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Theories from the Lab:
How Research on Science Commercialization can Contribute to Management Studies

Riccardo Fini
University of Bologna
Italy
Email: riccardo.fini@unibo.it

Einar Rasmussen
Nord University Business School
Norway
Email: einar.rasmussen@nord.no

Johan Wiklund
Syracuse University
USA
Email: jwiklund@syr.edu

Mike Wright
Centre for Management Buyout Research
Imperial College Business School
London, UK
Email: mike.wright@imperial.ac.uk

Abstract

Universities and research centres have long been used to study management issues. A growing body of research has focused on how science can be effectively commercialized, emphasizing technology-commercialization activities, university-industry collaborations, and academic entrepreneurship. While much of this work has documented empirical relationships, our aim in this introductory paper of the special issue is to show how research on science commercialization may yield conceptual contributions to the field of management. Hence, we first discuss the importance of context for theory development and how science commercialization can be a promising setting for making contributions to management theory. We then review how the science commercialization context has been used for theory development, identifying two facets used by scholars to conceptualize science commercialization (i.e., managing the lengthy complex process of transition between institutional contexts, and the multiple goals and impacts of actors engaging in science commercialization). This forms the basis for discussing what makes this context particularly suited for theory-development in general management and for outlining a future research agenda. We conclude by summarizing the papers in the special issue.

INTRODUCTION

The commercialization of science is a key process by which public investments in research generate impacts both at firm and broader societal levels, through the valorisation of lab-based inventions and technologies (Fini et al., 2018b; Nelson, 2015; Pisano, 2006). Science commercialization is a driver of innovation in many industries and an important part of innovation and technology management. Hence, more knowledge about the use and impact of scientific research is important for understanding how firms develop and maintain competitive advantage. Science commercialization plays also a role in creating societal impacts from new scientific inventions and knowledge (Fini et al., 2018b), and for developing a better world (George et al., 2016). Given its potential importance, it represents a relevant context for developing conceptual insights with large practical relevance and impact on business and society (Birkinshaw et al., 2014).

To date, research on science commercialization is mainly empirically driven and has adopted a variety of theoretical perspectives (Wright et al., 2018a; Zahra et al., 2018). Hence, we see great potential in making more focused and conceptually-driven explanations of science commercialization. Given the body of work that has now developed, we believe we have reached a juncture where it is fruitful to ask how the context of science commercialization can be an important arena for building and testing theories relevant for the management field more broadly. Rather than asking how management theory can inform science commercialization, we believe the time is ripe to ask how science commercialization can inform management theory. Indeed, while science commercialization represents a quite specific empirical context, the findings and theorizing from this context can provide new theoretical insights of general interest. Many of the phenomena central to management research are more prevalent and salient in science commercialization than in other contexts. In addition, science commercialization brings salience to the importance of context in research, an important consideration in relevant and robust theorizing (Rousseau et al., 2001).

In this essay, we first discuss the viability of using science commercialization as a context for theory development in management and highlight some key aspects that can be leveraged by scholars wishing to contribute to general management theorizing. Next, we perform a literature review covering leading (empirical) management journals and identify two features that make science commercialization relevant for theory development. Then, we build on these insights to

outline a research agenda for theory development in management. The paper concludes with a summary of the papers included in the special issue, offering some suggestions for further research.

THE IMPORTANCE OF CONTEXT FOR THEORY DEVELOPMENT: THE CASE OF SCIENCE COMMERCIALIZATION

Management and organization research increasingly emphasise that context - i.e., 'the conditions and circumstances that are relevant to an event or fact' (British Dictionary) - is important for theory development. Context is crucial for understanding the who, where, when and why of a theory (Johns, 2006). On the one hand, context provides boundaries for the generalizability of theorized relationships (Welter, 2011; Zahra et al., 2011); on the other hand, it provides the link between abstract conceptualizing and the real world. Using empirical data for theory development always raises questions about the trade-off between the development of general theory with broad applications across different contexts and the development of more specific theoretical insights having narrower (but higher) validity. In this paper, we are interested in the features making science commercialization suitable for more general theory development in management.

We believe the science commercialization domain provides a sound context for management theory development in several ways. First, the context should allow questions to be asked that are of interest beyond the specific empirical setting. In terms of generalizing findings to theorize beyond the specific context, it is crucial to consider in which ways findings and concepts generated from the science commercialization setting represent more general phenomena. For example, because science commercialization transcends both scientific and commercial environments, it can inform aspects of multiple identities (Fisher et al., 2016), multiple audiences (Fini et al., 2018a) and multiple goals (Josip et al., 2018), that are also salient in other settings (e.g., movie industry, haute cuisine).

Conversely, similar questions may find different answers depending on the context under scrutiny (Rosenbusch et al., 2010), because certain aspects of a phenomenon and/or theorizing of the phenomenon do not transfer across contexts. This calls for the establishment of relevant theoretical boundaries, and the internal consistency of the science commercialization context has certain advantages in this regard. For instance, academic institutions share many characteristics

across and within countries; the individuals involved share similar educational backgrounds; and the technologies involved are generally innovative. This facilitates the establishment of relatively homogenous samples within and across studies, reducing unobserved heterogeneity, while assisting in setting appropriate theoretical boundary conditions.

Further, while a specific context, such as science commercialization, may not be representative of all aspects of a phenomenon, it can have properties making it a particularly useful context for developing and testing theories. The access to rich and high-quality data makes science commercialization particularly attractive. Science commercialization often involves public institutions and public grants, with funders requiring detailed and systematic documentation of activities, which can be used for research purposes. Government involvement in the actual commercialization processes is also common, which generate additional rich and accessible data. Given public involvement and policy interest, there is extensive reporting, including intermediaries that collect data and produce reports about science commercialization initiatives and activities, which can be harvested for research purposes (Clayton et al., 2018). For example, by using sources such as publications and patents, it is possible to conduct large scale studies on the link between scientific research and firm value (Simeth et al., 2016). Because the people involved in science commercialization often have close ties to universities and a research background, they generally understand research and are willing to take part in research studies (Perkmann et al., 2015). Finally, the extensive time periods required for science commercialization provides for rich time-stamped data that can reveal the underlying processes in greater detail. All in all, this makes it an ideal setting for the collection of primary and secondary data, also suitable for qualitative approaches.

Finally, context driven research can facilitate theory development at the intersection between different academic fields and disciplines (Zahra et al., 2009). Approaching the same phenomena from different disciplinary backgrounds can improve both disciplines through borrowing and integrating theoretical insights, but also facilitate new theory development (Zahra et al., 2009). Science commercialization is permeable to other disciplines and some causal mechanisms investigated have been addressed using psychology, sociology, economics and history. Hence, this context can provide a rich arena for cross theoretical cross-fertilization. In the section below, we examine the existing management literature and how the science commercialization context has been used for theory development to date.

