, research universities are unique institutional environments within which public and private goods are produced for the common weal.

For example, most colleges and universities in the United States are not only designated as non-profit, tax-exempt organizations, they also receive substantial public subsidies including annual state appropriations, research funding, and student financial aid (Kezar 2004; Kezar et al. 2004). Further, universities are also recognized for their role in private markets providing salary-boosting skills and credentials for individual students, new technologies important for firm-level innovation, and entertainment in the form of, for example, college sports (Rhoades and Slaughter 2004).

A unique facet of academic entrepreneurship is the faculty entrepreneur herself. While university faculty possess knowledge important for scientific and technological progress, these individuals typically lack the experience or business acumen important for knowledge exploitation (Franklin et al. 2001; Murray 2004). Faculty also face a number of cultural and organizational disincentives to engage in technology commercialization and entrepreneurship (Acs et al. 2009; Bercovitz and Feldman 2004).

University spinoffs offer researchers a vehicle for the commercialization of new technologies and, thus, regional economic development (Acs et al. 2009; Link and Ruhm 2009; Shane 2004). Spinoff success depends on myriad factors, such as university culture and policies (Bercovitz and Feldman 2004), financial resources (Shane and Stuart 2002), professional management (Franklin et al. 2001), industry characteristics (Bekkers et al. 2006), geography (Kenney and Patton 2005), and the social networks of academic entrepreneurs (Hayter 2015), among other elements.

A modest literature assumes that the motivations of academic entrepreneurs are also a critical component of spinoff success (Hayter 2011; Lam 2011; Rizzo 2015). These studies show that academic entrepreneurs are motivated by a plurality of non-mutually independent factors, including technology development and commercialization, financial gain, peer recognition, the pursuit of alternative sources of (basic) research funding, public service, and an intrinsic interest in problem solving. Unfortunately, recent studies overlook how motivations among academic entrepreneurs evolve over time (or not) as well as how changing entrepreneurial motivations may relate to spinoff development. This paper is an initial effort to fill this void.

Specifically, this paper seeks to address this auspicious gap within the literature by investigating the motivations of academic entrepreneurs and their evolution. It does so by replicating a 2008 study (Hayter 2011), examining motivations and definitions of success among academic entrepreneurs, comparing current and previous responses. Understanding the evolution of entrepreneurial motivations will provide insights to scholars and policymakers seeking to accelerate the development of university spinoffs and, thus, their economic impact. Further, this study seeks to contribute to an emergent public entrepreneurship theory (Leyden and Link 2015) and its specific relevance to academic entrepreneurship.

[1] Leyden and Link (2015) refer to public sector entrepreneurship in the context of their discussion about US technology and innovation policies as initiatives that generate greater economic prosperity by transforming a status-quo economic environment into one that is more conducive to economic units engaging in creative activities in the face of uncertainty.

The structure of this paper is as follows. Section 2 reviews the extant literature relating to public sector entrepreneurship. Section 3 briefly outlines the study methodology while Sect. 4 presents the empirical results. Finally, Sect. 5 concludes, positing implications for research and policy.

2 Conceptual background

2.1 Public sector entrepreneurship

According to Hayter (2013), the choice of faculty to engage in academic entrepreneurship is a critical component of university economic development efforts. Scholars have yet to fully explain, however, how academic entrepreneurship fits into broader notions of entrepreneurship theory; Leyden and Link's (2015) concept of public sector entrepreneurship offer a promising alternative.

The extant entrepreneurship literature focuses on the role of the entrepreneur within markets and their response to prices in an effort to maximize profits (Baumol 2010). Thus, the entrepreneur plays a significant role in determining the function and outcomes associated with private-sector markets. The entrepreneur performs many functions and, drawing from diverse scholarly perspectives, Leyden and Link (2015) posit that the most important lie in their ability to recognize entrepreneurial opportunities and act upon them in the face of uncertainty as compared to calculated or probabilistic risk (Kirzner 1973; Knight 1921; Schumpeter 1926).

