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S Y M P O S I U M

ACADEMIC ENTREPRENEURSHIP: THE ROLES OF IDENTITY, MOTIVATION, CHAMPIONING, EDUCATION, WORK-LIFE BALANCE, AND ORGANIZATIONAL JUSTICE

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The burgeoning literature on academic entrepreneurship primarily incorporates macro-level ideas and tools from fields such as economics, sociology, strategy, and public policy. Most of this research focuses on institutional, economic, and demographic variables from a macro perspective, rather than examining micro processes that may be associated with academic entrepreneurship. The literature also tends to stress formal, as opposed to informal, mechanisms of academic entrepreneurship. We assert that a consideration of various micro-level processes is also useful for improving our understanding of academic entrepreneurship. We draw heavily on the organizational behavior literature to consider how micro processes, specifically processes associated with identity, motivation, leadership/championing, education, work-life balance, and organizational justice, may help explain scientists' engagement in academic entrepreneurship. We present some preliminary qualitative findings that support this perspective.

The passage of the Bayh-Dole Act in the United States in 1980 resulted in a substantial increase in patenting, licensing, and start-up creation at U.S. research universities (Grimaldi, Kenney, Siegel, & Wright, 2011). This commercialization of university-based research is often referred to by scholars as academic entrepreneurship (AE). The Bayh-Dole Act stipulates that university researchers who are funded by a federal research grant (e.g., by the National Institutes of Health, the National Science Foundation, or another federal agency) are required to disclose their inventions to the university. Research universities, in turn, have established technology transfer offices (TTOs) to manage the commercialization of university-owned intellectual property (Link, Siegel, & Wright, 2015). Successful university technology transfer requires that faculty and university administrators (especially TTO personnel) work together to patent, license, or start a new company aimed at commercializing an invention or discovery.

The rise in university technology commercialization has attracted considerable attention from management scholars seeking to understand the variables that enhance AE. Most of these studies have been conducted by researchers in three fields of management: entrepreneurship, technology innovation management, and strategic management. Academics in other social sciences, including economics, sociology, political science, and public policy, have also made significant

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contributions to the analysis of AE (for comprehensive reviews, see Perkmann et al., 2013; Rothaermel, Agung, & Jian, 2007; Siegel & Wright, 2015).

AE scholars have exhibited methodological diversity (e.g., employing both quantitative and qualitative methods) and have examined AE in many different countries and institutional contexts. However, academic research on AE has not demonstrated the same type of breadth with respect to levels of analysis. While there are examples of research on AE at the micro level (e.g., Jain et al. 2009; studies reviewed in Perkmann et al., 2013), the majority of research on AE has a macro-level orientation. Furthermore, the scholars who have engaged in micro-level research have largely examined individual characteristics associated with AE (e.g., empirical studies of the propensity of academics to patent and engage with industry; see Perkmann et al., 2013; Rothaermel et al., 2007). However, we contend that there are many micro *processes* that may be critical drivers of individual decisions related to AE that have yet to be investigated.

In this paper, we argue that a lack of scholarly emphasis on various micro processes, and how these processes are influenced by the technology transfer context, has limited our understanding of AE. This is the case even though, as we subsequently explicate, at least some AE research points to the importance of considering micro processes in the context of technology transfer.

In addition to limited investigation of micro processes, scholarship on AE has largely examined only formal, as opposed to informal, mechanisms of AE. This may be due in part to the availability of systematic data on university-based patents, licenses, and start-ups, which constitute proxies for formal technology transfer efforts (e.g., benchmarking data collected on an annual basis by the Association of University Technology Managers, or AUTM; see AUTM, 2016). In contrast, data regarding informal technology transfer processes are not readily available in annual public reports, and thus are difficult to obtain. No matter the reasons, a significant portion of AE may not involve formal, university-approved mechanisms (Kumar, 2010; Markman et al., 2005). Therefore, it is important to examine both formal and informal mechanisms of AE, as well as the micro processes involved in individuals' decisions to use one over the other—or to even engage in AE at all.

The purpose of this article, thus, is to begin a conversation aimed at achieving a more complete understanding of AE by examining micro processes at the intra-individual, relational, and organizational levels as they pertain to the context of academic entrepreneurship. We begin by selectively reviewing how macro-level research in AE suggests the need to examine such processes for both formal and informal technology transfer. Next, we show how various micro processes from the organizational behavior literature can be examined within the context of AE, including both formal and informal technology transfer. Finally, we provide some qualitative evidence from an ongoing project funded by the National Science Foundation (NSF). The qualitative data are derived from 30 interviews of faculty and TTO officials at two major research universities that highlight the importance of micro processes in AE. We use our perspective, in conjunction with the qualitative evidence we present, to put forward some preliminary ideas for future research in this area.

ACADEMIC ENTREPRENEURSHIP STUDIES WITH MICRO-LEVEL IMPLICATIONS

Micro Processes and Formal Versus Informal Technology Transfer

Before presenting a brief review of AE studies with micro implications, we wish to define some terms we will use in the remainder of the article. First, our key unit of observation for adopting a micro perspective of AE is the *faculty member*. Throughout this article, we will use *faculty member* as a generic term. This term refers to all of the scientists and engineers, including postdocs, who engage in university research.

Second, consistent with Snijders and Bosker (2012), we define micro-level variables as those that measure phenomena related to the primary unit of observation for a given AE system. For these systems, we consider the individual faculty member (or other individual engaged in research at the university) to be the key unit of observation. We also take into consideration the role of other individuals, such as department chair and center director, and TTO employees. Faculty members and their relationships with such individuals represent the most basic level at which decisions to engage in AE, along with whether to use formal or informal AE processes, are made. Thus, when considering micro processes, we are referring to cognition (or perceptions) and behavior that unfold over time and affect the extent to which AE behavior materializes.

Notably, our paper differentiates among three different types of micro processes within AE. First, there

are micro processes that are self-contained within the individual, which we refer to as intra-individual. They incorporate cognitive or affective phenomena that could ultimately influence AE behavior. Second, at the relational level, micro processes reflect the interaction between individual scientists and other individuals, such as department chairs and TTO personnel. Third, there are micro processes that are associated with how organizational-level factors, such as a university's technology transfer policies, influence individual faculty members in their AE endeavors.

Another important distinction is the one between formal and informal technology transfer. As noted earlier, in the United States, the Bayh-Dole Act requires researchers to disclose an invention that arises from federally funded research. Additional laws and policies have been established by other countries and states, as well as by each individual university. These regulations establish a specific path by which faculty and others engaged in university research are required to proceed to commercialize a technology. We consider formal technology transfer to have taken place when individuals have chosen to follow this path.

When individuals transfer technology via a different path, informal technology transfer has taken place. It is important to note that choosing not to follow the formalized path does not necessarily mean that an individual has broken any laws or even technically violated university policy. For example, a faculty member who advances a technology through research with a graduate student, gives the technology to the graduate student upon graduation, and then is hired as a consultant by the company the graduate student starts based on that technology has not violated any laws or policies. In such an instance we would argue that the scientist did engage in informal technology transfer.

