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THE ENTREPRENEURIAL INTENTIONS OF ACADEMIC SCIENTIST-INVENTORS



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ABSTRACT

The creation of spinoffs by academic-inventors stimulates economic development and develops state-of-the-art technology (Shane, 2004). In this exploratory study, we examine why academic-inventors commercialize inventions through the creation of a start-up. Drawing on data from a sample of 327 surveys of scientist-inventors from seven major universities around the U.S., we explore the relationship between inventors' motivations to file an invention disclosure (ID) and their intentions to start a spinoff, among other variables. Social motivations had the strongest relationship with intention to start. However, neither research reputation nor institutional context was related to this intention.

INTRODUCTION

The creation of spinoff companies by academic inventors is an increasingly important entrepreneurial phenomenon. University spinoffs stimulate economic development and effectively bring to market socially impactful state-of-the-art technologies (Shane, 2004). However, compared to research on non-university-based new venture formation, our understanding of the processes by which university based spinoffs emerge is sparsely researched (Markman et al., 2005). Furthermore, much of the research on university-based spinoffs focuses on the roles of the universities and their technology transfer offices (TTOs) in spinoff formation. Shane (2004) pointed out that for the creation of an academic spinoff, it is necessary that the inventors of the technology want the company formed. However, despite the importance of the scientist inventor in the spinoff process, the role of the individual scientist remains largely unstudied. Given the value of university-based spinoffs and the importance of the inventors' intentions to exploit their inventions via spinoff, a better understanding of the factors that affect entrepreneurial intentions of scientist-inventors would have theoretical and practical implications for policy makers and university technology transfer practitioners. In order delve into this "black box," we developed an exploratory study to examine two basic research questions: (1) Do scientist-inventors' motivations for filing intellectual property protection paperwork relate to their intentions to start a company? and (2) Do aspects of the university, industry, and technological contexts influence the intentions to start a company?

Our study is unique in its focus on inventors' *intentions* (rather than their *actual* involvement) to commercialize their technology via spinoff and in its attention to data collection in the earliest stages of the venture creation process. Specifically, we assessed entrepreneurial intentions at the point of invention disclosure (ID) filing. The process of a university-based spin-off, or any

commercialization of inventions, begins formally when scientist-inventors file IDs with their university's technology transfer office (TTO), which is the administrative unit charged with facilitating the commercialization of university-based technology. Inventors must disclose all inventions created using university resources and capable of generating intellectual property. Therefore, the ID is the first indication that the inventor believes that there is something more than academic research value in his or her invention.

Due to the dearth of either theory or empirical evidence about academic entrepreneurs' motivations and intentions to start companies, we approach this research inductively. Specifically, we describe actual motivations and intentions and use these descriptions as the basis for a set of exploratory analyses. In the following sections we describe existing research on factors influencing actual spinoff activity in universities; we then use this review to guide our exploration of factors influencing intentions to form companies or otherwise commercialize inventions.

THEORETICAL BACKGROUND

Entrepreneurial intentions

In order to understand the spinoff formation process, we should first understand the motivations that underlie founders' intention to start a business from an invention. Bird (1992) defined intention as "a state of mind directing a person's attention, experience and behavior towards a specific object or method of behaving" (p. 11). Founders are those persons who decide to start firms and act on that decision (Nelson, 2003). Founders exert considerable influence on the organizations they create, and continue to exert influence at least for as long as they continue to remain actively involved in the venture (Gupta & Rubenson, 1998). Founders' intentions represent an important means by which they influence their organizations (Bird & Jelinek, 1988).

Whereas entrepreneurial intentions can span an almost infinite variety of potential areas, most past research on founder intentions focuses on the intention to start a new organization (Douglas & Shepherd, 2002; Krueger Jr. & Reilly, 2000). We focus in particular on the motivational factors that academic inventor/scientists identify as the reasons that underlie their intention to pursue a spinoff. These motivations provide a way of understanding founder intentions more specifically. Here we explore a variety of motivations to pursue the same end, the new venture startup. Examining these varied motivations can provide insight into behaviors that founders undertake in the course of founding and managing their spinoffs. For example, they may form the bases of strategic goals within the spinoff or the processes by which those goals are pursued.