While different literatures deride the application of entrepreneurship concepts to public sector institutions (e.g. Terry 1993), Leyden and Link (2015) attribute these views to the conflation of context-specific factors from the fundamental characteristics of the entrepreneur, including opportunity recognition and action. Specifically, what differs within the public sector context is the specific nature of available opportunities, the specific motivations of individual agents, as well as the rules and professional ethos associated with public-sector employees (Bellone and Goerl 1992; Klein et al. 2010).

Drawing on Link and Link (2009), Leyden and Link (2015) find that, given the existence of significant institutional and cultural barriers to personal aggrandizement, public-sector entrepreneurship may be best accomplished by altering private sector market environments through changes in laws, policies, and regulations. The authors explore, for example, the passage and impact of legislative efforts such as the Bayh–Dole Act of 1980 and the Small Business Innovation Act of 1982. The success of these and other policy efforts, they posit, is a function of how well they promote and strengthen heterogeneous social networks among economic agents who can, in turn, generate economic activity. While public sector entrepreneurship remains in its empirical infancy, the concept is bold and can be applied, for example, to academic entrepreneurship and the unique institutional context that leads to academic entrepreneurship.

2.2 Motivations among academic entrepreneurs

Comprehensive reviews of the management and economics literature find that entrepreneurs generally establish and operate their enterprise for diverse personal reasons (Hayter 2011; Rizzo 2015; Stephan et al. 2015). Specific to university spinoffs, Hayter (2011) finds that nascent academic entrepreneurs from public research universities within in US are motivated by a plurality of goals, including (in order of importance): (1) technology

dissemination; (2) technology development; (3) financial gain; (4) public service; (5) peers and peer recognition; (6) seniority and career enrichment; (7) regional job creation; and, (8) commercialization and entrepreneurial skill development.

Lam (2011) analyzed the motivations of a sample of academic scientists within the UK to engage in technology commercialization. She does so utilizing self-determination theory (SDT), a framework adopted from social psychology. SDT views agency as an individual internalization process whereby external 'regulatory processes' are assimilated and reconstituted into inner values in support of the psychological need for autonomy and self-determination (Deci and Ryan 2000; Ryan and Deci 2000). According to SDT, extrinsically-motivated behavior can be transformed into intrinsically-motivated behavior as individual internalize the values and behavior regulation associated with it.

Lam (2011) accordingly categorized scientists by the degree to which they self-identify with technology commercialization goals, from (1) *introspection*: behavior that is not congruent with an individual's internal values and thus not self-determined; (2) *identification*: value is identified within a behavior that is more closely aligned with an individual's self-selected goals; and (3) *integration*: individuals completely embrace a particular set of values and assimilate them into their sense of self accepting them as their own (Deci and Ryan 2000). She found that traditional scientists, embodying introspection, are primarily motivated by research funding and reputational benefits ("ribbon"), hybrid scientists, embodying identification, are primarily driven by knowledge application and intellectual curiosity ("puzzle") and ribbon, and entrepreneurial scientists, embodying integration, are driven by money ("gold") as well as the puzzle.

Rizzo (2015) focused specifically on the motivations of faculty and PhD student entrepreneurs that have established university spinoffs within the Emilia-Romagna region of Italy.[2] He found that PhD students establish spinoffs as way to create jobs related to their areas of scientific expertise, especially given the paucity of academic positions for which they have prepared. Most senior (faculty) researchers establish their spinoff primarily for financial motivations. However, when faculty co-found spinoffs with PhD students, they appear to be motivated by a desire to help students find employment, followed by the need for peer recognition, and social approval.

Viewing Rizzo's (2015) findings through Lam's (2011) conceptual framework, it appears that faculty entrepreneurs within the Emilia-Romagna region similarly possess multiple views relating to entrepreneurship and, thus, different motivations for establishing companies. Interestingly, Rizzo's sample of spinoffs were established between 1999 and 2007; respondents are asked how and why founding teams evolve but there is no discussion as to how (and if) motivations might have changed. Likewise, Lam (2011) does not address the degree to which entrepreneurial attitudes evolve over time, an opportunity this study seeks to address.