FEATURES OF THE SCIENCE COMMERCIALIZATION CONTEXT SALIENT FOR THEORY DEVELOPMENT IN MANAGEMENT

Although the vast majority of studies related to science commercialization are published in innovation and entrepreneurship journals (Djokovic et al., 2008; Grimaldi et al., 2011; Miranda et al., 2018; Perkmann et al., 2013; Rothaermel et al., 2007), this context has gained increasing popularity in management research. A number of recent examples show the viability of using the science commercialization context as an empirical base for studying issues of more general interest to management scholars. Based on a literature-search of leading (empirical) management journals (i.e., *Academy of Management Journal, Journal of Management, Journal of Management Studies, Management Science, Organization Science and Strategic Management Journal*), we identified 40 articles, published over the last 15 years, that used empirical data from science commercialization to advance management research[1]. Table I summarizes the studies, describing the data and main findings. The exhibit also highlights how any given study used the context for theory development.

--- Insert Table I about here ---

Some insights emerge from our literature review related to both conceptual and methodological viewpoints. By looking at how the science commercialization context has been used for conceptual development over the last 15 years, two themes emerge: (a) issues related to managing the complex, bumpy and time-consuming process of transition between institutional contexts, and (b) aspects related to the multiple goals and impacts of actors engaging in science commercialization. These features may drive the theoretical development in the years to come.

1. We searched SCOPUS, querying for articles containing at least one term related to science (scien*, research*, academ*, universit*, facult*) and one related to commercialization (i.e. commercial*, entrepreneur*, OR innovat*, business*). We also screened forthcoming papers in the above-mentioned journals. The search resulted in about 200 published articles. After a manual screening, we retained 40 papers that, in our opinion, used empirical data related to the science commercialization context to inform general management theory. According to Colquitt and Zapata (2007), the theoretical contribution of empirical articles is reflected alongside two dimensions: theory building and testing. An article *builds theory* if it adds to existing theories or introduces mechanisms that serve as foundations for a new one. This effort ranges from a replication of previously demonstrated effects to the introduction of new constructs (Whetten, 1989; Colquitt and Zapata, 2007). Conversely, *theory testing* refers to the degree to which an existing theory is applied to an empirical setting to confirm/disconfirm a set of a-priori hypotheses. This effort ranges from articles in which the predictions are grounded in past studies to articles in which the predictions refer to existing theories (Colquitt and Zapata, 2007; Sutton and Staw, 1995). Theory building and testing are not zero-sum ideals, they can both co-exist within a given contribution. In our analysis, we retained articles that either build or test theories, or both.

In terms of (a), managing the transition across institutional boundaries (i.e. moving ideas and knowledge embodied in products and supported by various actors with different background from the realm of lab research to commercial industry application) is cumbersome and takes time. It represents a boundary spanning behaviour transcending institutional and organizational boundaries. As such, it seems ideal for studying the details of organizational processes unfolding over time (Langley et al., 2013), across different levels of analysis (Hitt et al., 2007), as well as across institutional logics (Colyvas et al., 2006), and to use such observations for novel empirically grounded theorizing. For example, new venture creation has received extensive attention in the entrepreneurship literature. Yet, the details of how this process unfolds is still not well understood. Science commercialization offers an excellent context for observing this process extended over long periods of time, for example, following the commercialization of a science-based invention from the lab to the final market.

As for (b), science commercialization encompasses a range of expectations, goals, and values held by distinctly different stakeholders. Also, the translation of these goals into outcomes generates different impacts. Apart from direct commercial outcomes for participating firms, science commercialization influences academic research and teaching (Wang et al., 2016), regional and industrial development (Saxenian, 1994), and technological and societal change (Fini et al., 2018b). Hence, science commercialization is well suited for studying activities with multiple goals, outcomes and impacts.

Regarding research design, it emerges that these two conceptual features are not specific to a given level of analysis but cut across all of them. Indeed, the literature has addressed the process of science commercialization at individual, group, organizational and institutional levels, and in a few cases has also documented cross-level interactions. Furthermore, a few studies underscore the existence of feedback loops linking impacts to goals that may retrospectively influence and modify how science commercialization unfolds. Although feedback loops are rarely addressed by extant studies, this may bear important implications for methodological and conceptual development based on science commercialization research.

In Figure 1, we systematize these core science commercialization features that may be useful for theory development and present a conceptual model of how science commercialization originates and unfolds. In the following sections, we then review and discuss the key conceptual aspects that could be used for theory development at different levels of analysis.

--- Insert Figure 1 about here ---

Managing across Institutional Boundaries: Science Commercialization as a Complex, Multi-stakeholder Process

The feature of science commercialization context that has been most frequently used for theory development is related to managing the complex multi-stakeholder process that transcends institutional boundaries, bridging from academic to commercial settings. For example, empirical data from this context has been used to examine issues related to coordination costs (Kotha et al., 2013), network ties (Tortoriello et al., 2010), social valuation (Fini et al., 2018a) and organizational ambidexterity (Ambos et al., 2008). These studies have leveraged the inherent differences between the academic and the business environments, or logics, and managing the hurdles of making transitions across this type of boundary. Such transitioning, boundary-spanning behaviours are evident at multiple levels of analysis.

At the individual level, contributions have emphasized how tensions between academic and business environments influence the collaborative behaviours of scientists (Ambos et al., 2008; Tortoriello et al., 2015; Balven et al., 2018; Hmieleski and Powell, 2018), the strategic decisions of science-commercialization (Bikard, 2018; Chai, 2017; Nelson, 2016), as well as the perceptions of other audiences to which scientists turn for resource acquisition and individual legitimation (Fini et al., 2018a). The tensions between academic and commercial demands are found to be more problematic at an individual than at an organizational level (Ambos et al., 2008). In a similar fashion, by observing scientists' enacting of transitioning behaviours from science to business, some research has also theorized on the outcomes of such a process, seizing individuals' ability to produce knowledge (Dougherty et al., 2012; Toole et al., 2010) and generate economic-value (Stern, 2004).

Other studies have adopted a meso-level of analysis, addressing issues at group level. This literature has mostly addressed how science-based teams behave and perform. In particular, within-team coordination costs (Kotha et al., 2013) and innovation capability (Jain, 2013), as well as international teams' mobility behaviours (Franzoni et al., 2018) and productivity (Gittelman, 2007), have been linked to team-level outcomes.

Organizational-level research also suggests that organizations, by bridging between science and commercial logics, are better positioned to generate organizational knowledge

(Tortoriello et al., 2010) and enhance organizational performance (Toole et al., 2009). Some other organizational-level research in science commercialization has stressed the multi-stakeholder and complex nature of the transitioning between science and business (Ambos et al., 2010). In particular, within-organization resource complementarity (Hess et al., 2011) and resource dependence (Kehoe et al., 2015) have been linked to organizational performance. Further, literature has also studied the ability of organizations to source science-based knowledge from universities and public research institutions (Perkmann et al., 2018; Sullivan et al., 2011), and how such behaviours resulted in more or less knowledge creation (West, 2008) and production of high impact innovations (Gittelman et al., 2003).

Finally, by taking an institutional perspective, Funk and Owen-Smith (2017) have studied the linkages between federal research funding and the ability of public research institutions to create disruptive inventions, addressing how the strength of commercial ties sets the boundary conditions for this relationship to unfold.