Motivations of academic entrepreneurs

Shane (2004) claimed that scientist-inventors found university spinoffs because they are "entrepreneurial types" who always wanted to start companies. To support this claim, Shane (2004) invoked evidence in the entrepreneurship literature showing that entrepreneurs differ from other members of society in their psychological attributes. Although such psychological attributes have never been tested in a spinoff formation setting, Shane (2004) argued that there is sufficient anecdotal evidence to suggest three basic psychological motivations for inventors to start spinoffs: (1) a desire for wealth; (2) a desire to bring the technology to market (regardless of the financial implications), and (3) a desire for independence. Shane also suggested career-enhancement goals (related to status and university affiliation) as a fourth class of motivations underlying entrepreneurial intentions of scientist-inventors. Beyond psychological attributes, it is plausible that

individual level demographic characteristics could be linked to motivations. Seashore et al. (1989), however, found no relationship between individual level attributes and spinoff formation in their exploration of entrepreneurial behavior among life scientists at major research universities.

While existing research points to potential explanations for academic scientist motivations to be involved in start-ups, it is largely based on anecdote with little systematic theory or evidence to support the conclusions. Also, most of the current wisdom about the motivations of academic entrepreneurs is based on retrospective accounts which are subject to post hoc rationalization and may be colored by outcomes of the decisions. Instead, we step back to an earlier point in the process and examine early motivations to protect intellectual property and begin *any* process of commercialization by the filing of an invention disclosure. We suspect that the individuals' reasons for filing an invention disclosure to protect intellectual property may influence intentions. The motivation to file an ID illuminates the value placed on scientific, commercial or social outcomes (e.g., those who believe that their invention will not get to the public unless they start a company will be motivated to be directly involved in the process of starting a company to do so). Thus, our first research question relates directly to the motivations to file the ID and their relationship to entrepreneurial intentions.

RQ1: Do various types of motivations to file an invention disclosure differentially relate to academic inventor intention to start a company?

There are several different ways that the university technology identified in an ID can be commercialized. Many IDs result in patent filings. A smaller percentage of IDs lead to licensing, and a very small percentage of IDs result in spinoffs. Shane (2004) presents detailed evidence on contextual factors related to the likelihood of each outcome and on the economic impact for universities of these different outcomes. However, we do not know how many inventors started with the intention to commercialize their inventions, nor do we know how their motivations to file an ID are related to their commercial intentions nor estimates of their likelihood of success.

Of course, filing an ID does not guarantee any commercial outcome. It typically indicates the recognition by the inventor that the invention *might* have commercial value. But many IDs are never commercialized in any fashion. In fact, IDs are sometimes filed for other reasons that have little or nothing to do with their actual commercial potential. Specifically, increased pressure by universities to realize value from investments in scientific personnel and continued pressure on scientists to obtain funding for their research have combined to obscure any clear connection between ID filing and an actual intention to commercialize inventions. Thus, mere counts of IDs, or patent filings, or the like, may be very misleading indicators of the actual commercial potential of the technology associated with the IDs being filed at a given university. In order to obtain a deeper understanding of the process of technology commercialization and how it unfolds in a university setting, we set out to gain greater insight into how personal motivations of inventors are related to their startup intentions and their expectations of the outcomes of their inventions.

RQ2: Are various types of motivations to file an invention disclosure differentially related to the expectations of academic inventors that the invention will be patented, licensed to an existing company or will form the basis of a startup?

A key contribution of our study is the examination of the relationship between motivations to file an ID and intention to launch a spinoff. Intention is generally recognized as the single

best predictor for an individual to engage in a specific behavior (Ajzen, 1991). Not surprisingly, this finding had been corroborated in the entrepreneurship literature, where intentions have been found to be the single best predictor for entrepreneurial behavior (Krueger & Reilly, 2000). Thus, understanding how scientists' intentions are formed is potentially valuable to understanding the initiation of the spinoff process. While sparse, existing evidence also led us to examine several other factors that might be related to intentions and expectations. Generally speaking, behavioral theory suggests that past behavior or experience is a strong predictor of intended future behavior. Additionally, the work of several authors (Markman et al., 2005; Powers & McDougall, 2005; Shane, 2004) suggests that differences in location (university resources and culture, TTO policies, regional infrastructure) and industry norms may also play a role in commercialization intent and expectations. In the next section we briefly review the literature on contextual factors and university spinoff activity leading to our research question about the role of context in academic scientists' intentions to start companies.