3 Theory and methodology

In order to account for the unique aspects of university spinoffs and their faculty founders, academic entrepreneurship is conceptualized as a form of public entrepreneurship. The word "sector" is dropped from Leyden and Link's (2015) concept in recognition of the role of research universities within private markets as well as the fact that technology

[2] Located in northern Italy, the region borders the Adriatic Sea and includes the cities of Bologna, Parma, and Ferrara.

commercialization (if it occurs) necessarily follows the establishment of a for-profit organization, the spinoff company. However, the functional elements of public sector entrepreneurship—opportunity recognition, action, and the extent which entrepreneurial action by the public sector leads to robust social networks—remain.

Following Lam (2011), motivations are conceptualized as a proxy for individual values. Further, this paper investigates how these motivations evolve over time. Given that all academic entrepreneurs have demonstrated some level of entrepreneurial action—that is, they have established a spinoff company—spinoff success is defined as technology commercialization, both as an indication of entrepreneurial action and the related successful formation of social networks (Hayter 2013, 2015; Link and Ruhm 2009).

In order to investigate these factors, the 74 academic entrepreneurs who participated in the original 2008 study (Hayter 2011) were contacted in late 2013 and asked to contribute to a follow-up study. A total of 68 individuals from the original sample responded to the inquiry though 11 of the individuals had shuttered their spinoff company; a total of 57 total respondents remained active within their original spinoff and agreed to participate in this study. Academic entrepreneurs were interviewed by phone and asked to respond to multiple, related, open-ended questions to not only capture their current motivations and definitions of success but also to understand perceptions among academic entrepreneurs as to how their motivations have changed. These questions included:

Q1: How has your role within your spinoff company changed?
Q2: What are your motivations for staying involved in your spinoff company?
Q3: How have your motivations changed?

All answers were recorded and coded replicating Hayter's (2011) attributional approach (Gatewood et al. 1995; Harvey et al. 1980). The current motivations and views of success were then compared to original responses. Further, after articulating current motivations, respondents were given their 2008 responses and ask to articulate why (or why had not) their motivations and definitions of success had changed. The next section reviews the empirical results.

4 Empirical findings

4.1 Motivations among academic entrepreneurs

Table 1 reports the motivations and definitions of success of academic entrepreneurs in the sample. Table 2 reviews these responses in greater depth, reported in order of plurality.

Table 1 Entrepreneurial motivations and success definitions among academic entrepreneurs

Entrepreneurial motivation	*n*	Mean	SE
Technology development: SBIR funding and consulting	49	0.8596	0.0464
Enhancing traditional university responsibilities	35	0.6140	0.6505
Concern for students and employees	31	0.5439	0.0666
Technology diffusion	26	0.4561	0.0666
Product development and commercialization	21	0.3684	0.0645
Avoid university bureaucracy	19	0.3333	0.0630
Financial gain	12	0.2105	0.0545

Echoing the 2008 study, academic entrepreneurs are motivated by varying and multiple factors, though their motivations have evolved. Specific motivations include using the spinoff as a platform to obtain SBIR awards and other types of research funding, enhancement of more traditional university teaching and research responsibilities, concern for students and employees, the diffusion of university technology, product development and commercialization, university bureaucracy avoidance, and financial gain. As indicated in Table 1, concern for employees and bureaucracy avoidance are newly reported while public service, job creation, and skill enhancement—motivations reported in 2008—are not mentioned.

Table 2 Motivation and success definitions among academic entrepreneurs

Entrepreneurial motivation	Definition
Technology development: SBIR funding and consulting	Respondents view spinoff is a mechanism to obtain resources available within the university to conduct translational research. These resources primarily include Small Business Innovation Research (SBIR) program grants, industry R&D contracts, or consulting. Spinoff research may not have short-term promise for commercialization but promise for way for respondents to develop their technologies with resources not available within the university
Enhancing traditional university responsibilities	Establishing and operating a spinoff company enhances the quality of an academic entrepreneur's teaching and research. Working in an applied, translational research environment vis-à-vis a university spinoff has resulted in a better understanding of how academic science may be applied and, thus, improved research proposals to government and industry—and better quality publications. Further, respondents report that their experience as an academic entrepreneur has also enhanced their teaching quality and ca
Concern for students and employees	Academic entrepreneurs are motivated by the opportunity to provide stable employment for their Ph.D. students and Postdoc or view student spinoff experience as a stepping stone to jobs within industry. Academic entrepreneurs are also concerned employers; spinoff sustainability is important to ensure that their employees have well-paying jobs
Technology diffusion	Respondents view their spinoff as a way to disseminate the results of their research and get new technologies out of the university
Product development and commercialization	Respondents see the primary mission of their spinoff as product development, related, the short-term development of new technologies, and revenue generation. These academic entrepreneurs are associated with spinoffs that
Avoid university bureaucracy	Related to technology diffusion, respondents see their spinoff as the best method for working with the commercial world as opposed to working through a sponsored research office or TTO. Over time academic entrepreneurs report learning how to avoid bureaucracy "without breaking the rules"
Financial gain	Financial benefits flowing from spinoffs provide motivation for some academic entrepreneurs in the sample. With a few exceptions, financial benefits are modest but are nonetheless seen as compensation for time of academic entrepreneurs. Most academic entrepreneurs do not view university spinoffs as an optimal way to secure financial rewards