These studies provide excellent examples of the potential for using the science commercialization context to develop management theory by leveraging the relatively large and distinctive differences between the academic and the business worlds. Hence, theoretical progresses have been made on issues related to how individuals and organizations deal with conflicting demands, through for instance cognitive and social processes and organizational ambidexterity. Moreover, this context has been used to study linkages across diverse contexts, thereby contributed to understanding resource acquisition and networking more generally.

Variety of Goals and Impacts in Science Commercialization Research

A second feature is the variety of goals, missions and values held by different stakeholders. Such heterogeneity is conducive to multiple outcomes and impacts across levels of analysis (Holstein et al., 2018). At the individual level, scientists' engagement in commercialization activity, such as academic entrepreneurship, is driven by a multitude of motivations, related to technology diffusion, technology development, financial gain, public service and peer motivations (Hayter, 2011; Lam, 2011). Individual preferences (Roach et al., 2015) and goals (Bercovitz et al., 2014) influence the means through which scientists engage in science commercialization. Also, their scientific backgrounds (Gruber et al., 2013) and social pressures (Bercovitz et al., 2008) exert a great deal of influence on the enactment of science commercialization behaviours, bearing

significant effects on the quality of individual- and group-level scientific and innovative outcomes (Bikard et al., 2015).

Literature has also addressed the heterogeneity in organizational goals and motives as predictors of science commercialization activities. In particular, research has emphasized how modes of engagement in technology-licencing behaviours (Ziedonis, 2007), university-industry collaborative efforts (Lacetera, 2009; Mindruta, 2013) and firms' scientific-disclosing behaviours (Polidoro et al., 2012) have important implications for organizations' ability to create value. Also, by linking organizational goals to impacts in science commercialization, research has addressed the foundations of science-based firms' economic performance (Clarysse et al., 2011; Lowe et al., 2006) and market value (Simeth et al., 2016), as well as the scientific value of their innovative behaviours (Capaldo et al., 2017; Roach et al., 2013).

Studies have also addressed impacts across level of analysis, for instance, Pitsakis, Souitaris and Nicolaou (2015) use the science commercialization context to look at how a specific organizational level outcome (i.e., performance of university spin-offs) influences performance at a different level of analysis (i.e., university research income). Similarly, Eesley et al. (2016), emphasize how institutional changes may alter individuals' beliefs and behaviours. Yet, to generate positive outcomes, such changes need to be consistent with the broader institutional environment to which individuals and firms are exposed to.

These studies illustrate the many possibilities for theoretical development offered by these features. Particularly, the variety of goals exhibited by scientists and how this influences their behaviour has contributed to progress related to understanding the links between individual and institutional characteristics and subsequent behaviour. However, relatively few studies have used empirical data from the science commercialization context to study the variety of impacts generated and there is clearly a void in our theoretical understanding of the link between different goals and impacts (Kotlar et al., 2018).

THEORY DEVELOPMENT USING THE SCIENCE COMMERCIALIZATION CONTEXT: A RESEARCH AGENDA

Our brief review shows that science commercialization is increasingly used as an empirical context for management research and related theory development. In this section we discuss opportunities for making theoretical contributions to management research using this context,

related to the two conceptual aspects outlined in the previous section and presented in Figure 1. We also emphasize the multiple-level nature of the phenomenon, as well as the importance of feed-back loops. Table II summarizes the potential research topics related to these opportunities.

--- Insert Table II about here ---

Managing the Transition across Institutional Boundaries

Individual and group levels. Individual scientists hold high levels of human capital and skills. As such, science commercialization research can inform expertise-based approaches. According to cognitive research in entrepreneurship (Randolph-Seng et al., 2015), individuals engage in search and value-added activities as a result of differences in their acquired skills and expertise (Baron et al., 2010), as well as past learning experiences (Corbett, 2005). The idea of different modes of exploitation of opportunities is seen as a key consideration in entrepreneurship theory (Shane et al., 2000). That is, the opportunities that individuals discover can be exploited within existing organizations, through the start-up of a new organization, or through the market mechanism, e.g., through the sale or licensing of a patent. Yet, very few studies have been conducted that examine these choices between modes of exploitation and therefore factors influencing these choices and their consequences are poorly understood. With time consuming exploitation processes, distinct types of knowledge possessed by different actors in the process, and great access to high quality data, science commercialization is an ideal context for such studies. For instance, the founders of university spin-offs can develop entrepreneurial competencies by adding expertise to their teams from across the boundary between universities and industry (Rasmussen et al., 2011), or pass the exploitation of opportunities on to external parties who already possess such knowledge, which would require social capital (Mosey et al., 2007; Steinmo et al., 2018) and networking skills (Rasmussen et al., 2015).

Both scientific research and the science commercialization process involve high degrees of groupwork. This is taking place in both university-based labs and extended labs (i.e., labs established in for profit firms to keep the research team together), as well as within the founding teams of science-based firms (Knockaert et al., 2011) and project teams in collaborations across university-industry boundaries (Bercovitz et al., 2011). Hence, the science commercialization context may provide fertile playgrounds to advance research on small group dynamics and team-

based literatures (Van Knippenberg et al., 2004), particularly related to how teams evolve and perform (Nikiforou et al., 2018). In particular, the science commercialization process is a promising empirical context for developing theories where it is important to capture events as they unfold over time (e.g., real options theorizing, work on first mover advantages). One example is science-based entrepreneurship, which entails entrepreneurial ventures and processes involving opportunities based on new scientific knowledge or technology developed in universities or other research organizations (Ambos et al., 2008; Wright et al., 2007). Science-based entrepreneurship is a complex phenomenon, involving many actors at multiple levels, engaging in processes that unfold over extended time-periods. Start-up processes of science-based firms may take years to complete, involving multiple constituents such as individual entrepreneurs, teams, industry partners, venture capitalists, and universities (Rasmussen et al., 2011). In entrepreneurship it has been noted that the duration of venture creation processes is typically short (Shim et al., 2018), which makes the collection of fine grained data challenging. The context of science commercialization can help overcome this challenge by providing rich data on start-up processes extending over long time period.

Organizational level. Given the commonalities of the challenges faced by organizations in the process of commercializing scientific knowledge, the underlying organizational mechanisms characterizing the different science commercialization pathways warrant better theoretical models. The literature has suggested the existence of both formal and informal links for technology transfer and commercialization of research, involving different types of knowledge bases. Such mechanisms often complement each other, rather than being substitutes (Van Looy et al., 2011). Hence, there is potential for studying the configurations and interactions between different organizational mechanisms linking science and application, as well as their boundary conditions, rather than investigating single mechanisms separately. Accordingly, the context of science commercialization appears well suited to explore topics of more general interest such as coordination costs (Kotha et al., 2013) and agency theory (Semadeni et al., 2011).

Furthermore, we also see an opportunity to further conceptualize how inter-organizational collaborations can be designed to favour knowledge spillovers across organizational boundaries and how intermediary organizations may help to mitigate information asymmetries between the parties (thus lowering search and transaction costs). Thus, contributions to organizational design

and ultimately transaction cost economics may be spurring from research done on science commercialization and its impact.