Contextual factors

The relationship between contextual factors and actual spinoff formation has been explored to some extent (Markman et al., 2005; Powers & McDougall, 2005; Shane, 2004). Further, extant entrepreneurship literature provides evidence that contextual factors may even influence entrepreneurial intentions (Bird, 1988). However, the literature has not directly examined how context influences the entrepreneurial intentions of academic entrepreneurs. Therefore, considering the contextual factors linked to actual spinoff formation should shed some light on their effects on entrepreneurial intentions of inventors in relation to spinoffs.

The university setting is one of the contextual factors that has been linked to the variance in academic spinoffs across universities. The institutional context of the university can have implications for spinoffs for a variety of reasons. First, university policies toward technology transfer can either promote or constrain spinoff creation (Markman, et al., 2005; Shane, 2004). For example, the policy of licensing to spinoffs for equity rather than for cash facilitates spinoff formation, as it reduces the spinoff's capital needs and improves its cash position (Di Gregorio & Shane, 2003). Second, the Technology Transfer Office (TTO) itself represents a powerful source of influence, direction, and support; its characteristics such as structure, resources and expertise can further influence what form of commercialization may be sought (Powers & McDougall, 2005; Shane, 2004). Other factors affecting spinoff formation related to the university setting are the (entrepreneurial) cultural environment of the institution and the presence of entrepreneurial role models among faculty (Shane, 2004).

Beyond the university itself, the external environment surrounding the university has implications for spinoff creation. Regional entrepreneurial networks and clusters (Sorenson & Audia, 2000) may have an impact on scientist-inventors' intentions to start spinoffs as well as access to social capital. Similarly, access to early stage financing sources, especially venture capital, can also foster the emergence of spinoffs (Shane, 2004). Because venture capital firms tend to be clustered around certain geographical areas (Gupta & Sapienza, 1992), the physical location of the university can influence its spinoff activity. Scientists intending to start new businesses, for example, may select universities located in hotbeds of venture capital activity. Furthermore, the presence (or absence) of such funding sources may also influence scientists' expectations of the likelihood that their inventions will result in spinoff or licensing outcomes.

Finally, the industry targeted for the invention can have implications for spinoff and/or licensing options. Certain industries (e.g., biotech) involve lengthy, expensive, and uncertain processes; in such industries creating a spinoff would be relatively rare. Given the importance to spinoff success of protecting the uniqueness and differentiability of an invention, the effectiveness of intellectual property protection in a given industry is also a key determinant of the choice between academic spinoff and licensing (Shane, 2001). Other industry dynamics, such as market segmentation, number of firms in the field, etc, can also affect spinoff formation (Shane, 2004).

The above relationships demonstrate the potential links between the context and spinoff or licensing outcomes. It is worth reminding the reader, however, that the link between these factors and entrepreneurial intentions and expectations of academic entrepreneurs has not been made empirically. Thus, we ask, do aspects of the university, the region, or the technology also influence academic scientists' intention to start companies or their expectation of the likely outcome of their IDs?

RQ3: Is there any relationship between the university setting, geographic location of university, or industry setting and entrepreneurial intentions and expected outcomes of academic inventors?

The Invention Disclosure Process

Before turning to the specific methods we used to explore our research questions, it is helpful to provide detail about the invention disclosure process in order to illustrate its role in (1) early identification of spinoff activity, (2) the option of different motivations to file, and (3) why motivations to file might be linked to start-up intentions. Invention disclosure forms are documents in which inventions are officially recorded and which provide the basis for determining whether the invention is patentable and what information necessary to draft a patent application. Potential intellectual property generation is thus the ultimate purpose of IDs. There are no specific rules for when an invention disclosure has to be submitted. Under existing research funding regulations, researchers have the obligation to assign new intellectual property to the institutions in which they carry out their activities. So, while IDs are "compulsory," inventors can ignore them if they do not believe that their discovery is likely to generate intellectual property. Universities usually want to err on the safe side and provide guidelines to researchers on filing IDs even when unsure of the intellectual property implications of their inventions. Thus IDs are useful as identifiable milestones of inventors' estimations of the existence of intellectual property that may be commercialized.