Based on Hayter (2011), the primary response, "technology development," is subjected to an additional level of coding. The results show that academic entrepreneurs in the sample are primarily motivated by the ability to use university spinoffs as a platform to apply for SBIR awards and consult. Far fewer respondents (21) are motivated by commercialization and product development. Interestingly, five respondents who did not indicate that they were motivated by product development or commercialization did indeed develop a product but reported that the return was not worth the effort, while they view SBIR as "free research money."

To be clear, academic entrepreneurs motivated by the opportunity to win SBIR awards are not *against* commercialization; ten individuals reported that they were also motivated by the need to commercialize technology. Most understood the importance of commercialization but indicated that their relative capabilities (and that of their spinoff) lie in translational research that might one day be commercialized by industry. Most spinoffs not only conducted research, they also offered related consulting services, typically to the R&D divisions of larger, more developed companies. In other words, spinoffs in the sample seem to constitute a unique organizational intermediary that may not have the capability to commercialize technologies yet play an important role in the further development and dissemination of new knowledge.

In contrast, 21 academic entrepreneurs reported that product development and commercialization is an important motivation. In all but one of these cases, the academic entrepreneur was no longer the spinoff CEO and instead occupied a CSO or board member position within the spinoff; professional managers had long ago assumed leadership for the company.

Three reported motivations seem to support the aforementioned spinoff-as-knowledge-intermediary finding. First, academic entrepreneurs use their spinoff and derivative resources to enhance traditional teaching and research responsibilities, the second most common response. Related to research, academic entrepreneurs report that working "outside the university" allowed them to pursue more applied projects and sources of funding that they, in turn, used to bolster the number and quality of their academic publications. Relating to teaching and mentoring, academic entrepreneurs reported "teaching differently", emphasizing the application of science, and mentoring students to consider jobs in industry or startups as opposed to traditional academic jobs.

Twenty-six respondents also viewed spinoffs as a vehicle for disseminating new knowledge created in universities. While relatively fewer individuals report knowledge dissemination as a motivation compared to the 2008 study, it nonetheless shows its importance. Third, and related, respondents see their spinoffs as a way to avoid university bureaucracy, especially the technology transfer office, and ensure they could more easily work with companies and research partners without "dealing with IP issues."

The third most commonly reported motivation was a concern and feeling of responsibility for spinoff employees. Discussed below, most spinoffs in the sample did not employ large numbers of individuals (typically less than five) but academic entrepreneurs were nonetheless concerned for their wellbeing, especially former students. Academic entrepreneurs reported staying involved and "doing a bit more than I [they] should" to ensure that their spinoff remained viable so that employees maintained their jobs.

Finally, financial motivations are the most infrequently reported motivation. Similar to the Hayter (2011), financial motivations among academic entrepreneurs not only remain modest, they have also become relatively less important. Discussed below, this is not to say that revenues are not important but that financial gain is not the primary motivation for staying involved in a spinoff, nor is it how academic entrepreneurs define success.

4.2 Evolving motivations

When asked *why* their motivations had evolved, academic entrepreneurs offered a number of reasons as summarized below.