Institutional level. Universities and research organizations have undergone drastic organizational changes over the last three decades making the commercialization of science increasingly important to their missions (Bercovitz et al., 2008; Colyvas et al., 2006). Fostered by institutional and regulatory developments, science commercialization activities have become core to the new mission of the modern university, in addition to the more traditional mandates of education and research (Siegel et al., 2015). These changes, especially in public universities, are creating hybrid public-private organizations with potentially conflicting objectives between such third mission activities and more traditional university activities (Holstein et al., 2018; Kivleniece et al., 2012). In an attempt to favour knowledge transfer activities, research centre administrations have created intermediary organizations to broker between science and commercial applications (Villani et al., 2017; Wright et al., 2008). For instance, TTOs, research centres, incubators, accelerators and broker services have flourished across the globe over the last decade. There has been a tremendous shift from a situation in which only a few pioneers had infrastructures to support science commercialization, to a condition in which virtually all research organizations have such intermediaries. Hence, science commercialization is increasingly seen as a legitimate activity in which several organizations engage. Such transformations, which have redesigned the boundaries between public and private science, have systematically reshaped the missions of the organizations that engage in it, also influencing the identities and preferences of the individuals exposed to such changes. Therefore, we believe this context provides unique opportunities to further develop institutional approaches, emphasizing their dynamic and evolutionary aspects, as well as investigating the effect of institutional changes on organizational practices and individual behaviours.

Furthermore, institutional theory (DiMaggio et al., 1991) and institutional logics (Thornton et al., 2012) can use science commercialization as a fertile ground for theorizing. For instance, Sauermann and Stephan (2012), by applying the institutional-logics framework to science commercialization, provide a sound empirical test of the coexistence of multiple-logics within a given institutional realm. Also Murray (2010) by addressing science commercialization, argues that, when institutional logics overlap (e.g., logic of academic science and logic of commercial science), the emerging hybrid forms do not originate from a collapse or blending of

the different institutional logics but rather maintain the distinction and resilience of constituting logics.

Multi-level. The role of scientist-entrepreneurs, whether through start-ups, licensing or patenting, may differ across institutional contexts. Science commercialization may involve the movement of academic scientists between universities with different strategies towards science commercialization in the same country and may also involve scientist mobility across institutional boundaries relating to different countries (Wright et al., 2018b). There may be differences in the approaches to science commercialization between individual scientists from one context moving to another, the universities they move to and the country level institutional contexts relating to the regulation of science commercialization. For example, foreign-born scientists may be more likely than their domestic counterparts to start a company in some environments (Krabel et al., 2012). A further issue concerns the potential resistance by incumbents to new, socially beneficial innovations emanating from the lab. Multi-level analysis might usefully explore whether resistance is down to direct anti-competitive defence or whether it relates to legitimate elements of the institutional infrastructure (Zietsma, et al., 2018). Science commercialization may thus provide an interesting context in which to conceptualise the interactions between different levels of analysis.

Variety of Goals and Impacts

Individual and group level. As many individuals involved in science commercialization span organizational and identity boundaries (e.g., university professor vs. entrepreneur in a new venture), studying social identity issues would appear to be particularly salient in this context (Tajfel, 2010). Some recent work has started shedding light on the implications of different founder identities on organizational performance and impacts (Fauchart et al., 2011; Powell et al., 2017).

The differences in the goals of academics, university managers and policymakers provide a context to analyse the interactions between the actors involved in developing and implementing academic entrepreneurship that can extend theory relating to institutional entrepreneurship (Battilana et al., 2009) and multiple agency theory (Arthurs et al., 2008). Further, recognition of the role of individual actors presents opportunities for the development of micro theories relating to cognition, organizational commitment and organizational justice (Cropanzano et al., 2003) that

present an opportunity to extend theoretical boundaries to individuals and groups operating in a traditionally non-commercial context.

Organizational level. Issues of identity are also salient at the firm level, where, for instance, Fisher et al. (2016) used the context of a science-based new venture to develop theory on how the identity of a new venture needs to adapt according to the expectations of critical resource holders at different stages of development. These ideas warrant further testing within the science commercialization context.

Institutional level. Science commercialization represents a context in which multiple impacts may occur. This is relevant not only for science and public policy but it may open up new avenues for management research. In fact, the recent science commercialization debate is moving beyond maximization of the number of commercialization projects (i.e. spin-offs and licenses) and revenue generated, to a greater emphasis on their broader role of facilitating research and its societal impact. A good example of this development is the U.S. Association of University Technology Managers' "Better World Project," which was launched in 2005 to promote public understanding of how academic research and technology transfer benefits individuals, local communities and mankind. This proliferation of goals and missions within this context raises a number of managerial challenges that warrant further attention from a number of different disciplines, investigating how individuals, organizations, as well as institutions, manage the science commercialization process and deliver multiple impacts (e.g., social and societal impacts related to wellbeing or sustainability).

Multi-level. The variety and potential conflicts of goals may especially occur in public-private governance contexts, as public organizations such as universities may have different balances of social, economic and financial goals compared to private organizations as well as differing time horizons. Universities and academic scientists may themselves have different goals (Holstein et al., 2018), as might individuals and organizations in the private sector (Kotlar et al., 2018). Further research is needed that explores how these various goals at different levels influence the selection of and interactions between the parties involved in science commercialization. Such analyses would help extend conceptual and empirical understanding of university-industry relations by making challenges related to different goals at different levels more explicit. More generally, such analyses may add to conceptual understanding of partner selection and interaction decisions in trading relationships and alliances.

Feedback loops

Finally, data availability opens unique possibilities for studying feedback loops from different activities and processes occurring at different levels. For instance, at the individual level, it would be possible to study the impact of academics' engagement in science commercialization on their subsequent careers and roles in research projects. Questions such as, how does an experience of failure impact the subsequent engagement in science commercialization activities? Or whether scientists become better scientists by engaging in commercialization activities, may find a sound answer in this context. Also, examining multi-level feedback loops can provide key insights into the emergence and development of entrepreneurial ecosystems (Autio et al., 2018). Universities may develop continuing commercialization relations with industry rather than one-off interactions, enabling the building of trust and involving the management of alliances built on feedback from prior experience. Important issues for further research concern the extent to which these involve multi-level relationships between universities and firms but also between individuals and groups of academics.

PAPERS IN THE SPECIAL ISSUE

Following a general call for papers, we received 29 submissions. After a first round of desk rejections, 17 of these submissions were reviewed according to the standard Journal of Management Studies process, using three referees for each paper. The 4 papers presented here and summarised in Table III successfully navigated this process. Together, these papers represent excellent examples of how the science commercialization context can be used to address various theoretical issues in management.

--- Insert Table III about here ---

The papers illustrate several theoretical perspectives, notably imprinting theory (Hahn, Minola and Eddleston), social worlds theory (Mason, Friesl and Ford), institutional theory and person-environment fit theory (Ebers, Klingbeil, Semrau and Wilhelm), as well as real options logic (Huang and Jong). The papers reflect different levels of analysis also, with Hahn et al. examining scientists' careers within start-ups and Ebers et al. looking at researchers working for research

group leaders in different research institutes, while Mason et al. take the case of a single scientific discovery and, finally, Huang and Jong focus on multiple R&D projects. They also demonstrate the applicability of both quantitative (Hahn et al.; Ebers et al.; Huang and Jong) and qualitative approaches (Mason et al. using an abductive method).