The Role of the Technology Transfer Office

Unlike a corporate setting, which may rely on organizational designs that allow for an integrated and networked research and development group, faculty members are often disconnected from the research that occurs in other departments (DeSanctis, Glass, & Ensing, 2002). As such, a TTO may serve to connect faculty members to individuals both within and outside the university. This important entity has become one of the most commonly studied aspects in AE research. Table 1 summarizes some of the most widely cited articles on AE, which have most frequently focused on the TTO or the university as the unit of analysis. For each of these studies (which are arranged in chronological order), we identify the unit of observation, the aspects of AE analyzed, the disciplinary orientation of the authors (e.g., economics, sociology, strategy, or public policy), and the article's key results. Consistent with the extant literature, the focus of the majority of these articles is at the macro/institutional level. However, as shown in Table 1, many of the article findings suggest that micro-level processes may also have a significant impact on AE.

A number of studies of AE have focused on the role of the TTO as an agent of the university. As noted earlier, universities established TTOs to manage the commercialization of intellectual property arising from federally funded research. Faculty members who wish to patent, license, or form a new company based on this intellectual property are required by law and/or contractual obligations to work through the university TTO. We refer to this process as "formal" technology transfer because the faculty member formally discloses his or her inventions to the university via the TTO. An advantage of engaging in formal technology transfer is that technology transfer officers may be able to connect faculty with others who are involved in similar technology development to more widely exploit the knowledge base. Such an "open innovation" approach may lead to quicker technology transfer and increased benefits for all parties involved (Lichtenthaler, 2011).

Articles that examine TTOs typically focus on modeling and explaining TTO performance. That is not surprising because, until recently, management and commercialization of intellectual property at universities was a relatively new activity. Thus, there was substantial academic, practitioner, and government interest in identifying best practices and optimal institutional and public policies to support effective commercialization. Interest in performance and benchmarking issues has risen as universities expand their economic development initiatives and do more to promote entrepreneurship on campus and in the surrounding region.

Studies of AE have also focused on two specific dimensions of commercializing university research: patenting and licensing. Thursby and Thursby (2002) estimated a production function to show that the growth in university patenting and licensing can be attributed to an increase in the willingness of professors

TABLE 1
Selected Articles on Academic Entrepreneurship (AE)

Author(s)	Unit of observation	Aspects of AE analyzed	Disciplinary orientation of the authors	Key results
Zucker, Darby, and Brewer (1998)	Biotech start-ups	Connections of these firms to university "star scientists"	Sociology and economics	The location of star scientists predicts firm entry in biotechnology.
Bercovitz, Feldman, Feller, and Burton (2001)	University (TTO)	Patents and licenses	Strategy	An analysis of different organization structures for technology transfer at Duke, Johns Hopkins, and Penn State demonstrated that differences in structure are related to technology transfer performance.
Shane and Stuart (2002)	A single university (MIT)	University- based start-ups	Sociology and economics	An event history analysis of MIT start-ups reveals that the social capital of company founders is an important endowment for start-ups.
Thursby and Thursby (2002)	University (TTO)	Patents and licenses	Economics	Growth in university licensing and patenting can be attributed to an increase in the willingness of professors to patent and license, as well as outsourcing of R&D by firms.
Siegel, Waldman, and Link (2003)	University (TTO)	Patents and licenses	Economics	Qualitative data demonstrated that organizational practices explain a significant percentage of the variation in AE performance, and that many faculty members are not disclosing inventions.
Link and Siegel (2005)	University (TTO)	Patents and licenses	Economics	Higher royalty shares for faculty members are associated with greater licensing income.
Lockett and Wright (2005)	University (TTO)	University-based start-ups	Regression analysis/ strategy	A university's rate of start-up formation is positively associated with its expenditure on IP protection and TTO business development capabilities and the extent to which its royalty distribution formula favors faculty members.
Link, Siegel, and Bozeman (2007)	Faculty scientists and engineers	Informal AE	Public policy	Considering three types of informal AE by faculty members (knowledge transfer to industry, joint publications with industry scientists, and

TABLE 1
(Continued)

Author(s)	Unit of observation	Aspects of AE analyzed	Disciplinary orientation of the authors	Key results
				consulting), male and tenured faculty are more likely to engage in all three forms of informal technology transfer, and academics who allocate more time to grants are more likely to engage in informal AE.
Bercovitz and Feldman (2008)	Faculty	Invention disclosures	Strategy	The propensity of faculty members to disclose inventions is positively related to the propensity of their department chairs to disclose.
Grimpe and Fier (2010)	Faculty scientists and engineers	Informal AE	Public policy	Same findings as Link, Siegel, and Bozeman (2007) in a German context. "Research group leaders" are more likely to engage in commercialization and consulting.
D'Este and Perkmann (2011)	Faculty scientists and engineers	Informal AE	Public policy	Most faculty members engage with industry to advance their research, not to further commercialization. The primary mechanisms for this activity are joint research with industry scientists, sponsored research, and consulting.
Kenney and Patton (2011)	University	University-based start-ups	Public policy	Inventor ownership universities are more efficient in generating spin-offs. Computer science and electrical engineering generate more spin-offs than life and physical sciences.
Zheng, Miner, and George (2013)	A single university	Licensing agreement associated with university patents	Organizational learning	An event history analysis of patenting licensing at a single university provides empirical support for an integrated model of organizational learning. Specifically, the authors find that learning occurs when both internal failure and success occur across levels. They offer a framework for multilevel internal learning from experience.

TABLE 1
(Continued)

Author(s)	Unit of observation	Aspects of AE analyzed	Disciplinary orientation of the authors	Key results
Rasmussen, Mosey, and Wright (2014)	University start-up (8 case studies)	University-based start-ups	Strategy	Although universities have developed policies to promote start-ups, they must be reinforced by academic departments "on the ground." Academic departments can vary substantially on how enthusiastically they endorse university policies on start-ups, as well as how they allocate resources to these activities.
Rasmussen, Mosey, and Wright (2015)	University start-up (4 case studies)	University-based start-ups	Strategy	In an analysis of social networks among academic entrepreneurs, both strong and weak network ties are shown to be critical to the emergence and growth of new ventures, including the development of key entrepreneurial competencies.
Huyghe, Knockaert, Piva, and Wright (2016)	Faculty scientists and engineers	Informal AE	Strategy	Some bypassing activity may be due to a lack of awareness of the university TTO.
Goel and Göktepe-Hultén (2017)	Scientists at the Max Planck Institutes in Germany	Informal AE	Economics	Greater interaction with industry increases the likelihood of TTO bypassing. Group research leaders are less likely to engage in bypassing.

to patent, without a concomitant fundamental change in the type of research they conduct (i.e., a shift away from basic research toward more applied research). That pattern of behavior by professors implies that at least two micro processes, occurring at the individual level, are relevant. The first micro process involves identity construction and importance (Ashforth, Harrison, & Corley, 2008; Ashforth & Mael, 1989). A professor may not identify as being an entrepreneur, or if that identity does exist, it may be subordinate to that of being a researcher or faculty member.