4.2.1 Experience

Time, experience, and learned lessons are the most common responses as to why the motivations of academic entrepreneurs have evolved. All of the individuals within the sample established a spinoff company while they were full-time, tenured faculty at research universities. Respondents described their earlier motivations as "naïve"; most expected entrepreneurial success to come easily. Instead, even modest enterprises require large time, financial, and personal commitments often at the expense of the personal obligations and academic career of the academic entrepreneurs. In short, *all* respondents expressed the challenge of establishing a company as a part-time endeavor, especially with little experience, guidance, and institutional support.[3] Motivations related to financial gain, short-term commercialization, and the purpose of their spinoff thus became much more realistic over time.

4.2.2 Realized capabilities and networks

Another common theme relates to the self-awareness of academic entrepreneurs regarding their own capabilities, along with their networks. At least half of respondents eventually recognized that they did not have the managerial and technical capabilities required to commercialize technology and develop their spinoff. Respondents also realized that their social networks, including connections with technology transfer offices and entrepreneurship support programs, could not provide the contacts and resources needed to develop their spinoff. Conversely, these experiences helped respondents better understand and embrace their relative strengths as scientists.

These realizations often led to significant changes in strategy within spinoff companies; several academic entrepreneurs decided that technology commercialization was not among their core capabilities and should therefore not be a part of their spinoff's mission per se. Instead, these companies focus on contract research, obtaining SBIR awards, and scientific and technical consulting. In the words of one academic entrepreneur in the sample "our competitive advantage is basic and translational research, not commercialization."

4.2.3 Modest financial gain (or loss)

In the 2008 study, financial gain was relatively more important while only one in five respondents in the current study report financial gain as a critical motivation—the lowest response among categories. Asked why, a common response was that (academic) entrepreneurship "can never be about money" and comes at a great personal cost. Several respondents spoke of stress, fatigue, and strained personal relationships for little or no financial reward. In six cases, respondents had incurred significant personal debt with little promise of return.

[3] In their review of the 'spinout' literature, Djokovic and Souitaris (2008) find that the early studies debated the efficacy of part-time faculty entrepreneurs compared to those who left their academic positions while more recent debates focus on the importance of surrogate entrepreneurs.

To be clear, three quarters of the sample has enjoyed financial returns from their spinoff company. Four respondents earned significant returns that "would have allowed me [them] to retire." But most individuals felt that the opportunity costs of entrepreneurship were high; other options, including not establishing a spinoff, would have yielded greater financial returns. In other words, academic entrepreneurs typically continued their involvement in a spinoff for reasons other than money.

4.2.4 IP roadblocks

Several academic entrepreneurs saw their spinoff as a way to avoid what they viewed as burdensome administrative practices and procedures, especially those associated with their TTO. Discussed in Hayter (2011), all respondents established their spinoff based on technologies licensed from their home universities. Through this and subsequent experiences, respondents viewed IP protection as something that was "rarely needed" especially for translational research. Spinoffs allowed these individuals to "do translational work rarely funded within universities" while "avoiding attorneys…and IP issues that often seem to get in the way." Academic entrepreneurs also spoke of the willingness of company personnel to work informally with faculty within the (legal) context of their spinoff because they were not required to sign an IP agreement to do so.

4.2.5 Employees, not jobs

In contrast to Hayter (2011), public service and job creation were not among motivations reported within the sample. When asked why, academic entrepreneurs echoed comments above that highlighted the limits of their capabilities and, uniquely, what their tangible contributions could be. With a few exceptions, most spinoffs employ ten employees or less, with the majority having less than six; jobs were not viewed as the primary contribution of spinoffs. However, respondents spoke of their fiduciary responsibility as an employer, including the importance of spinoff viability to the future of their current employees. Supporting Rizzo (2015), academic entrepreneurs also viewed their spinoff as a way to employ students and graduates in an effort to provide employment to mitigate the challenge of finding an academic job.

5 Discussion

While this paper's conceptual lens—public sector entrepreneurship (Leyden and Link 2015)—remains early in its empirical development, it nonetheless accommodates the context of academic entrepreneurship and enables multiple levels of analysis. The present study focuses on *direct* entrepreneurial action vis-à-vis the academic entrepreneur herself, her self-reported motivations, and how motivations evolve over time.