First, the paper by Hahn, Minola & Eddleston explores how the science commercialization context can extend imprinting theory. By examining a sample of Italian start-ups with or without scientist founders, they shed light on how mindsets and norms associated with a previous career imprint transfer and adapt to a new context. They also show that the imprinting effect of the scientists' career may have a positive or negative effect on the venture. On the one hand the effect may be positive if scientists' career imprint stimulates search breadth and depths. On the other hand, the effect can be negative and lead to rigidities if the startup fails to pursue strategic planning or emphasizes non-commercial goals.

Second, Ebers et al. shed light on the link between organizational-level institutional logic and researchers' mindsets. Using data on 254 researchers working for 85 research group leaders in 49 German research institutes, they use a multi-level research design to test the effect of organizational-level research commercialization logic on researchers' entrepreneurial intentions. They also show the extent to which two attributes of research group leaders, i.e. their track record of entrepreneurial behaviour and their entrepreneurial intentions, play a significant role in transmitting the organizational-level logic to individuals.

Third, the single longitudinal case study of a scientific discovery by Mason et al. provides new insights for social worlds theory from science commercialization. Their study emphasises that rather than institutional arrangements providing a pre-determined marketization path, a series of choreographed contestations between practices at the nexus of social worlds perform the collective working out of innovative next steps in the marketization process.

Fourth, Huang and Jong use a real options approach to investigate how firms decide which R&D projects should be pursued and which ones should not. They argue that resource needs for R&D projects are difficult to predict, in particular at project inception. They focus on 570 R&D projects in the global cell therapy sector, launched between 1986-2011 in the US. Their results highlight lower R&D project initiation rates and higher discontinuation rates for projects launched after a US policy-change that increased uncertainties about the outlook for public cell therapy research. They also show how this effect was reversed as the US public funding outlook

for such research recovered. Their findings show how uncertainties about the institutional scientific environment affect both the initiation and discontinuation of R&D projects.

CONCLUSION

In this paper, we have argued why the science commercialization context can be a highly productive lab for exploring several topics of more general interest to management theory. The title of this special issue, 'Theories from the lab', connotes two distinct features of science commercialization research. First, it points to an important origin of the scientific knowledge and technology being commercialized – the research laboratory. Second, it connotes our belief that the science commercialization context can serve as a laboratory for researchers seeking to advance our understanding of key issues in management and organization studies.

Also, science commercialization is gaining more attention as organizations and managers face increasing pressures related to how they can contribute to sustainable development and wellbeing alongside with traditional business objectives. This more complex landscape calls for a deeper conceptual understanding of how innovations originating from the frontiers of science is exploited and commercialized, and eventually used to solve broader and more complex societal issues. We hope the ideas put forward here will inspire future research that can have an impact both on the field of management as well as on the intriguing task of commercializing science.

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Table I: Summary of papers included in the literature review

Authors	Year	Journal	Title	Data	Key findings	Level-of-analysis	Prevalent theme	Specific theme	Theoretical conversation
Ambos and Birkinshaw	2010	OS	How do new ventures evolve? An inductive study of archetype changes in science-based ventures	9 ventures followed up to 5 years (in all, 56 interviews)	There are three distinct archetypes of new ventures (capability driven, market driven and aspiration driven). The new ventures may change archetype over time. The transition between archetypes is triggered by collective cognitive dissonance. There are two distinct forms of transition: sustaining transitions and disruptive transitions.	Organizational	Transition	Organizational change	Evolutionary theory
Ambos, Mäkelä, Birkinshaw and d'Este	2008	JMS	When does university research get commercialized? Creating ambidexterity in research institutions	207 research council-funded projects, combining data on project outcomes with principal investigators' perceptions	The tension between academic and commercial demands is more salient at the level of the individual researcher than at the level of the organization.	Individual	Transition	Conflicting logics	Organizational ambidexterity
Bercovitz and Feldman	2008	OS	Academic Entrepreneurs: Organizational Change at the Individual Level	1,780 faculty members in 15 matched departments at medical schools of two universities	Individual attributes are important for participation in university technology transfer, but is conditioned by the local work environment.	Individual	Goals/Impact	Motivations/ expectations	Organizational change
Bercovitz and Tyler	2014	OS	Who I Am and How I Contract: The Effect of Contractors' Roles on the Evolution of Contract Structure in University–Industry Research Agreements	Field interviews and content analysis of monitoring and intellectual property terms of sponsored research agreements	As scientists gain contracting experience with an exchange partner the enforcement terms of subsequent contracts become less detailed. Contract administrators primarily accumulate joint governance experience and establish administrative routines that cause the enforcement terms of subsequent contracts to become more detailed.	Individual	Goals/Impact	Individual preferences and characteristics	Contracting literature, behavioral theory

Bikard	2018	OS	Made in Academia: The Effect of Institutional Origin on Inventors' Attention to Science.	479 patents and their citations of 90 scientific papers. 924 patent-paper dyads	Inventors are 23% less likely to cite the academic paper than its "twin" from industry.	Individual	Transition	Individual preferences and characteristics	Attention theory
Bikard, Murray and Gans	2015	MS	Exploring Trade-offs in the Organization of Scientific Work: Collaboration and Scientific Reward	Annual research activity of 661 faculty scientists over a 31-year period	Collaboration is associated with important trade-offs, including higher-quality publications, lower individual productivity and credit shared across collaborators. The size of these effects is considerable.	Individual	Goals/Impact	Collaboration activities	Organizational choice: benefits and costs of collaboration
Capaldo, Lavie and Petruzzelli	2017	JM	Knowledge maturity and the scientific value of innovations: The roles of knowledge distance and adoption	5,575 patented biotechnology innovations by 283 U.S. firms between 1985 and 2002	The effect of knowledge maturity on innovation value is curvilinear and it is contingent on different types of knowledge distance.	Organizational	Goals/Impact	Innovation and knowledge management	Knowledge management and innovation
Chai	2017	OS	Near Misses in the Breakthrough Discovery Process	Historical case study. 27 interviews and archival data	Seminal discoveries are led by paradigmatic rigidity characterized by three mechanisms (i.e., not noticing or recognizing anomalies, actively resisting solutions, and failing to make the link between communities).	Individual	Transition	Complexity of science innovation process	Cognition and psychology
Clarysse, Wright and Van de Velde	2011	JMS	Entrepreneurial origin, technological knowledge, and the growth of spin-off companies	48 corporate and 73 university spin-offs comprising the population of spin-offs in Flanders during 1991–2002	Corporate spin-offs grow most if they start with a specific narrow-focused technology sufficiently distinct from the technical knowledge base of the parent company. University spin-offs benefit from a broad technology which is transferred from the parental organization.	Organizational/ Institutional	Goals/Impact	Imprinting and knowledge	Knowledge-based view
Dougherty and Dunne	2012	OS	Digital Science and Knowledge Boundaries in Complex Innovation	Interviews with 85 scientists and managers working on drug discovery	Digitalization creates a new form of knowledge that provides essential complementary insights for complex innovation that cannot exist otherwise. However, digitalization also creates new knowledge boundaries that concern central activities of innovation.	Individual	Transition	Complexity of science innovation process	Innovation management