The second micro process involves life balancing. When deciding how to allocate their time and effort (e.g., work-life balance or role balance), these professors may view AE as a very low priority. Thus, to encourage AE, organizations might need to examine how to help faculty construct and enhance the importance of an entrepreneurial identity (see Brenner, Serpe, & Stryker, 2014; Navis & Glynn, 2011). Additionally, universities may need to structure AE activities in such a way that professors do not perceive it as interrupting their ongoing research and, thus, interrupting their work-life or role balance.

Siegel, Waldman, and Link (2003) used stochastic frontier estimation to assess and explain the relative productivity of 113 university TTOs in the United States. Contrary to conventional economic models, they found that variation in relative AE performance

cannot be completely explained by environmental and institutional variables. Thus, these authors concluded that organizational variables must be critical in explaining why some universities outperform others. To further explore the role of organization practices in AE performance, the authors supplemented their econometric research with qualitative data from 55 structured, in-person interviews of 100 professors, university administrators, and local firms and entrepreneurs at five research universities in Arizona and North Carolina.

This research allowed Siegel et al. (2003) to identify intellectual property policies and organizational practices that can potentially enhance AE. They identified three key impediments to AE with strong micro implications: (1) informational and cultural barriers between universities and firms, especially for small firms, (2) insufficient rewards for faculty involvement in AE, including both pecuniary and nonpecuniary rewards, such as credit toward promotion and tenure, and (3) human resource management problems with licensing officers in the TTO, including a high rate of turnover, a lack of incentive compensation, and insufficient business, marketing, and entrepreneurial experience.

In a subsequent paper, Link and Siegel (2005) found that a particular organizational practice, the royalty distribution formula, which stipulates the fraction of revenue from licensing that is allocated to a faculty member who develops the new technology, can potentially enhance technology licensing. Link and Siegel found that universities that allocate a higher percentage of royalty payments to faculty members tend to be more effective in technology transfer activities. Thus, organizational incentives for university technology transfer appear to be important. This finding was independently confirmed by Friedman and Silberman (2003) and Lach and Schankerman (2004), using slightly different methods and data.

Though the best practices that were examined by Siegel et al. (2003) and Link and Siegel (2005) are considered organizational-level variables (i.e., macro), research suggests that they influence the behavior of the individuals who are responsible for initiating AE (i.e., university professors) through processes associated with motivation and justice. For example, an increase in motivation through rewards and compensation has been associated with an increase in individual performance (see Gerhart & Fang, 2015). Also, policies regarding how rewards are distributed are relevant to individual perceptions of justice, which in turn have been associated with various positive outcomes such as organizational commitment, task performance, and organizational citizenship behavior (see Colquitt et al., 2013). Thus, organizational practices, though important, are only part of the picture. As these studies imply, an understanding of the micro processes through which such practices translate to individual behavior is the other critical piece.

Formal Versus Informal Technology Transfer

Although there exists research on how contextual factors, such as economic or political institutions, may affect technology transfer decisions (Autio, Kenney, Mustar, Siegel, & Wright, 2014), in this section we specifically review the literature concerning how individual-level variables may affect these decisions. When working through the formal technology transfer process, AE typically begins with an invention disclosure by a researcher working on a federal grant. However, based on extensive interviews with academic scientists in the United States, Siegel, Waldman, Atwater, and Link (2004) found that many faculty members were not disclosing their inventions to the university TTO or were creatively bypassing the TTO even after disclosing inventions. This finding is in line with survey research by Thursby, Jensen, and Thursby (2001) and research by Markman, Gianiodis, and Phan (2008), which documented that many technologies are indeed "going out the back door" instead of being commercialized through formal processes. Also, as noted earlier, many faculty members may be reluctant to engage in either formal or informal AE processes for a variety of reasons, including insufficient incentives and human resource management problems in the TTO.

As shown in Table 1, there have been several major studies of informal AE (e.g., D'Este & Perkmann, 2011; Goel & Göktepe-Hultén, 2017; Grimpe & Fier, 2010; Huyghe, Knockaert, Piva, & Wright, 2016; Link, Siegel, & Bozeman, 2007). Note that these studies are based on surveys conducted at the individual (faculty member) level. However, they did not examine the micro processes that we identify later in this paper. These studies also go beyond commercialization to assess broader notions of engagement by academics with industry, such as coauthoring with industry scientists, sponsored research, and consulting. They report a relatively high level of informal technology transfer activity. For example, D'Este and Perkmann (2011) found that most faculty

members engage with industry to advance their research, not to further commercialization or AE more generally. Indeed, there have also been several major academic studies (not shown in Table 1) that focus on co-authoring and patenting activity involving university and industry scientists (e.g., Azoulay, Ding, & Stuart, 2007; Haeussler & Colyvas, 2011).

We conjecture that deciding to engage in AE, whether formally or informally, is a within-person phenomenon with important consequences. If a faculty member chooses not to engage in AE, even though she or he might have a technology that could benefit society, then his or her research activity (which is typically funded by the federal government, a foundation, or industry) results in little value to key stakeholders (e.g., investors, businesses, university, society in general). Also, the transferring of technology through informal rather than formal processes has the potential to deny universities access to potentially lucrative streams of revenue generated by successful technology commercialization. Though certainly influenced by macro variables, the decision to engage in AE and to use informal technology transfer processes is an individual-level decision, and thus cannot be fully understood without examining the micro processes associated with technology transfer.

University-Based Start-ups

TTOs are increasingly focusing on the start-up dimension of university technology transfer. This increase in start-up activity has also attracted considerable attention from scholars in recent years. As shown in Table 1, most empirical studies of entrepreneurial activity at universities are based on the TTO or the university as the unit of analysis.

Although not specifically focused on universities, seminal articles by Lynne Zucker, Michael Darby, and various collaborators explored the role of "star" scientists in the life sciences in the creation and location of new biotechnology firms in the United States and Japan. A star scientist is defined as a researcher who has discovered more than 40 genetic sequences, and affiliations with firms are defined through coauthoring between the star scientist and industry scientists. Zucker, Darby, and Brewer (1998) assessed the impact of these university scientists on the research productivity of U.S. firms. They measured research productivity using three proxies: (1) number of patents granted, (2) number of products in development, and (3) number of products on the market. They found that ties between star scientists and firm scientists have a positive effect on these three dimensions of research productivity, as well as on other aspects of firm performance and rates of entry in the U.S. biotechnology industry. It is interesting to note that the authors also discovered that some of these scientists resigned from the university to establish a new firm, or kept their faculty position but worked very closely with industry scientists.

The Zucker et al. (1998) study highlighted the need to enhance our understanding of the micro processes that make collaborations between academic and industry scientists effective. For example, is the salience of an entrepreneurial identity (see Forehand, Deshpandé, & Reed, 2002; Navis & Glynn, 2011) reduced in an academic setting (as opposed to an industry setting), and are there fewer knowledge spillovers when faculty members work in academic labs? Does working with industry provide higher motivation for star scientists to commercialize their technology, or does it streamline the process of commercialization, thus making it possible for faculty members with low motivation to patent their technology? Do industry leaders inspire scientists to commercialize by presenting a picture of what the scientist could be (e.g., wealthy or famous; see Pratt, 2000), while academic leaders do not? It seems likely that industry leaders would champion commercialization, given that such activity could yield a competitive advantage (Barney, 1991; Jacobson, 1992), while many academic leaders do not have the same focus and therefore may not champion technology transfer. These questions have important implications for how to structure academic–industry scientific partnerships. However, micro-level research in the field of AE is necessary to address them.