METHOD

Sample

Our sample included scientist-inventors who filed IDs during 2004 at any one of seven major research universities located across the U.S. Powers and McDougall (2005) found a positive relationship between faculty quality and the number of startup companies formed. Selecting only major research institutions for our sample should control for variation in faculty quality to a certain degree. In accordance with agreements with these institutions, we do not provide the names of these institutions in this paper.

The data we rely upon in this paper came from a brief "screening" survey we administered to identify academic entrepreneurs' intentions at the point of ID. Generally speaking, TTOs gave our

survey to the inventors and had them mail responses directly to us. This process helped provide scientists with a level of anonymity. However, the process prevented us from ensuring that the sampling was absolutely complete or random. Furthermore, the process varied slightly in some instances as some TTOs preferred to follow their own process. TTOs also provided us a profile of IDs filed. Inventors returned completed surveys directly to us via mail. As of January 2005, we had received 327 surveys. These respondents constituted our sample.

Variables and data collection

Although we viewed our effort as a theory creating rather than testing exercise, the existing literature suggested several concepts worth examining; thus, the variables we used for our exploratory analysis are divided into two main categories: (1) variables related to inventors' individual-level factors and (2) contextual variables (institutional setting and industry context).

We examined two types of individual-level variables: those related to the inventors' motivation to file the invention disclosure and those related to their own entrepreneurial experience.

Individual level variables

Items in "reasons to file invention disclosures." Prior to administering the survey, we identified many possible motivations for inventors to file an ID, based on extant research (see theoretical background section) and interviews with scientists and TTOs. We included in our survey the ten reasons for filing the invention disclosure that were identified most frequently in our pilot phase (depicted in table 1.1). We did not attempt to be totally exhaustive because we feared that an excessively long survey would harm the response rate. For the ten included, respondents were asked to indicate which motivations they considered "primary" reasons for filing, and which they considered "secondary" reasons. They were told they could choose as many as they deemed appropriate in each category, but we cautioned them to not include any that did really not factor into their decision to file.

Exploratory factor analysis for "primary" reasons revealed three multi-item dimensions of motivations for ID filing and one motivation ("to establish legal ownership") did not load onto to any other factor. Table 1.1 shows a good three-factor structure for the other items. We grouped into factors all items that loaded at 0.5 or higher on a factor and that did not load on any other factor at 0.35 or higher. Furthermore, the groupings suggested "sensible" collections of three types of motivations: academic research, commercial ends, and social concerns:

Academic research related reasons included enhancing academic reputation, enhancing prospects for future research funding, and advancing future research prospects. *Commercial reasons* included turning the discovery into a finished product, making it broadly available, and simply commercializing the invention). Here is important to note that "make it available to other people" fits Shane's (2004) suggestion that one of the reasons behind spinoff formation is the will of the inventor to make his or her invention available regardless of the financial implications. Thus, our commercial reasons variable includes commercialization for both financial profit motives and market diffusion motives. *Social duty reasons* included enhancing the social good and following university rules as the inventor understood them. As we mention later, it is the enhancing the social good item (and not the "following the rules" item) that accounts for the positive relationship between intention to start the social duty reasons.

Establishing legal ownership of the invention did not fit in any the groups and remained by itself. Almost all inventors cited this as a primary or secondary reason so that there was little variation on this item.

Finally, because there is some evidence in the literature that entrepreneurial experience is positively related to entrepreneurial intentions (Shane, 2004), we included it in our analyses. *Entrepreneurial experience* was measured as a dichotomous variable in which the scientist indicated whether or not s/he had any prior or concurrent experience in creating a startup. We expected entrepreneurial experience to be positively correlated to entrepreneurial intentions.