According to Hayter (2011), the choice of faculty (and students) to engage in technology transfer activities, including the establishment of a university spinoff company, is a critical component of university economic development efforts. However, academic entrepreneurs are trained and socialized as scientists, a specific professional identity and culture, which can itself present a barrier to entrepreneurial success (Bozeman et al. 2001; Crane 1972; Hayter 2013, 2015; Ruef et al. 2003).

Following Hayter (2011), this paper finds that academic entrepreneurs are motivated by a plurality of factors. Specifically, respondents are motivated primarily by what Lam (2011) terms "the ribbon," funding and reputational benefits closely aligned with their academic responsibilities. Reflected in the primary motivation, operating a spinoff company provides access to SBIR awards and other important resources for translational research. Reflected in the second motivation, faculty used spinoffs and the additional resources available through programs such as SBIR to enhance their traditional university research teaching and research responsibilities.

Academic entrepreneurs within the sample seem to also exemplify Lam's (2011) 'identification' behavior, whereby significant benefits are recognized through entrepreneurial behavior otherwise incongruent with the values of traditional university faculty. Respondents do not take issue with entrepreneurship and, in fact, see themselves as intermediaries for commercially-valuable knowledge. However, neither have they fully embraced neoclassical economic values (i.e. Lam's integration) evidenced by their views on financial gain and emphasis on traditional academic responsibilities.

Technology commercialization and, related, financial gain are certainly part of the entrepreneurial lexicon within our sample. Further, several academic entrepreneurs are associated with spinoffs that by all accounts have enjoyed extraordinary commercial and financial success. However, the relative importance of short-term, market-oriented motivations within our sample has declined over time. The reason, according to academic entrepreneurs, is a better understanding of the difficulty and uncertainty associated with technology commercialization. The second, is recognition of their own limited capabilities, resources, and networks—and the lack of robust policy solutions that might help them overcome these difficulties, especially after the initial startup phase.

Absent significant resources and augmented capabilities, many academic entrepreneurs in the sample have decided *not* to focus on commercialization, though the inability to commercialize technology is not viewed by academic entrepreneurs as a failure per se. Instead, academic entrepreneurs adopted a contract research business model for the spinoff supported by SBIR awards, industry contracts, and consulting agreements. Respondents believe that while this role is not specifically focused on commercialization that their spinoffs nonetheless play a critical role in society, contributing to product development and commercialization within *other* companies while enhancing their teaching, mentoring, and research contributions to their home university.[4]

Further, this paper highlights the emergence of specific managerial considerations among academic entrepreneurs, including fiduciary concerns for employees and ways that spinoffs can operate more flexibly by avoiding the administrative requirements of universities. On the latter point, future research might investigate the role of university spinoffs in what Markman et al. (2008) calls 'out the back door patenting' or what Link et al. (2007) term 'informal technology transfer'; recent research shows that most university spinoffs are established without formal IP (Fini et al. 2010). Scholars might investigate these types of spinoffs and how they differ from IP-based spinoffs.

Relating to the development of public entrepreneurship theory, Leyden and Link (2015) focus on the indirect nature of public entrepreneurship and do so from the perspective of the federal government. The authors discuss the Small Business Act of 1982—the enabling

[4] Lowe's (2006) model of university invention development anticipated the translational research role of university spinoffs; he posited that inventions associated with high levels of tacit knowledge will typically be developed via inventor-founded start-up firms though he did not indicate how this would occur. Similarly, Karnani (2013) discusses the role of 'tacit knowledge start-ups' and their importance for innovation.

legislation for SBIR—as an excellent example of public entrepreneurship, supported by the findings of this paper. Interestingly, it seems that the SBIR program is itself an opportunity recognized (i.e. opportunity recognition discussed above) by faculty who then establish a spinoff company (demonstrating entrepreneurial action) in order to exploit that opportunity. As discussed in Sect. 2, the success of indirect forms public entrepreneurship eventually depends on the extent to which robust networks are created among economic actors.