Lockett and Wright (2005) examined the relationship between the resources and capabilities of TTOs in the United Kingdom and the rate of start-up formation at their respective universities. In so doing, the authors applied the resource-based view of the firm (Barney, 1991) to the university. This perspective asserts that an organization's superior performance is related, at least in part, to its internal resources and capabilities. Lockett and Wright (2005) used the resource-based view to distinguish empirically between a university's resource inputs and its routines and capabilities. Based on estimations of count regressions (Poisson and negative binomial), the authors concluded that there is a positive relationship between start-up formation and the university's expenditure on intellectual property protection, the business development

capabilities of TTOs, and the extent to which its royalty distribution formula favors faculty members. These findings imply that universities wishing to spawn numerous start-ups should devote greater attention to the selection and development of technology transfer officers with broad-based commercial skills.

Findings presented in O'Shea, Allen, and Chevalier (2005), Lockett and Wright (2005), and Markman, Phan, Balkin, and Gianiodis (2005) imply that universities and TTO personnel should select employees with experience in industry. TTOs that hire such employees can be expected to capitalize on this industry-based knowledge, which will enable them to be highly productive. However, these studies also suggest that TTO employees are focused on short-term financial gains, while faculty may have a more long-term focus. Thus, it would seem that effective leadership at the TTO and academic department/university level is necessary to provide guidance and direction to both TTO personnel and faculty. Additionally, it appears that educating faculty on the functions, focus, and capabilities of the TTO would also enhance the TTO employee–scientist relationship. In other words, micro studies may prove useful in encouraging the coordination and success of AE, which is inherently a collaboration involving TTO employees and faculty.

KEY MICRO PROCESSES IN ACADEMIC ENTREPRENEURSHIP

Our qualitative inquiry was driven by one primary research question: Why do faculty members engage in technology transfer, especially informal practices? To answer this question, we drew from literature rooted in organizational behavior. Because technology transfer decisions are ultimately dependent on the actions of the individual faculty members themselves, our aim was to investigate various micro processes that may dictate such decisions.

As discussed previously, the AE literature reveals several areas in which an examination of micro processes may help increase our understanding of AE. Through a series of interviews with individuals involved in technology transfer, we identified various micro processes that may be especially relevant to technology transfer. These constructs are based on preliminary data from our broader, ongoing NSF-funded project. Below we discuss our data collection methods.

We conducted semi-structured interviews with 30 faculty members (e.g., individuals in life sciences, physical sciences, and engineering), department chairs, and TTO officials at two major research universities located in the eastern and western regions of the United States. For these interviews, we developed a protocol of open-ended questions that were based on our primary research question regarding why faculty members may choose to engage in informal technology transfer. Each interview was conducted by two of the authors and lasted between 30 and 60 minutes. Data were collected until theoretical saturation was accomplished (Charmaz, 2014). All interviews were recorded and transcribed so that they could be continually referred to throughout the data collection and analysis process. The authors engaged in initial and focused coding (Charmaz, 2014) to identify common themes that emerged from the data. The authors found similar themes across interviewees, then discussed each theme in terms of meaning and theoretical grounding until agreement was reached.

These themes point to various micro processes that influence faculty members' AE decisions. Further, we found that many of the experiences of faculty members were reinforced by data gathered from leaders (i.e., department chairs) and TTO employees. It is important to note that the micro processes identified in our study are by no means exhaustive. However, as stated earlier, the goal of this article is to begin the conversation regarding how such processes can influence AE at the individual level. Our hope is that this article will encourage other researchers, both in AE and in other fields, to consider how micro-level research can advance our understanding of AE, both theoretically and empirically. The remainder of this article uses the interview data to inform our understanding of how micro processes affect technology transfer behavior, especially the bypassing of the TTO through informal technology transfer. Specifically, we provide examples of various micro processes that may influence faculty members' decisions about how they engage in technology transfer.

Informal Technology Transfer

As suggested in an earlier section, some faculty members find creative ways to circumvent the formal technology transfer process when attempting to commercialize (Siegel et al., 2004). Indeed, Markman et al. (2008) documented that 42% of faculty members who patent have chosen to circumvent or bypass the university at least once. Our interview data indicate that methods for bypassing the TTO

are often creative and do not always happen before disclosing an invention to the TTO. For example, one faculty member said:

> *"I know of some faculty members who have gotten so bogged down in the [formal technology transfer] process that they simply just tried to run an end-around and take [their technology] out [of the formal system]. They basically frame it in a way that they hoped would be different enough from an invention disclosure that they already filed to get it off the radar of the university [so they could] take it forward independently."*

Additionally, bypassing behavior may involve other individuals aside from the faculty. For instance, when asked about methods of bypassing, one faculty member responded:

> *"I also know faculty members who just won't patent anything. Flat out. [They say] 'If I have a good idea, I will give it to an undergraduate student because [university policies] can't cover them. [Undergraduates] can go off and do whatever they want.' They literally bypass the whole system in a nutshell."*

Interestingly, faculty who circumvent formal technology transfer processes, and thus engage in informal technology transfer, do not always do so intentionally. Research regarding *bypassing* underscores an intentionality to avoid appropriate university procedure on the part of the faculty members who are trying to commercialize. However, we use the blanket term of *informal technology transfer* to refer to actions taken by faculty members—regardless of intentionality—that circumvent the TTO when transferring technology. Thus, informal technology transfer includes intentional bypassing as well as unintentional sidestepping of formal technology transfer processes.

There has been little theoretical or empirical research on the factors that may drive faculty to engage in various forms of informal technology transfer. We suggest that often it may be due to a communication breakdown between the university and its faculty members. Such a breakdown may result from a lack of communication efforts from either the TTO or university leadership, or both entities. For example, when asked about TTO communication, one department chair stated, *"I just got an email very recently—within the past week, maybe—about patents that looked boring, and I haven't read it."* To study communication failures and other such reasons why faculty members may either intentionally or unintentionally not use formal procedures when engaging in technology transfer, we look to various micro processes of organizational behavior to help explain how and why individual faculty members engage in either formal or informal technology transfer.

Micro Processes and Future Research Agendas

The micro processes relevant to AE are presented in Table 2. For each micro process, we identify the level, its definition in the context of AE, and its potential impact on academic entrepreneurship. In the remainder of the paper, we discuss how these micro processes—identity, motivation, leadership, TTO communication, work-life balance, and justice—may affect faculty members' propensity to engage in both formal and informal technology transfer. It is important to note the large role that the AE context plays in each of these micro processes. The context of a study can be as important as the study itself (Johns, 2006), and in the case of AE, this point is especially salient as such micro processes occur at the individual, relational, and organizational levels. Below we discuss how, within the context of AE, micro processes can lead to important outcomes.