Contextual variables

University dummy variable. As mentioned earlier, there are reasons to expect that university-specific conditions will vary and that these variances may influence intentions and expectations. Therefore, our analyses include a dummy variable for six of the seven schools. The seventh school (one of the large Midwestern universities) served as the base case in our analyses. That is, a significant coefficient for the East Coast university would indicate that inventors in that university had more (if the coefficient were positive) or less (if the coefficient were negative) inclination to create a startup than those at the base-case school. Coefficients would be similarly interpreted for expectations of the likelihood of spinoff, licensing, or patenting.

Because our sample was limited to leading research universities, we may have failed to detect differences that might relate to university eminence, resources, or policies. However, our sample did contain some degree of institutional variation. For instance, it included both public and private universities. The sample also reflected regional variation as well as historical variations that would likely affect TTO policies and structures, entrepreneurial culture and other factors more directly related to spinoff formation.

Industry setting. In the survey, we asked the inventors to categorize the industry that would best match their invention. We relied on their input in this regard, because many of these inventions reflected a very high degree of technological sophistication. Accordingly, we thought it would be more accurate to permit them to characterize the industry setting in broad terms. We used four main industry categories: Biomedical, engineering, food and software. Technologies that did not fit any of these descriptions were included in a fifth category labeled as “other.”

Regression models and exploratory dependent variables

In our exploratory analysis, we regressed inventors’ intentions to start a spinoff on the individual and context variables, and we did the same with their probability assessments of potential outcomes.

The dependent variable for the first regression was their startup intentions and the data were collected in a survey item that asked respondents to state their intentions to start a company based on their invention. The response for this survey item was binomial (Yes/No) so the dependent variable for the entrepreneurial intentions regression was dichotomous in nature.

The dependent variables for the expectations regressions were the inventors’ probability assessments (as percentage likelihood between 0% and 100%) that the invention will be patented,

licensed to an existing company or form the basis for a new company. These data were also collected via survey.

To summarize, the three dependent variables utilized in the expectations regressions were:

1. Likelihood (probability from 0% - 100%) that the invention will form the basis for a startup.
2. Likelihood (probability from 0% - 100%) that the invention will be licensed to an existing company.
3. Likelihood (probability from 0% - 100%) that the invention will be patented.

We used LOGIT regression for the startup intentions model and regular OLS regressions for the expectations models. The university and industry settings were controlled for by including them as dummy variables and leaving as a base one of each out of the equations. One of the Midwestern universities was utilized as a base case, and the biomedical industry was also chosen for this purpose. The individual-level independent variables were all binomial. In these cases, respondents either checked or left blank each of the various ID-filing motivations that we proposed. Entrepreneurial experience was also provided as Yes/No dichotomous data.

RESULTS

Table 1.2 presents descriptive statistics and bivariate correlations. 19.3% of inventors surveyed (63 out of 327) responded positively to the question of startup intentions. In addition, as expected, there was a substantial correlation between the presence of positive startup intentions and a high probability assessment that the technology would form the basis for a company. The mean probability assessment for this outcome was 20%. Also, not surprisingly, the other, more common forms of commercialization (licensing and patenting) were associated with higher probability assessments. For example, the mean probability assessment of the technology being licensed to existing companies was 54% and the patenting probability was assessed at 63% on average.

Commercial reasons to file the ID were positively correlated with entrepreneurial intentions and with higher probability assessments of spinoff formation. They were even more significantly correlated with higher probability assessments of licensing. On the other hand, commercial motivations were uncorrelated with patenting.

Interestingly, social duty reasons were correlated with both spinoff measures and with patenting expectations but not with licensing expectations. Prompted by this result, we conducted an additional analysis in which the single item corresponding to the motivation, “enhancing the social good,” was regressed as an independent variable, rather than as part of the larger social duty factor. Doing this revealed that it was positively correlated to intentions to start a spinoff. The coefficient associated with this item also came out significant in a regression analysis. On the other hand, academic research motivations were not correlated with any of the dependent variables.