Eesley, Li and Yang	2016	OS	Does institutional change in universities influence high-tech entrepreneurship? evidence from China's project 985	Survey to all Tsinghua University alumni (1947-2007) with an address on record. 2,966 responses	Institutional changes may alter individuals' beliefs and behavior, but they must be consistent with the broader institutional environment to improve firm performance.	Institutional	Goals/Impact	Institutional change	Institutional theory and individual preferences
Fini, Jourdan and Perkmann	2018	AMJ	Social valuation across multiple audiences: The interplay between ability and identity judgments	Peer valuation of 9,502 academic scientists applying for research grants at a UK research university	Scientists' chances of receiving peer-reviewed grants are highest at moderate levels of industry evaluation, beyond which they recede. The inverted U-shaped relationship is attenuated in disciplines with a strong publication record and when scientists have proximate identity to industry (e.g. medicine and engineering).	Individual	Transition	Audiences	Social valuation
Franzoni, Scellato and Stephan	2018	JMS	Context factors and the performance of mobile individuals in research teams	Survey data for 4,336 scientific teams, located in 16 countries	Three context factors are positively associated with international mobility and the performance of the research units: the degree to which knowledge in the relevant subfield of science is geographically concentrated, the creative intent of the activities performed and the decision power of the mobile individual.	Group	Transition	Innovation and knowledge management	Knowledge recombination and learning
Funk and Owen-Smith	2017	MS	A Dynamic Network Measure of Technological Change	2.9 million U.S. utility patents (1976-2006). Analyses patents issued to the 110 most research-intensive universities	Although federal research funding pushes campuses to create inventions that are more destabilizing, deeper commercial ties lead them to produce technologies that consolidate the status quo.	Institutional	Transition	Instructional change	Empirical, investigating technological change
Gittelman and Kogut	2003	MS	Does Good Science Lead to Valuable Knowledge? Biotechnology Firms and the Evolutionary Logic of Citation Patterns	Publications and patents of 116 biotechnology firms (1988-1995). Nearly 7,000 articles	Publication, collaboration, and science intensity are associated with patented innovations; however, important scientific papers are negatively associated with high-impact innovations.	Organizational	Transition	Conflicting logics	Community perspective

				and 1,200 U.S. patents					
Gittelman	2007	OS	Does Geography Matter for Science-Based Firms? Epistemic Communities and the Geography of Research and Patenting in Biotechnology	5,143 collaborative research papers published by a large sample of small biotechnology firms	The spatially clustered teams are more likely to publish papers that are subsequently cited in the authoring firms' patents, whereas teams that are globally dispersed produce papers that are more highly cited in the scientific literature, but less cited in the authoring firms' patents.	Organizational	Goals/Impact	Conflicting logics	Innovation clusters and geography
Gruber, Harhoff and Hoisl	2013	MS	Knowledge Recombination Across Technological Boundaries: Scientists vs. Engineers	1,880 inventors named on 30,550 EPO patents; relevant bibliographic data.	Inventors with a scientific education are more likely to generate patents that span technological boundaries than inventors with an engineering degree.	Individual	Goals/Impact	Individual preferences and characteristics	Micro-level theories on technological recombination
Hess and Rothaermel	2011	SMJ	When Are Assets Complementary? Star Scientists, Strategic Alliances, And Innovation In The Pharmaceutical Industry	The innovative performance of 108 global pharmaceutical firms (1974–2003)	Resource combinations that focus on the same parts of the value chain are substitutes due to knowledge redundancies. Conversely, resource combinations that link different parts of the value chain are complements due to integration of non-redundant knowledge.	Organizational	Transition	Complexity of science innovation process	Resource complementarity
Jain	2013	OS	Learning by Doing and the Locus of Innovative Capability in Biotechnology Research	Patent data from 20,886 scientists working in 611 biotechnology firms in the U.S. and Canadian biotechnology industry (1970-2007)	The individual is the primary repository of innovative capability and experience working together in teams has a secondary influence on productivity. Accumulated firm experience has no direct effect on productivity. However, when individuals possess relevant domain knowledge and have experience working together, they benefit from knowledge spillovers within the firm.	Organizational	Transition	Complexity of science innovation process	Organizational learning
Kehoe and Tzabbar	2015	SMJ	Lighting the way or stealing the shine? An examination of the duality in star scientists' effects on	Data from 456 biotechnology firms (1973-2003)	Stars positively affect firms' productivity, but their presence constrains the emergence of other innovative leaders in an organization. Firm productivity	Organizational	Transition	Complexity of science innovation process	Human capital, resource dependency

			firm innovative performance		and innovative leadership among non-stars in a firm are greatest when a star has broad expertise and collaborates frequently.				
Kotha, George and Srikanth	2013	AMJ	Bridging the mutual knowledge gap: Coordination and the commercialization of university science	Sample of 3,776 university invention disclosures	Anticipated coordination costs influence whether an invention is licensed and that specific forms of team experience attenuate such coordination costs.	Group	Transition	Coordination costs	Small group dynamics, innovation management
Lacetera	2009	OS	Different Missions and Commitment Power in R&D Organizations: Theory and Evidence on Industry-University Alliances	Sample of research contracts between biotech companies and academic organizations and qualitative case examples	Outsourcing a research project to a university allows firms not to drop scientifically valuable projects before termination. Such commitment is valuable in context where economic and scientific values are not aligned.	Organizational	Goals/Impact	Organizational characteristics and preferences	Organizational dynamics and learning; Economics of science
Lowe and Ziedonis	2006	MS	Over-optimism and the Performance of Entrepreneurial Firms	734 inventions disclosed to the University of California (1981-1999) and licensed exclusively to a firm	Start-ups exhibit statistically equivalent performance rates to established firms in commercializing university inventions, but continue unsuccessful development efforts for longer periods of time.	Organizational	Goals-impact	Commercialization process	Cognitive bias in decision making
Mindruta	2013	SMJ	Value creation in university-firm research collaborations: A matching approach	447 contracts between 238 firms and 217 university scientists	Faculty–firm matching is multidimensional: firms and scientists complement each other in publishing capabilities but substitute each other in patenting skills. Firms and scientists with specialized knowledge create more value by teaming with more knowledge-diversified partners.	Organizational	Goals/Impact	Organizational characteristics and preferences	Knowledge management, alliance formation
Nelson	2016	OS	How to Share "A Really Good Secret": Managing Sharing/Secrecy Tensions Around Scientific Knowledge Disclosure	46 interviews and 58 oral histories with researchers in biotechnology and digital audio	Researchers use 4 tactics to manage sharing/secrecy tensions: leveraging trust, strategic withholding, delaying, and patenting. The use of such tactics is tied to particular sharing practices, organizational environments, and scientific fields.	Individual	Goals/Impact	Conflicting logics	Sharing/ Secrecy Tensions; Individual preferences