Identity and identification. The first set of micro processes that we present occur strictly at the intra-individual level. Here we discuss the role of a faculty member's identity in AE. Identity is "a self-referential description that provides contextually appropriate answers to the question 'Who am I?' or 'Who are we?'" (Ashforth et al., 2008, p. 327), and has been conceptualized on at least three different levels. Personal identity is "a person's unique sense of self" (Postmes & Jetten, 2006, p. 260). Social identity involves defining oneself in terms of different groups to which one may belong (Brewer & Gardner, 1996; Tajfel, 1978; Tajfel & Turner, 1986). An example of this would be a faculty member defining herself or himself as part of the generic research team. Indeed, even defining oneself as a faculty member is a social identity because one's sense of self is, in part, dependent upon the perceived characteristics that are represented by "scientist." Finally, organizational identity (Whetten, 2006) involves how individuals perceive themselves in terms of the collective or their role within an organization (Ashforth et al., 2008). For example, both a faculty member and a TTO employee may say, "We are ABC University." In so doing, they would be expressing a shared organizational identity.

Identification is an individual's "perception of oneness or belongingness to" a given target

TABLE 2
Micro Processes Relevant to Academic Entrepreneurship (AE)

Micro process	Level	Definition in the context of AE	Potential impact on AE
Identity and identification	Intra-individual	Asking the question "Who am I?," which is especially important in the context of AE because faculty members have many roles: faculty member, researcher, teacher, inventor, and entrepreneur	If a faculty member's identity is strongly entrepreneurial, he or she may be more likely to attempt to commercialize his or her invention.
Motivation	Intra-individual	The impetus for faculty members and TTO personnel to engage in AE efforts (patenting, licensing, start-up companies)	Understanding what motivates faculty members and TTO personnel to engage in AE, as well as how each individual's motivation interacts within a team, may point to specific structures and incentives that can help increase AE efforts.
Leadership/championing	Relational	When a department chair acts as an AE champion by taking action in promoting AE and shepherding commercialization through the technology transfer process	If a department chair serves as an advocate/champion for faculty commercialization efforts, this may reduce the probability that faculty engage in informal technology transfer.
TTO communication and educational campaigns	Relational	Continual efforts by the TTO to inform faculty members of their services. This type of education is executed by individual TTO personnel and is especially important when a faculty member is hired by the university.	If a faculty member lacks knowledge of the existence of a TTO, or lacks knowledge of services provided by the TTO, he or she may choose to engage in informal technology transfer out of ignorance.
Work-life and role balance	Organization–individual	Whether a faculty member believes that he or has an appropriate workload or work requirements relative to responsibilities that stem from other work duties or personal duties and/or interests	When work-life or role balance issues arise, a faculty member may choose to withdraw commercialization efforts to spend more time on other activities.
Distributive justice	Organization–individual	Whether faculty members believe that they are being rewarded (compensated/recognized) fairly	A faculty member's perception of the fairness of the rewards system may influence his or her propensity to engage in AE (both to initiate the process and to circumvent the TTO).
Procedural justice	Organization–individual	Whether faculty members perceive that they are being treated in an unbiased and consistent manner by the TTO and the university	A faculty member who believes that the university procedures are unfair may be more likely to circumvent the TTO and engage in informal technology transfer.
Interpersonal justice	Relational	Whether faculty members perceive that they are treated with dignity and respect when interacting with their department chair and/or TTO personnel	If faculty members believe they are being treated with a lack of respect by university administrators (due to administrators ignoring them, or delayed responses), they may be more likely to circumvent the TTO and engage in informal technology transfer.
Informational justice	Relational	Whether faculty members perceive that they have received complete, timely information from university administrators	If information is withheld or delivered at inappropriate times, faculty may perceive this as unfair and possibly circumvent the system as a result.

TABLE 2
(Continued)

Micro process	Level	Definition in the context of AE	Potential impact on AE
Deontic justice	Organization–individual	A faculty member's desire to see his or her research used in a manner that benefits society	Faculty members with a strong deontological perspective may be more likely to engage in technology transfer, but they may do so informally if they believe that formal technology transfer procedures hinder their chances of speedy commercialization.

(Ashforth & Mael, 1989, p. 21). Identification is different from identity in that identity involves a self-concept, while identification involves a cognitive and affective evaluation as to whether or not that self-concept matches a given target's (group, organization, profession, and so forth) characteristics and attributes (Ashforth et al., 2008; Besharov, 2014; Dutton, Dukerich, & Harquail, 1994). Perhaps the most prolific type of identification in the management literature is organizational identification (see Mael & Ashforth, 1992). However, like identity, identification can exist at several levels, with the work group being one of, if not the most, salient (Ashforth & Rogers, 2012).

Identity and identification both have the potential to illuminate important processes in AE. In addition to the implications in the macro literature regarding the need for identity-based research (see Table 1), our interview data also indicate the importance of identity. Of the themes that emerged from our interview data, two of the more prominent ones are identity and motivation. In fact, in virtually every interview, these concepts emerged unsolicited. Perhaps the most frequent theme is that faculty members who were involved in entrepreneurial activities either before or at the very beginning of their careers were more likely to engage in AE. One faculty member, when asked the reasons for being so heavily involved in technology transfer, said, *"So, I have been an entrepreneur since my Ph.D. thesis. My Ph.D. thesis spun out the first company that I was involved with at [Research University]."* This same faculty member later added, *"I'm a serial entrepreneur."* These statements support other research in entrepreneurship that suggest that previous entrepreneurial experience is an indicator of future entrepreneurial activity (Zhao, Seibert, & Hills, 2005).

However, in the case of academics, developing an entrepreneurial identity before starting an academic career may be critical, as academia often actively discourages entrepreneurship both formally (e.g., promotion and tenure criteria) and informally (e.g., organizational and institutional norms). It follows that even conducting the type of applied research that might lead to entrepreneurial opportunities would be eschewed. As one faculty member put it: *"But by and large, in our training we're not encouraged to invent anything because that requires that you focus on applied research, as opposed to basic research."* Indeed, there seems to be a general assumption embedded at some research universities that academics simply do not want to engage in entrepreneurial activity. One senior university official, when asked about faculty members' desire to become entrepreneurs, went so far as to say, *"I think they're faculty members for a reason and . . . they want to remain faculty members,"* indicating her perception that faculty members are largely not interested in becoming entrepreneurs.

Research suggests that, at least to some extent, the groups and organizations in which individuals work help shape their identity (Tajfel, 1978). Given the negative, or at best neutral, perception of entrepreneurial activity by academic units within universities, it seems unlikely that such an identity will be developed (if it is not already there) once faculty members begin their academic careers. However, this lack of identification is in direct conflict with the intentions of the Bayh-Dole Act and most universities' policies regarding AE. To address this issue, future research is needed to answer questions such as these: How can academic departments actively build entrepreneurial identities among faculty members? How can new faculty members' entrepreneurial identities be strengthened? What factors will encourage faculty members who do not have an entrepreneurial identity to engage in AE? In sum, investigations of identity as a micro process are needed to help build, maintain, or mitigate a lack of

entrepreneurial identification among academic scientists.