The regression models are depicted in table 1.3. As these models reveal, social-duty motivations exhibited the strongest relationship with startup intentions. Commercial motivations were also significantly related, but less so than social motivations. The results were similar for the probability assessments of spinoff as an outcome, a result which suggests considerable correla-

tion between intentions and expectations. Entrepreneurial experience was significant in all models except for the licensing probability assessment. Neither research motivations nor institutional context was related to intention to start. However, institutional and industry context and startup experience were strongly related to estimates of the probabilities of patenting, licensing or starting new ventures with their ideas.

DISCUSSION

In this study we set out to explore the relationship between motivations for academic scientist-inventors to file invention disclosures and their intentions to start a university spinoff. We also looked at the relationships of other individual-level and context-related factors with startup intentions as well as the relationships between these variables and inventors' expectations regarding potential outcomes of filing invention disclosures. Some of the results of these exploratory analyses are intuitive, but others are less so.

Reasons to file invention disclosure

In terms of answering our first two research questions, the results of our exploratory model suggest that there is in fact a relationship between some of the motives for filing an invention disclosure and the inventors' early intentions to start a spinoff. That the desire to disseminate and commercialize the technology had a relationship with intentions to start a spinoff was not surprising, lending support to Shane's arguments (2004) that desire for wealth and a desire to bring technologies to market act as catalysts for spinoff creation. Commercial and technology dissemination motivations played even a greater role in the inventors' expectations of licensing and no role in their expectations for patenting. This last observation was not surprising given the fact that the initiative of patenting the invention is often a responsibility of the TTO and, accordingly, lies outside the control of inventors themselves, who may or may not have commercialization objectives.

More interesting was the fact that the social good was the motivation that exhibited the strongest relationship with entrepreneurial intentions. This motivation can have some connection with the goal of bringing the technology to market; in fact the commercial and the social duty factors were significantly correlated. At the same time, it also points to a completely non-commercial argument, in this sense: It would imply that the strongest motivations to start a spin-off would be to enhance the social good, regardless of financial considerations. This potential implication was reinforced by the results of the probability assessment regressions. Social duty motivations were significant both for higher probability assessments of spinoffs and patents as outcomes, but this was not true for licensing, which can be considered a purely commercial outcome. This is also consistent with anecdotal evidence observed during interviews that indicated that some scientists were on a crusade to get their valuable ideas to the world regardless of their immediate commercial viability. Some of these inventors saw themselves as the only chance for their inventions to reach the market and benefit the public. In other words, they did not seem to believe that a third party acting purely out of a profit motive would carry out these plans. This was a potentially interesting result, and it has implications for both academics and practitioners. Many of the public policy initiatives geared towards promoting academic spin-off activities emphasize the economic incentives and the focus on the financial rewards for inventors engaged in spin-off activity. But it may be that different kinds of policies that instead emphasize the societal benefits of spinoffs would have a stronger effect on inventors intentions and ultimately on spin-off formation activity.

Contextual setting

Our exploration of RQ3 revealed that the institutional context of the university was not significantly related to entrepreneurial intentions. This is not necessarily at odds with previous findings reported in the literature, which show that university setting influences spinoff activity. One of the Midwestern universities showed a significant negative relationship with the probability assessment for all the potential outcomes. Inventors' intentions in that university may not be affected by the institution, but their expectations on the probabilities of startup, licensing and patenting may be, perhaps reflecting university policies or TTO characteristics. This dissonance between intentions and expectations is interesting and warrants further research. On the other hand, the university setting *did* seem to matter for the expectations to obtain a patent for the invention. This may reflect on patenting policies at different institutions.

The fact that only the food industry showed a significant (and negative) relationship with both entrepreneurial intentions as well as with licensing and patenting expectations may support the argument that the industry setting affects the spinoff formation process from its early stages.

Limitations, implications and future research

We conducted here an exploratory study informed by fragments of theory and anecdotal interview data. Accordingly, we emphasize that our data and analyses are highly limited with regard to their ability to conclusively address the questions we raise. For example, certain aspects of our sample selection (notably, our focus on only seven major U.S. universities) may have reduced variation in the contextual factors that we explored. In addition, our sample included universities in the East Coast, the West coast and the Midwest, so the geographic dispersion of the universities in our sample introduced the element of the external environment of the university. Given that there is some evidence in the literature of the influence of the external environment in spinoff formation (Shane, 2004), it would not be possible to separate the effects of the institutions themselves and of the external environments in which they are located.