Perkmann, McKelvey and Phillips	2018	OS	Protecting Scientists from Gordon Gekko: How Organizations Use Hybrid Spaces to Engage with Multiple Institutional Logics	8 university–industry research centers at 3 EU research universities	Organizations can use structural hybrids to externally engage with multiple institutional logics. These spaces require three kinds of work: leveraging, hybridizing andbolstering, and they are hybrids rather than being dominated by a single logic.	Organizational	Transition	Hybrid organizations and institutional logics	Institutional theory
Pitsakis, Souitaris and Nicolaou	2015	JMS	The Peripheral halo effect: Do academic spinoffs influence universities' research income?	113 universities and 1404 spinoffs (1993-2007)	Developing a reputation for a peripheral activity (e.g., universities' social impact via spinoffs) have positive spillovers for core organizational activities (e.g., university research). This effect is more prominent for high-status than for low-status organizations.	Institutional	Goals/Impact	Institutional change	Organizational reputation, signaling
Polidoro and Theeke	2012	OS	Getting Competition Down to a Science: The Effects of Technological Competition on Firms' Scientific Publications	New drugs that the FDA approved (1983-2004)	Scientific articles about competing drugs compel a firm to highlight its own drug in scientific papers to assert the drug's uniqueness and mitigate the threat of substitution.	Organizational	Goals/Impact	Motivations/expectations	Technology management
Rasmussen, Mosey and Wright	2011	JMS	The evolution of entrepreneurial competencies: A longitudinal study of university spin-off venture emergence	The creation and growth of 4 university spin-offs within the UK and Norway	The specific competencies for venture creation had to be developed or acquired. This could be achieved iteratively through entrepreneurial experience and accessing competencies from industry partners and equity investors.	Organizational/Institutional	Transition	Organizational characteristics and preferences	Evolutionary theory and competence-based view
Roach and Cohen	2013	MS	Lens or Prism? Patent Citations as a Measure of Knowledge Flows from Public Research	Matching managers' reports on the use and character of knowledge flows with patent data (676 R&D labs)	Patent citations reflect the codified knowledge flows from public research, but they appear to miss knowledge flows that are more private and contract based in nature, as well as those used in firm basic research.	Organizational	Goals/Impact	Innovation and knowledge management	Economics of science

Roach and Sauermann	2015	MS	Founder or Joiner? The Role of Preferences and Context in Shaping Different Entrepreneurial Interests	Survey of 4,168 science and engineering Ph.D. candidates at 39 leading U.S. research universities	An interest in being a founder is most strongly associated with individuals' preferences for entrepreneurial job attributes, whereas contextual factors do little to shape individuals who lack these preferences. An interest in being a joiner is associated with both preferences and context.	Individual	Goals/Impact	Individual preferences and characteristics	Individuals preference and contextual theories of entrepreneurship
Simeth and Cincera	2016	MS	Corporate Science, Innovation, and Firm Value	Firm data and matched scientific publication and patent data for 1,739 high-technology firms (1996-2006)	The positive impact of scientific publications on a firm's market value occurs beyond the effects of research and development, patent stocks, and patent quality.	Organizational	Goals/Impact	Corporate science and innovation performance	Knowledge management
Stern	2004	MS	Do Scientists Pay to Be Scientists?	Multiple job offers to 107 postdoctoral biologists who received a total of 223 job offers	A negative relationship exists between wages and science.	Individual	Transition	Science/business transition	Economics of science
Sullivan and Marvel	2011	JMS	Knowledge acquisition, network reliance, and early-stage technology venture outcomes	Survey data on 151 technology ventures located in university incubators	Acquiring technology knowledge positively relates to the innovativeness of products/ services developed by entrepreneurs. Entrepreneurs can enhance this positive relationship by relying more on networks for technology knowledge acquisition.	Organizational	Transition	Innovation and knowledge management	Knowledge acquisition
Toole and Czarnitzki	2009	MS	Exploring the Relationship Between Scientist Human Capital and Firm Performance: The Case of Biomedical Academic Entrepreneurs in the SBIR Program	Biomedical academic entrepreneurs associated with 169 firms that participated in the NIH SBIR program (1985-1996)	The scientific and commercial components of an academic scientist's human capital have differential effects on the performance of research and invention tasks at the firm. The contribution of an academic scientist to a firm's patent productivity is decreasing with	Organizational	Goals/Impact	Individual and organizational productivity	Human capital

					the depth of their scientifically oriented human capital.				
Toole and Czarnitzki	2010	MS	Commercializing Science: Is There a University "Brain Drain" from Academic Entrepreneurship?	Panel database with 89 NIH academic entrepreneurs and 444 NIH research peers (1975-1996)	The academic brain drain has a nontrivial impact on knowledge production in the not-for-profit research sector.	Individual	Goals/Impact	Individual productivity	Economics of science
Tortoriello and Krackhardt	2010	AMJ	Activating cross-boundary knowledge: The role of Simmelian ties in the generation of innovations	Survey and archival data on 276 R&D scientists and engineers in a large multinational high-tech company	The advantages traditionally associated with bridging ties are contingent upon the nature of the ties forming the bridge, specifically, whether these bridging ties are Simmelian.	Organizational	Transition	Boundary spanning behaviors	Intra-organizational social networks and innovation
Tortoriello, McEvily and Krackhardt	2015	OS	Being a Catalyst of Innovation: The Role of Knowledge Diversity and Network Closure	Interviews, survey and archival data from 249 researchers in a large multinational high-tech company	Individuals having access to diverse sources of external knowledge through a closed network of contacts within the organization are well positioned to play the role of innovation catalysts. The role of catalysts of innovation is distinct from the role of innovators.	Individual	Transition	Collaboration activities	Organizational innovation and network
West	2008	JMS	Commercializing open science: deep space communications as the lead market for Shannon Theory, 1960–73	Data on communication technology development and application at two MIT spinoff companies	Maps the first 25 years of Shannon theory, the role of MIT in developing and extending that theory, and the importance of deep space communications as the initial market for commercialization. Contrasts the early paths of two MIT-related spinoffs that pursued this opportunity.	Institutional	Transition	Innovation and knowledge management	Open innovation
Ziedonis	2007	MS	Real Options in Technology Licensing	669 firm-choice observations on 309 UC patents licensed on an exclusive basis	Firms are more likely to purchase option contracts for more uncertain technologies. Firms that are better able to evaluate an external technology are less likely	Organizational	Goals/Impact	Motivations/expectations	Real-options

				(1979-1998), with 258 firms	to purchase options before licensing.				

Note: AMJ= Academy of Management Journal; JM= Journal of Management; JMS=Journal of Management Studies; MS= Management Science; OS=Organization Science; SMJ= Strategic Management Journal; Prevalent themes refer to the main topic addressed by the paper. 'Transition' emphasizes the processual nature and characteristics of managing the transition across the institutional boundaries of science and business. 'Goals/Impacts' refers to the identities, preferences, tastes, goals and impacts of actors engaging in science commercialization behaviors. The two prevalent themes may co-exist in a single paper. In our coding we refer to the predominant one.