Motivation. The next micro process we consider here is motivation, which is also an intra-individual level phenomenon. Motivation is defined as "a set of energetic forces that originate both within as well as beyond an individual's being" that determine the intensity and duration of behavior (Pinder, 1998, p. 11). Motivation has been categorized in various ways (see Latham & Pinder, 2005, for a review), with perhaps the most common categorization being intrinsic versus extrinsic motivation (see Gerhart & Fang, 2015). Extrinsic motivation involves behavior that is related to the attainment of some separable outcome (Deci & Ryan, 2000). For example, the less risky possibility of financial gain in the form of a share of the royalties from a licensing agreement may induce TTO personnel to encourage faculty members to license technology, as opposed to the more risky act of starting a company. This may be one reason why Markman et al. (2005) found that universities focus on short-term cash maximization. Indeed, it may not be the university itself with such a focus, but instead the individual TTO employees who would prefer a quick, and relatively certain, payout that can be had through licensing, instead of waiting to see if a business becomes profitable. However, it is not possible to extract such details using a macro approach to AE research.

Intrinsic motivation involves behavior that is done because there is inherent satisfaction in the behavior itself (Deci & Ryan, 2000). Almost every faculty member we interviewed indicated that this is their primary form of motivation for both becoming an academic and engaging in AE. As one faculty member expressed it:

> *"So I think a lot [about] our motivation. . . . We have a device that can help people. There are people dying in Africa from diseases we could treat, but we don't have the kind of assessment out there that's needed. So working on [commercializing this invention]—I think a lot of the motivation is just in that realm, [rather] than trying to make money."*

Interestingly, the vast majority of faculty members had the perception that the TTO and other university officials were extrinsically motivated to engage in AE. In other words, faculty members perceived that TTO employees helped them patent, license, or start a company almost exclusively because the employee and the university made money from doing so. This perception is perhaps best seen in the following statement from a faculty member:

> *"I think it's a lot about money. Sometimes [faculty members] feel like the tech transfer [office] wants their money. . . . That's what it is to them. It's a business deal, and the people up high, they don't look at the faces of the [faculty], they don't look at the small businesses. They say that 'oh this will cost this, this will cost this,' and that's it. That's what I've been told by a lot of people."*

TTO personnel confirmed this perception. For example, one senior TTO official stated:

> *"So most tech transfer offices say . . . 'Give us your mission statement,' or 'What are you trying to do?' Most will say, 'Well, we're there to protect intellectual property and basically to bring in money to the university.'"*

The majority of TTO employees and faculty members believe that, strictly from a motivational perspective, formal technology transfer is better than informal technology transfer because it generates additional revenue for the university (which, according to the Bayh-Dole Act, should be "reinvested" in academic research). However, there were some divergent views that indicated that informal technology transfer may actually generate even more revenue. These individuals gave two main reasons for their view. First, informal processes (e.g., working with private equity and venture capital firms) were perceived to be more efficient. Thus, the process of patenting, licensing, and start-ups would happen faster and have a greater chance of success. Second, because of the perception that the informal route had a greater chance of success, there was a better chance that the inventors would gain wealth and then donate money to the university. One TTO official sums this up by saying, *"There is a train of thought in . . . tech transfer offices: 'We don't mind if people go out through the back door, because if they make a lot of money, they tend to give the money back to the university.'"*

The above ideas and quotes highlight several areas in AE that are in need of research regarding micro processes. Although changes in the level of a faculty member's motivation may be a micro process that occurs primarily at the individual level, future research on motivation within the AE context may investigate how motivation is affected by relational processes as well. For example, at the relational level, how does the interplay between the primarily intrinsic motivation of faculty members and

extrinsic motivation of TTO employees affect their interaction as an entrepreneurial team? Because receiving external rewards for intrinsically motivated activities may reduce an individual's intrinsic motivation (Deci, Koestner, & Ryan, 1999), it is possible that working with the university TTO may actually hinder future AE by academics. Research regarding the interpersonal relationships of faculty members and TTO employees is needed to illuminate this issue.

Second, does the external motivation of TTO employees result in a larger number of patents at the cost of having fewer start-up companies? We encourage researchers to investigate TTO employees who are intrinsically motivated (e.g., want to help society) as well as those who are extrinsically motivated by money. Such efforts may reveal any differences in both their short-term production of patents versus spin-off companies and their long-term revenue generation for the university.

Finally, it is important to investigate the attitudes and behavior of senior TTO and university officials. If, as one official indicated, it is more profitable for the university to let individuals engage in informal technology transfer, then perhaps policies preventing this behavior should be changed (e.g., encouraging forms of informal technology transfer that do not violate laws). Moreover, perhaps TTO officials should be selected based on these attitudes and beliefs. If, however, the conventional view of requiring faculty to go through formal technology transfer processes is more beneficial, then personnel selection and/or leadership processes may need to be changed to ensure congruence between the university's and TTO's intentions and practices.

Leadership and championing behaviors. Another factor we propose as relevant to AE is leadership. We categorize leadership as a micro process that takes place at the relational level, as it captures the interplay between the faculty member and other individual technology transfer stakeholders. Although leadership may be relevant at different organizational levels, we argue specifically that university department chairs who take on a champion role may play an important part in faculty decisions to engage in technology transfer. Championing is defined as supporting or defending a cause. However, within the management literature, championing is primarily associated with supporting the progression of a new technological development or innovation (see Schon, 1963). Notably, most descriptions of champion behavior focus on the champions themselves, rather than delineating the behavior in particular. For example, Howell and Shea (2001, p. 15) defined champions as "individuals who informally emerge in an organization and make a decisive contribution to the innovation by actively and enthusiastically promoting its progress through the critical [organizational] stages." Similarly, Clarysse and Moray (2004) described a champion as an individual who drives an idea and manages it all the way through completion.

With that said, we argue that championing behaviors can be applied to more than one project. Indeed, it is inconsistent that definitions of a champion are based largely on how an individual acts regarding a particular project, while many of the descriptors used in these definitions involve traits and actions that would carry over to multiple projects or even to a more encompassing cause. For example, because champions are internal entrepreneurs who take creative ideas and bring them to life (Tushman & Nadler, 1986), we assert that these characteristics of someone exhibiting championing behavior could cross over to more than just one project. In other words, we view championing in the context of AE to be a more generalized quality of the leader, specifically department chairs.

There are several aspects of such generalized championing behavior that may be relevant to department chairs as champions of AE. First, there is outward demonstration of efforts to advance AE. Second, there is an aspect of risk taking in AE championing because it may run counter to predominant academic norms (e.g., norms of publishing). In other words, the department chair who champions AE may find herself having to defend policies and individuals that go against the grain of academic traditions. Third, to be an effective champion, the department chair may have to network or form coalitions with others. That is, chairs may not have the authority to push innovations through the university bureaucracy. But if they are able to involve others, such as deans and TTO officials, then the projects they are promoting are more likely to be moved through the system.