Moreover, the construct validity for the motivations that we studied could be questioned. Again, however, the purpose of this study was not to test theory empirically but to shed some light on a set of research questions related to academic entrepreneurship and to potentially illuminate further theory-building efforts. We think the early-stage entrepreneurial intentions data that we use here are useful in advancing this goal.

The implications of our exploratory findings for further theory building and for policy makers are that there may be a host of social good motivations behind the entrepreneurial intentions of scientist-inventors that have been hitherto overlooked. Fine-tuning and operationalizing this construct for more rigorous empirical testing could be a worthwhile exercise. Similarly, policy-makers concerned with increasing university spinoff activity should look into other ways of influencing the entrepreneurial intentions of scientists-entrepreneurs beyond the incentives constructed around financial returns and market penetration.

For future analysis, it would be interesting to follow up on these inventors and obtain data on actual spinoff formation. This could be then compared to the early intentions to start expressed in this study for the purpose of examining the relationship between entrepreneurial intentions and actual spinoff formation. Also, some other items in the survey not discussed for this study, including some that referred to the early intentions of inventors with regard to working with others

– i.e., with regard to relationships that could form the basis of entrepreneurial teams. We found no relationship between these early entrepreneurial intentions and inventors' early team-building activities, but future data on actual spinoff formation could be analyzed against the early team formation activities of inventors.

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Table 1.1 Rotated component Matrix (a) – Reasons to file ID

Component	1	2	3
Advance research	0.79	0.12	0.04
Enhance academic reputation	0.77	0.08	-0.08
Enhance prospects of further research	0.81	0.08	0.04
Establish legal ownership	-0.28	0.36	-0.09
Get hep determining what to do	0.26	0.65	-0.09
Turn into finished product	0.19	0.67	0.15
Start process of commercialization	-0.10	0.77	0.06
Follow the rules	-0.02	-0.13	0.78
Enhance the social good	0.01	0.28	0.77
Make invention available to other people	0.33	0.57	0.33

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

(a) Rotation converged in 4 iterations.