Previous studies demonstrate that the SBIR program plays an important role in technology commercialization within small businesses writ large (e.g. Link and Ruhm 2009; Link and Scott 2010). However, it remains to be seen if SBIR awards play an enabling role for university spinoffs or if the awards themselves are the primary objective of academic entrepreneurs. Thus, while Leyden and Link (2015) focus on indirect public entrepreneurship and this paper examines individual entrepreneurial motivations associated with direct public entrepreneurship, scholars should also consider viewing university policies and management decisions as (potential) acts of indirect public entrepreneurship and the extent to which they are successful. Recalling Rizzo (2015): to what extent does university policy effectively 'push' faculty (and others) toward successful public sector entrepreneurship?

Similar to shortcomings discussed in Hayter (2011) the findings in this paper are limited to a small, non-random sample and thus its contributions are more exploratory in nature. Further, the paper does not claim external validity or application within other contexts. However, its contributions are enabled by the paucity of research on entrepreneurial motivations within an academic context. This paper's findings also reinforce the importance of what Franklin et al. (2001) terms surrogate entrepreneurs, motivated, professional (i.e. non-faculty) spinoff managers as well as discussions as to the role and appropriate success metrics for university spinoffs writ large.

Future research that addresses success among academic entrepreneurs might build on the seeds herein in the following ways. First, scholars could study the interplay between the unique motivations of faculty entrepreneurs and policies and programs meant to promote and support academic entrepreneurship. University and regional policies typically assume that university spinoffs embody growth-oriented, profit-making roles without considering the unique motivations (and potential contributions) of their academic founders. Related, scholars might investigate and conceptualize different 'business models' for university spinoffs. This paper has introduced one—the low-growth contract research firm—but many other forms likely exist. Finally, this paper has introduced definitions of entrepreneurial success that include traditional university responsibilities. Future work should not only delve deeper into this topic, it could also employ public sector entrepreneurship as an appropriate theoretical lens to understand how these enhancements might contribute to the public weal.

References

Acs, Z., Braunerhjelm, J. P., Audretsch, D. B., & Carlsson, B. (2009). The knowledge spillover theory of entrepreneurship. *Small Business Economics, 32*(1), 15–30.

Baumol, W. J. (2010). *The microtheory of innovative entrepreneurship*. Princeton: Princeton University Press.

Bekkers, R., Gilsing, V., & van der Steen, M. (2006). Determining factors of the effectiveness of IP-based spin-offs: Comparing the Netherlands and the US. *Journal of Technology Transfer, 31*, 545–566.

Bellone, C. J., & Goerl, F. (1992). Reconciling public entrepreneurship and democracy. *Public Administration Review, 5*(2), 130–134.