In a university setting where red tape and bureaucracy often surround the technology transfer process, we assert that having a champion could significantly affect faculty members' attempts to commercialize their technologies. Although such a champion may exist in many forms, department chairs inherently represent a position that is critical to the role of champion. As leaders of their academic units, it is their responsibility to manage and account for work-related activities of faculty members. Despite this assertion, department chairs sometimes

limit themselves in their championing roles because they place a low priority on AE or have busy schedules or a lack of information regarding their own faculty members, as indicated by this statement from a department chair after he was asked if any faculty in his relatively small department are engaged in technology transfer: *"I haven't really kept up on what folks are doing. I have only been chair for a year. [AE] hasn't really been a priority; I've had other things on my plate to deal with."* Table 2 presents some additional examples regarding the role of department chairs as champions of AE.

These results are consistent with the findings of Bercovitz and Feldman (2008) (see Table 1), who found that the propensity of faculty members to disclose inventions is positively related to the propensity of their department chairs to disclose. Accordingly, faculty members may see their department chairs as role models for disclosure behavior. This ability of a department chair to affect individual faculty members' decision making regarding technology transfer reflects the importance of micro processes that occur at the relational level. Thus, scholarly work in AE may benefit from future research that examines leadership in the context of technology transfer.

TTO communication and educational efforts. Another micro process at the relational level that may influence AE is TTO communication and education efforts. We argue that the extent to which the TTO attempts to educate faculty members regarding formal mechanisms of technology transfer may affect faculty members' decisions to pursue commercialization, as well as what path (formal or informal) they use for this pursuit. We define educational efforts as actions undertaken by the TTO to increase awareness of the office and its services. Such education emphasizes the notion that innovation and commercialization of intellectual property are important to the university and underscore the need for a balance between research and commercial goals (Pillegaard, Moroz, & Neergaard, 2010). This, in turn, may aid in creating a mutual understanding that technological discoveries on the part of faculty should be shared, and potentially commercialized, within the bounds of formal mechanisms of the university.

We recognize that TTO educational campaigns may be formulated at the university level (most TTOs are university-wide entities). Thus, this theme may be studied at the organizational level. However, we focus on TTO educational campaigns at the relational level, given that such initiatives are implemented by individuals. Fundamental to AE are the two-way communication, understanding, and negotiation that exist between the inventor or scientist on one hand and representatives of the receiving organization on the other (Rogers, 2002). Despite the necessity of this two-way communication, there may be a breakdown in the flow of information. Specifically, a faculty member may participate in informal technology transfer because he or she is unaware of the TTO and the full range of its services, or because of poor communication experiences with individuals associated with the TTO. As one faculty member stated:

> *"[T]he problem is that for many [faculty members], we're in our little silos. You know, we're in our little cubbyholes in terms of what we do. There's no proactive encouragement whatsoever from tech transfer or any other [university] office."*

This sentiment was not uncommon. We found that a lack of information or even miscommunication is prevalent between faculty members and personnel who work for the TTO. Furthermore, this two-way communication between the faculty member and TTO personnel may be hampered by biases a faculty member may have when it comes to innovation and involving outside sources. Such biases may be due to the faculty member's perception of technology transfer officers as outsiders who have little value to add (Antons & Piller, 2015). Alternatively, there could exist a symbiotic relationship between a faculty member and a technology transfer officer, such that both together are able to add value to and advance a project toward commercialization. The notion that the relationship between a technology transfer officer and a faculty member may be the difference between a scientist engaging in technology transfer or not is another indication of how paramount relational-level micro processes are to AE. Future research may explore the intricacies of the dyadic relationship between a TTO agent and a faculty member to shed light on both the positive and negative aspects of the relationship between university faculty members and the TTO.

Work-life and role balance. We identified issues surrounding work-life and multiple role balancing as another set of micro processes that may affect technology transfer in a university setting. Work-life balance generally refers to organizational support for aspects of an employee's personal life, such as flexible work hours, dependent care, and family/personal leave (Beauregard & Henry, 2009; Estes & Michael, 2005). Work-life and role balance is dependent on the interaction of organizational factors

and personal factors; thus, we categorize this theme as a micro process that stems from organizational-level forces. The idea of balance has a strong presence in the organizational behavior literature, and prior research has elicited organizational changes that support a better balance between work and personal responsibilities. For example, many organizations have implemented policies such as family-leave programs, job sharing, and on-site childcare to offer their employees more personal support. Although issues of work-life balance have long plagued organizations, we assert that such issues are especially salient in the context of university–industry technology transfer.

In 1977, Kanter stated that having separate worlds for work and personal life is a myth, as the two are unavoidably connected. Today, the workforce deals with this issue even more as technology has brought about boundaryless organizations (Kreiner, Hollensbe, & Sheep, 2009). Though such connectedness may have made certain aspects of work easier, unintended consequences such as the toll of managing multiple emotional roles between home and the workplace may adversely affect employees (Wharton & Erickson, 1993). Furthermore, the shift of household and child-rearing responsibilities from female-centered to a model that leans toward greater shared responsibilities introduces various new complexities in the way fatherhood affects the workplace (Ladge, Humberd, Watkins, & Harrington, 2015).

In a similar vein, issues may also arise as individuals struggle to balance their work roles. As a unique type of knowledge worker, faculty members are placed in a position where they not only have to manage their personal lives with respect to their work responsibilities, but they have to also manage the different roles within their work responsibilities. A faculty member may be a professor, researcher, teacher, inventor, and entrepreneur, and these roles may conflict with one another. Adding to this burden is the reality that faculty members are complex, in terms of identification (discussed further below) and levels of organizational commitment (Benson & Brown, 2007). For example, faculty members are typically more committed to their academic field than to their department or university. As one of our interviewees put it, *"[I]t's really a question of when you go to develop the technology and commercialize it. That becomes difficult in conjunction with being a full-time academic."* Several faculty members stated that they would not give up research to pursue patenting, licensing, or starting a company. A statement representative of this sentiment is:

> *"[T]here really is no way to . . . be a full-time faculty member and be president of a company. In fact, those two activities are not compatible. So you either need to take a leave of absence from your academic position, or you need to find somebody else to run your company."*

This notion that there is not room to be fully engaged in both academic and entrepreneurial activities demonstrates how organizational factors, such as support in the form of allowing a leave of absence, may affect AE. Future scholarly work in AE may consider how these micro processes regarding work-life and role balance are swayed by university policy.

Organizational and deontic justice. Organizational justice is the final type of micro process we consider, with regard to the interaction between individual- and organizational-level factors. Organizational justice involves a cognitive process that is internal to the individual. However, this cognition occurs in relation to events or policies that occur in the greater organization, so we broadly categorize this theme as a micro process pertaining to the organizational level—although separate dimensions of justice, as discussed below, occur at the relational level. Organizational justice is the umbrella rubric under which four different justice dimensions fall, and it has received much attention as an explanatory mechanism of important organizational outcomes in the management literature (e.g., Colquitt, 2001; Colquitt & Rodell, 2011). The basic idea can be couched in terms of social exchange (Masterson, Lewis, Goldman, & Taylor, 2000). Specifically, when individuals perceive fair treatment on the part of an organization, they will be more likely to feel an obligation to reciprocate by helping to further the goals of the organization (Lavelle, Rupp, & Brockner, 2007; Rupp & Cropanzano, 2002). Although a justice-oriented perspective on university technology transfer phenomena has yet to be explored, we believe that the justice-based micro processes underlying the technology transfer context are very important.