Table 1.2 Descriptive and correlations

	Mean	s.d.	N	1	2	3	4	5	6	7	8			
1 Intention to start	0.19	0.39	327	1.00										
2 Startup probability	0.20	0.27	292	0.68 **	1.00									
3 License probability	0.54	0.30	314	-0.10	0.07	1.00								
4 Patent probability	0.63	0.34	316	0.27 **	0.43 **	0.30 **	1.00							
5 Research goals	0.35	0.39	327	0.01	-0.01	0.07	-0.14 *	1.00						
6 Commercial goals	0.30	0.32	327	0.13 *	0.13 *	0.33 **	-0.07	0.29 **	1.00					
7 Social duty goals	0.22	0.33	327	0.22 **	0.16 **	0.03	0.19 **	0.04	0.23 **	1.00				
8 Establish ownership	0.76	0.43	327	0.09	0.13 *	0.01	0.11 *	-0.09	0.10	0.04	1.00			
9 Experience	0.32	0.47	324	0.29 **	0.28 **	-0.08	0.17 **	-0.10	0.03	0.07	-0.07	1.00		
10 West University 1	0.16	0.37	327	0.10	0.11	-0.22 **	0.17 **	-0.06	-0.15 **	0.00	0.07		1.00	
11 West University 2	0.08	0.27	327	0.11 *	0.01	0.04	0.07	-0.05	0.05	0.10	-0.05			1.00
12 East University 1	0.15	0.36	327	0.03	0.12 *	-0.06	0.10	-0.05	-0.06	-0.12 *	-0.01			
13 Midwest University 1	0.12	0.33	327	-0.04	-0.03	0.04	0.02	-0.07	0.02	-0.01	-0.01			
14 Midwest University 2	0.06	0.23	327	-0.08	-0.14 *	-0.21 **	-0.24 **	0.14 *	-0.06	-0.04	-0.24 **			
15 Midwest University 3	0.17	0.37	327	-0.03	0.02	0.15 **	0.22 **	0.00	0.01	0.14 *	0.06			
16 Engineering industry	0.35	0.48	327	0.11	0.08	-0.06	0.22 **	0.03	-0.21 **	-0.11 *	-0.02			
17 Food industry	0.13	0.34	327	-0.14	-0.20 **	0.27 **	-0.3 **	0.13	0.27 **	0.00	0.02			
18 Software industry	0.05	0.22	327	0.00	0.06	-0.08	0-0.10	-0.04	0.02	0.09	0.03			
19 Other industry	0.02	0.15	327	0.02	0.01	0.10	0-0.02	-0.08	0.16 *	0.05	-0.10			
	Mean	s.d.	N	9	10	11	12	13	14	15	16	17	18	
1 Intention to start	0.19	0.39	327											
2 Startup probability	0.20	0.27	292											
3 License probability	0.54	0.30	314											
4 Patent probability	0.63	0.34	316											
5 Research goals	0.35	0.39	327											
6 Commercial goals	0.30	0.32	327											
7 Social duty goals	0.22	0.33	327											
8 Establish ownership	0.76	0.43	327											
9 Experience	0.32	0.47	324	1.00										
10 West University 1	0.16	0.37	327	0.07	1.00									
11 West University 2	0.08	0.27	327	0.09	-0.13 *	1.00								
12 East University 1	0.15	0.36	327	0.05	-0.18 *	-0.12 *	1.00							
13 Midwest University 1	0.12	0.33	327	-0.04	-0.16 **	-0.11 *	-0.16	1.00						
14 Midwest University 2	0.06	0.23	327	0.12 *	-0.11	-0.07	-0.10	-0.09	1.00					
15 Midwest University 3	0.17	0.37	327	-0.12 *	-0.20 **	-0.13 *	-0.19 **	-0.17 **	-0.11 *	1.00				
16 Engineering industry	0.35	0.48	327	0.01	0.26 **	-0.01	0.15 **	0.02	-0.18 **	-0.09	1.00			
17 Food industry	0.13	0.34	327	-0.19 **	-0.14 **	-0.05	-0.16 **	-0.12 *	-0.09	-0.05	0.28 **	1.00		
18 Software industry	0.05	0.22	327	0.02	0.02	-0.07	0.06	-0.08	0.19 **	-0.06	-0.17 **	-0.09	1.00	
19 Other industry	0.02	0.15	327	0.02	-0.07	0.03	-0.01	0.00	-0.04	0.09	-0.12 *	-0.06	-0.04	1.00

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 1.3 Regression analysis

Dependent variables	Startup intentions (LOGIT)	Startup probability	License probability	Patent probability
Beta values				
Individual factors				
ID filing motivation				
Research goals	0.44	0.28	-0.02	-0.05
Commercial goals	1.02 *	1.21 **	0.25 ***	0.01
Social duty goals	1.33 **	0.82 *	-0.05	0.15 *
Establish ownership	0.48	0.06	-0.04	0.06
Experience	1.45 ***	0.16 ***	-0.01	0.10 **
Context factors				
University setting				
West University 1	0.48	0.07	-0.13 **	0.22 ***
West University 2	0.75	0.00	0.02	0.17 **
East University 1	0.26	0.08	-0.05	0.19 ***
Midwest University 1	-0.18	0.01	0.02	0.13 **
Midwest University 2	-1.28	-0.17 **	-0.23 **	-0.18 **
Midwest University 3	-0.01	0.04	0.10	0.29 ***
Industry setting				
Engineering industry	0.52	0.02	0.06	0.06
Food industry	-1.46 *	-0.13	0.16 **	-0.20 ***
Software industry	-0.11	0.06	0.01	-0.12
Other industry	0.02	-0.02	0.08	-0.11
Constant	-3.49	0.03	0.49	0.41
Model				
F		4.61 ***	5.99 ***	10.03 ***
R ²		0.20	0.23	0.34
R ² adjusted		0.16	0.19	0.30

*** Significant at the 0.01 level (2-tailed).

** Significant at the 0.05 level (2-tailed).

* Significant at the 0.10 level (2-tailed).