Bercovitz, J., & Feldman, M. (2004). *Academic entrepreneurs: Social learning and participation in university technology transfer (Mimeo)*. Toronto: University of Toronto.
Bozeman, B., Dietz, J. S., & Gaughan, M. (2001). Scientific and technical human capital: An alternative model for research evaluation. *International Journal of Technology Management, 22*(8), 616–630.
Crane, D. (1972). *Invisible colleges: Diffusion of knowledge in scientific communities*. Chicago: University of Chicago Press.
Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination behavior. *Psychological Inquiry, 11*(4), 227–268.
Djokovic, D., & Souitaris, V. (2008). Spinouts from academic institutions: A literature review with suggestions for further research. *The Journal of Technology Transfer, 33*, 225–247.
Fini, R., Lacetera, N., & Shane, S. (2010). Inside or outside the IP system? Business creation in academia. *Research Policy, 39*, 1060–1069.
Franklin, S., Wright, M., & Lockett, A. (2001). Academic and surrogate entrepreneurs in university spin-out companies. *Journal of Technology Transfer, 26*, 127–141.
Gatewood, E., Shaver, K., & Gartner, W. (1995). A longitudinal study of cognitive factors influencing startup behaviors and success at venture creation. *Journal of Business Venturing, 10*, 371–391.
Harvey, J., Yarkin, K., Lightner, J., & Town, J. (1980). Unsolicited interpretation and recall and interpersonal events. *Journal of Personality and Social Psychology, 35*, 556–568.
Hayter, C. S. (2011). In search of the profit-maximizing actor: Motivations and definitions of success from nascent academic entrepreneurs. *Journal of Technology Transfer, 36*, 340–352.
Hayter, C. S. (2013). Harnessing university entrepreneurship for economic growth: Factors of success among university spin-offs. *Economic Development Quarterly*, *27*(1), 17–27.
Hayter, C. S. (2015). Social networks and the success of university spinoffs: Toward an agenda for regional growth. *Economic Development Quarterly, 29*, 3–13.
Karnani, F. (2013). The university's unknown knowledge: Tacit knowledge, technology transfer and university spin-offs findings from an empirical study based on the theory of knowledge. *Journal of Technology Transfer, 38*(3), 235–250.
Kenney, M., & Patton, D. (2005). Entrepreneurial geographies: Support networks in three high-technology industries. *Economic Geography, 81*(2), 201–228.
Kezar, A. J. (2004). Obtaining integrity? Reviewing and examining the charter between higher education and society. *The Review of Higher Education, 27*(4), 429–459.
Kezar, A. J., Chambers, T. C., & Burkhardt, J. C. (2004). *Higher education for the public good: Emerging voices from a national movement*. San Franscisco, CA: Jossey-Bass.
Kirzner, I. M. (1973). *Competition and entrepreneurship*. Chicago, IL: University of Chicago Press.
Klein, P. G., Mahoney, J. T., McGahan, A. M., & Pitelis, C. N. (2010). Toward a theory of public entrepreneurship. *European Management Review*, *7*, 1–15.
Knight, F. H. (1921). *Risk, uncertainty, and profit*. Boston: Houghton Mifflin.
Lam, A. (2011). What motivates academic scientists to engage in research commercialization: 'Gold', 'ribbon' or 'puzzle'? *Research Policy, 40*, 1354–1368.
Leyden, D. P., & Link, A. N. (2015). *Public sector entrepreneurship: US technology and innovation policy*. New York: Oxford University Press.
Link, A. N., & Link, J. (2009). *Government as entrepreneur*. Oxford: Oxford University Press.
Link, A. N., & Ruhm, C. (2009). Bringing science to market: Commercializing from NIH SBIR awards. *Economics of Innovation and New Technology, 18*, 381–402.
Link, A. N., & Scott, J. T. (2010). Government as entrepreneur: Evaluating the commercialization success of SBIR projects. *Research Policy, 39*, 589–601.
Link, A. N., Siegel, D. S., & Bozeman, B. (2007). An empirical analysis of the propensity of academics to engage in informal university technology transfer. *Industrial and Corporate Change, 16*(4), 641–655.
Lowe, R. A. (2006). Who develops a university invention? The impact of tacit knowledge and licensing policies. *Journal of Technology Transfer, 31*, 415–429.
Markman, G., Giandonis, P., & Phan, P. (2008). Full-time faculty or part-time entrepreneurs. *IEEE Transactions on Engineering Management*, *55*(1), 29–36.
Murray, F. E. (2004). The role of academic inventors in entrepreneurial firms: Sharing the laboratory life. *Research Policy, 33*(4), 643–659.
Rhoades, G., & Slaughter, S. (2004). Academic capitalism in the new economy: Challenges and choices. *American Academic, 1*(1), 37–59.
Rizzo, U. (2015). Why do scientists create spinoffs? The influence of context. *Journal of Technology Transfer, 40*, 198–226.
Ruef, M., Aldrich, H. E., & Carter, N. M. (2003). The structure of founding teams: Homophily, strong ties, and isolation among US entrepreneurs. *American Sociological Review, 68*(2), 195–222.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*(1), 54–67.

Schumpeter, J. A. (1926). *The theory of economic development* (2nd ed.), reprinted in R. Opie (trans.) (1934). Cambridge, MA: Harvard University Press.

Shane, S. A. (2004). *Academic entrepreneurship: University spinoffs and wealth creation*. Northampton, MA: Edward Elgar.

Shane, S., & Stuart, T. (2002). Organizational endowments and the performance of university start-ups. *Management Science, 48*(1), 154–170.

Stephan, U., Hart, M., & Drews, C. (2015). *Understanding motivations for entrepreneurship: A review of recent research evidence*. Birmingham: Enterprise Research Center, University of Sheffield.

Terry, L. D. (1993). Why we should abandon the misconceived quest to reconcile public entrepreneurship with democracy: A response to Bellone and Goerl's "Reconciling public entrepreneurship and democracy". *Public Administration Review, 53*(4), 393–395.