The four traditional justice dimensions shown in Table 2 are distributive, procedural, interpersonal, and informational justice (Colquitt, 2001; Rupp & Cropanzano, 2002). *Distributive* justice involves the extent to which an individual's outcomes (i.e., rewards, recognition, and so forth) are perceived to be in line with the effort, accomplishments, and other contributions of the individual to the organization.

Procedural justice pertains to the extent to which an individual perceives consistency and lack of bias in the determination of his or her attained outcomes from the organization. *Interpersonal* justice describes whether individuals perceive that they are treated with dignity and respect by others. Finally, *informational* justice pertains to whether procedures and information are explained in a candid, timely, and individualized or personalized manner.

Early justice conceptualizations (e.g., Greenberg, 1987) emphasized distributive and procedural justice. Procedural justice has been studied in the context of entrepreneurship, but not specifically in the realm of AE or university technology transfer. For example, Sapienza and Korsgaard (1996) and Sapienza, Korsgaard, Goulet, and Hoogendam (2000) examined procedural justice in relationships between entrepreneurs and their investors. In the context of technology transfer, distributive justice might pertain to whether the faculty member perceives that he or she receives a fair distribution of rewards (e.g., royalties), perhaps as compared to what the greater university receives based on intellectual production. Relevant to the technology transfer processes, procedural justice might involve perceived inadequacies (e.g., lack of timeliness) in how a TTO operates in relation to faculty.

The interpersonal and informational components of organizational justice also play an important role. These two justice dimensions are associated more closely with micro processes at the relational level. For instance, a faculty member might perceive injustice if he or she is not treated with respect by a TTO, or if reasons for pursuing (or not pursuing) commercialization are not clearly and thoroughly explained. Indeed, when asked if he felt respected by TTO employees, one faculty member in our sample responded, *"I think it's respect, I mean I had to go to [a senior faculty member] just to get respect."* This faculty member went on to describe how his perceptions of interpersonal injustice made it highly unlikely that he would work with the TTO again, inducing him to consider leaving the university.

In addition to these traditional ways of conceiving organizational justice, in Table 2 we also recognize that a more recent, deontological perspective of justice may be relevant to AE (Cropanzano, Goldman, & Folger, 2003). In contrast to the above justice dimensions, which stress the individual's personal needs or interpersonal factors, deontic justice emphasizes the role that morality and the needs of others (e.g., society as a whole) can play in justice perceptions (Cropanzano et al., 2003; Folger, 2001). Because deontic justice takes into account morality and the treatment of others, it plays an important role in understanding how individual employees are relevant to the implementation of corporate social responsibility (Rupp, Ganapathi, Aguilera, & Williams, 2006). Thus, we suggest that knowledge workers, such as faculty members, may be especially sensitive to deontological justice infringements (Sauermann & Roach, 2014).

To a large extent, faculty members work to further technological development to better society or the quality of human life. Thus, they may have a vested interest or sincere desire to see their ideas quickly put into practice through commercialization. For example, consumer-focused technologies, such as self-service technologies, may elicit strong deontological motives from inventors because their ultimate goal is to create something that makes life easier for society (Bitner, Ostrom, & Meuter, 2002). Sauermann and Cohen (2010) found that even scientists and engineers with doctorate degrees working in the private sector considered the value of their research to society to be fairly important. Enthusiasm to see society use the innovation or technology may engender frustration and weariness when dealing with formal technology transfer channels (e.g., TTOs) because the potential red tape involved in commercializing their technology may be perceived as an unnecessary barrier to accomplishing the ultimate goal of serving society. In short, faculty members who are deeply concerned about deontic justice issues may attempt to circumvent TTOs by engaging in informal technology transfer. Interestingly, at least one TTO official seemed to support such attempts, stating:

> *"You know, in some sense, there is a theoretical argument here, because we are funded by the taxpayers for the benefit of the taxpayers. Is it really [that] bad that a scientist went out through the back door and made a product that benefits society? What's the bigger goal?"*

Clearly, at both the relational and organizational levels, there are various factors that affect how and why faculty members engage in technology transfer. Future research in this area may juxtapose deontic justice with the other justice dimensions to see whether there is a potential divergence in technology transfer decisions based on how these dimensions influence one another.

CONCLUSIONS AND DISCUSSION

According to Zahra and Wright (2011), we need additional research on AE, given its important

managerial and public policy implications. As noted by Siegel and Wright (2015), many studies of TTOs and the AE literature in general have focused on university-level data. Those studies that have been based on individual-level data have not focused on key micro processes, as addressed in the organizational behavior literature. Here, we have shown the importance of several micro processes that can enhance our understanding of AE, including the decision to engage in informal technology transfer.

These micro processes include identity, motivation, leadership/championing, TTO communication and education efforts, work-life balance, and organizational justice. To understand how changes in these factors can influence AE, we have drawn heavily on the organizational behavior literature. We assert that a focus on these factors will help us better understand why university faculty members engage in either formal or informal technology transfer.

We also outline a research agenda on micro processes in the context of AE. In addition to the specific questions we offer to inspire future research, we also note that the various themes presented here could be juxtaposed against one another. For example, there are various ways through which the university may affect work-life and role balance issues. Also, at the relational level, exploring the influence that technology transfer officers have in the success of a faculty member's commercialization efforts may shed light on changes in various psychological factors of the faculty member, such as justice perception, identity, and motivation.

A new focus on micro processes in AE could radically change how we view the AE process. Instead of a focus on institutions, strategy, and public policy, our approach could shed greater light on the human dimension of AE. More specifically, it would shift more attention to the key "supplier" of AE, the faculty member. A greater emphasis on the human dimension of AE would result in better theoretical understanding and empirical research on AE by enabling researchers to draw on theories such as social exchange theory, social cognitive theory, and concepts of identity and organizational justice that we have introduced in this paper.

For instance, in future research, we hope to analyze the relationship between organizational justice and identity. Social exchange theory (Bandura, 1988) suggests that these two sets of variables should be related. On the empirical side, a greater focus on the human aspect of AE is also likely to lead to better explanations of AE performance. This is important because, as noted earlier, the first wave of AE studies was focused on this variable. We also believe that an emphasis on micro processes will lead to a better understanding of which universities and academic departments have the best organizational climate for AE.

Unfortunately, the paucity of research regarding micro processes involved in AE restricts our understanding regarding faculty members' decisions to either bypass the university TTO when engaging in AE or to simply not engage in any type of commercialization (formal or informal) of university-based research. At a time when many universities are aggressively promoting new initiatives to stimulate AE (via both faculty and others involved in the research enterprise), this lack of understanding may lead to the implementation of either ineffective or even detrimental policies. We hope that the examples provided here demonstrate the importance and potential fruitfulness of micro-level organizational behavior research in the area of academic entrepreneurship.

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