Table II: Examples of opportunities for theory development using the science commercialization context

Level of analysis	Managing across institutional boundaries	Variety of goals and impacts	Feedback loops
Individual	• Social identity • Career transitions	• Wellbeing • Organizational justice • Incentives • Hybrid and employee entrepreneurship	• Learning processes • Learning from failure
Group	• Cross-disciplinary work • Team entry and exit • Team processes	• Team cohesion • Ambition level and performance	• Changes in team composition • Competency development • Resolution of conflicts
Organizational	• Intermediary units and brokers • Imprinting effects across organizational contexts (from academic to business contexts and vice versa) • Organizational identiy • Firm boundary issues • Organizational resistance • Status borrowing • Ambidexterity	• Hybrid objectives • Performance measurement • New organizational forms	• Business model development • Decision making under uncertainty • Organizational learning
Institutional	• Technological fungibility • Institutional logics	• Organizational goals • Multiple agency theory • Social entrepreneurship • Signalling theory • Behavioural theory of the firm	• Historical evolution of organizations • Path dependencies • Longevity, leadership and succession of organizations • Process theories
Multi-level	• Firm internationalization to different institutional contexts • Knowledge worker mobility across institutional contexts	• Public-private governance	• University-industry relations and development of trust, alliance management

Table III: Summary of papers in the Special Issue

Authors	Research Question	Theory	Data and Method	Findings and Conclusions
Hahn, Minola and Eddleston	How can scientists' career imprint contribute to their innovative startup's performance?	Imprinting theory	211 Italian startups with and without scientist founders	Scientist career imprint can provide an advantage to innovative startups if multiple scientist founders are involved by stimulating search breadth and depths, but it can act as a rigidity if the startup does not pursue strategic planning or emphasizes noncommercial goals.
Ebers, Klingbeil, Semrau and Wilhelm	In academia, which actors and mechanisms constitute the cross-level link between the organizational-level institutional logic of science commercialization and the researcher's entrepreneurial intentions?	Institutional theory and person-environment fit theory	Multi-level analyses based on a sample of 254 researchers working for 85 research group leaders in 49 German research institutes	Two distinct attributes of research group leaders—i.e. their track record of entrepreneurial behaviour and their entrepreneurial intentions—play a significant role in transmitting the organizational-level logic to the individual level. There is also a complementary interaction between organizational-level commercialization logic and the entrepreneurial track record of leaders.
Mason, Friesl and Ford	In the process of marketization, how do contestations between different market actors make scientific discoveries valuable?	Social worlds theory	Single longitudinal abductive case study of a scientific discovery over 30 months; 52 interviews and archival data	Science marketization unfolds through a series of choreographed contestations at the nexus of social worlds which bring together valuation practices and market devices from multiple social worlds to temporarily frame and fix what is being valued and how; how marketization is achieved only becomes apparent as each moment of valuation unfolds the next; rather than institutional arrangements emphasizes the practices and devices that perform the collective working out of innovative next steps in the marketization process.
Huang and Jong	How do firms decide which R&D projects to pursue and which ones to cast aside? And which are the factors that play into these decisions?	Real option theory	Longitudinal, quantitative study based on a dataset on 570 R&D projects in the global cell therapy sector initiated between 1986-2011 in the US.	A change in the US science and public policy, which introduced increased uncertainties about the outlook for public cell therapy research, originated a decrease in R&D project initiation rates and an increase in project discontinuation rates in the global cell therapy sector. This pattern was reversed as soon as the policy was modified and the US public funding outlook for such research recovered.
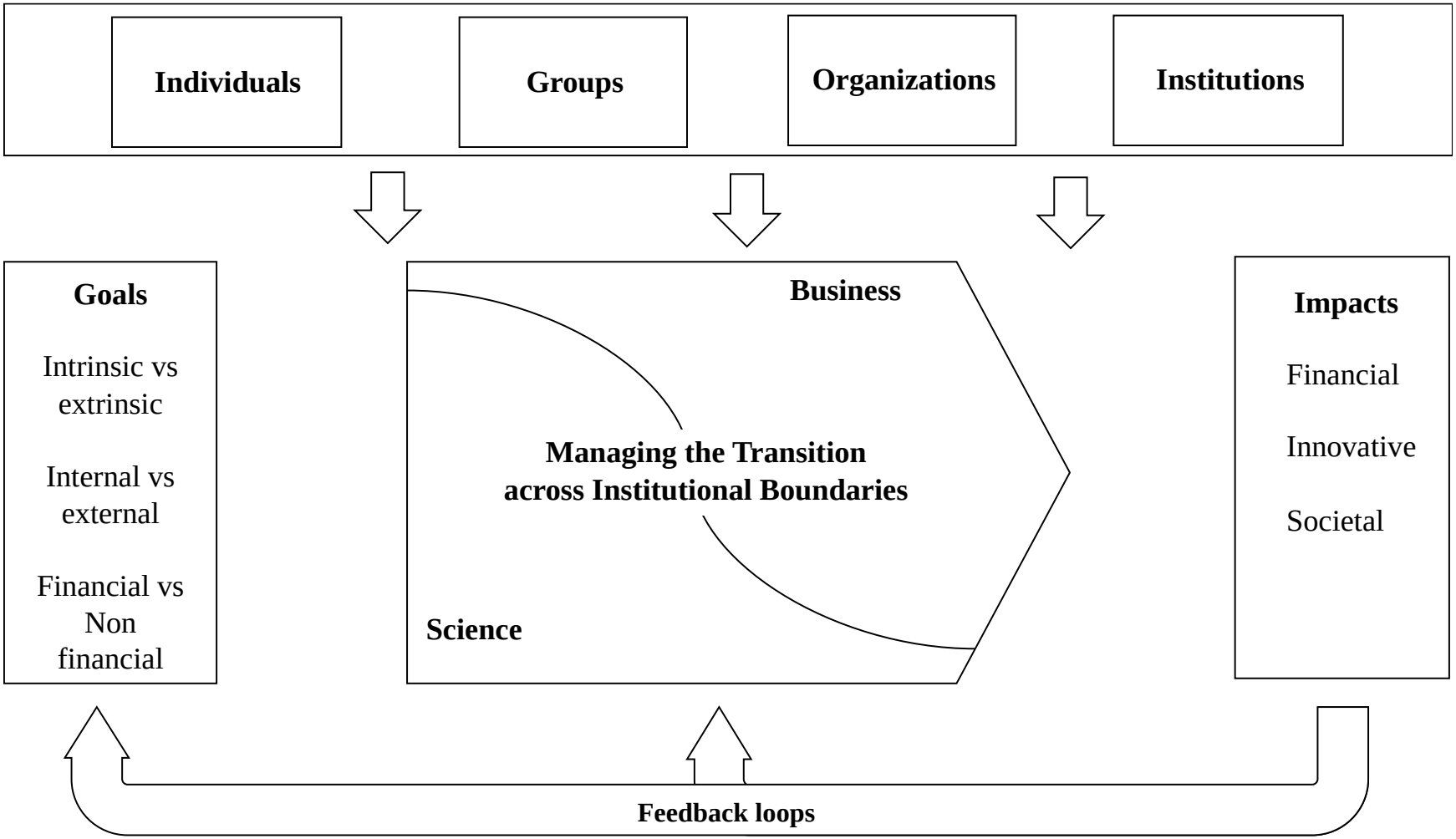
Figure 1: Conceptual model illustrating key features of the science commercialization process