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Academic entrepreneurship, technology transfer and society: where next?

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Abstract I outline a synthesis of micro and macro levels that attempts to provide a broader conceptualization of academic entrepreneurship and an appreciation of the contextual heterogeneity of academic entrepreneurship and the implications for how it occurs. The micro-level concerns how firms orchestrate their resources and capabilities, specifically knowing where resources come from and how to accumulate, bundle and configure them to generate sustainable returns. At the macro level, I analyse four different dimensions of context: temporal, institutional, social and spatial. Consequently, I argue that there is a need for a reconciliation of utilitarian and education-for-education's sake perspectives on the role of universities.

Keywords Spin-offs · Universities · Technology transfer · Academic entrepreneurship

JEL Classification N13 · O31

1 Introduction

Academic Entrepreneurship and technology transfer are maturing as an area of study and policy. Maturation of research poses major challenges for publishing on this topic in good journals since it becomes harder to identify research questions and opportunities that challenge the conventional wisdom rather than simply 'filling in the pot holes'. Indeed, the most important reason why submissions are rejected at journals is because of a lack of contribution to the literature. Clark and Wright (2007, 2009) show that some 92 % of papers rejected after review at *Journal of Management Studies* received this decision because of their lack of a contribution.

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At the same time, the societal benefits of universities and academic entrepreneurship are the subject of much continuing policy debate. I suggest that these developments provide opportunities for new research avenues in the area of academic entrepreneurship and technology transfer. These developments also call forth a need to reassess policy towards academic entrepreneurship specifically and towards universities more generally.

There is now an extensive literature on academic entrepreneurship and technology transfer (for reviews see for example, Siegel et al. 2007; Grimaldi et al. 2011). These studies provide mixed evidence on the societal impact of such research commercialization in terms of its financial benefits. Existing research has also provided limited understanding of the processes by which academic entrepreneurs accumulate resources and skills to be successful in the market.

Some have also questioned whether the institutional arrangements to commercialize research are socially optimal (Kenney and Patton 2009). Particular concerns relate to the narrow perceptions of academic entrepreneurship and the contexts in which it occurs. Further, there is debate about the nature of innovation policy in rapidly changing and complex environments.

In this article, I outline a synthesis of micro and macro levels that attempts to provide a broader conceptualization of academic entrepreneurship and an appreciation of the contextual heterogeneity of academic entrepreneurship and the implications for how it occurs. The micro-level concerns how firms orchestrate their resources and capabilities, specifically knowing where resources come from, on the one hand, and how to accumulate, bundle and configure them to generate sustainable returns on the other. At the macro level, I analyse four different contextual dimensions of context: temporal, institutional, social and spatial. I then discuss the implications of the analysis for further research and policy. I also suggest that for the future of universities that there is a need for a reconciliation of utilitarian and education-for-education's sake perspectives on the role of universities.

2 Academic entrepreneurship, resource orchestration and context

The relationship between micro and macro-levels with respect to academic entrepreneurship is presented schematically in Fig. 1.

2.1 Resource orchestration

The strategic entrepreneurship perspective emphasizes the need to select and structure human, social/network, financial and technological resources in order to exploit opportunities and gain competitive advantage, achieve growth and create value (Ireland et al. 2003). Recent developments in the resource based theory of the firm have also stressed the need to understand how firms orchestrate or better coordinate their resources and capabilities (Sirmon et al. 2011). This involves knowing where resources come from (Ahuja and Katila 2004) and how to accumulate, bundle and configure them to generate sustainable returns on the other. Rasmussen et al. (2011), based on evidence from university spin-offs find that the process of configuring and bundling resources requires the identification of opportunity recognition, leveraging, championing and networking competencies.

With respect to the configuration and bundling of resources, a first issue concerns the need to examine how an initial research idea can be refined (and re-refined) into a viable business concept. The notion of re-refining reflects the challenges arising from eventual market identification being at some variance from initial expectations (Vohora et al. 2004),

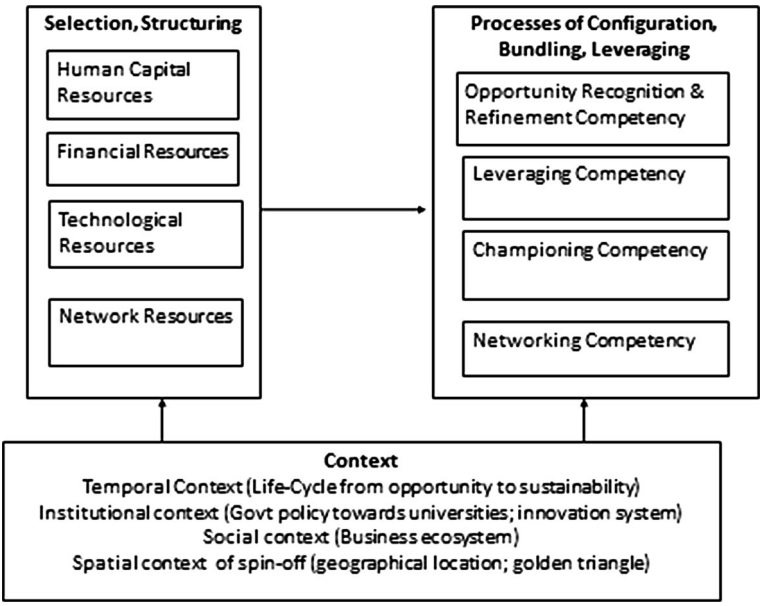

Fig. 1 Academic entrepreneurship, resource orchestration and context

and suggests the need to develop the capabilities to adapt an initial trajectory to what will be a viable one.

A second dimension concerns the need to examine how (and when) resources from industrial and financial partners can be accessed and how this can be communicated to external investors. A third issue concerns how appropriate individual(s) to champion university spin-offs can be identified over the venture's life-cycle. The person who is an appropriate champion initially may not be the one to take the business forward to growth and there is a need to understand how such transitions are made. Fourth, is the challenge of understanding how an appropriate networking competency can be developed over the life-cycle of the venture.

2.2 Context

It is important to study individual entrepreneurs in the context in which they find themselves. However, attention to context in the entrepreneurial literature has been limited (Welter 2011). Further, the dimensions of context are also not well-understood and incorporated into the entrepreneurship literature. Zahra and Wright (2011) identify four dimensions of context: temporal, institutional, social and spatial.

The temporal dimension concerns the emergence of spin-off ventures over time (life-cycle). This emergence has implications for the development of leadership in these companies, and how entrepreneurs and companies learn through this process of emergence and become sustainable ventures. For example, Zahra et al. (2009) focus on the need to develop boards that can monitor and also add value at different phases in a venture's development.

Second, the institutional dimension concerns the effect of different institutional contexts. This context includes the characteristics of the external environment in which spin-off ventures emerge and compete. It also involves the role of national and regional institutions that may influence the extent and nature of academic entrepreneurship.

Third, the social dimension concerns the relationships between the various parties that influence the emergence and development of spin-offs, such as alliance and trading partners, investors and parent universities.

Finally, the spatial dimension (Welter 2011), denotes the concentration of spin-off creating activities and the dispersion of institutions that support these ventures. It also encompasses the geographical mobility of these firms and their founding academics (Wright 2011).

In what follows, I discuss issues relating to research orchestration in each context.

2.3 Temporal

The temporal context involves consideration of the different life-cycle phases of an academic spin-off, from the opportunity recognition phase through to sustainability (Vohora et al. 2004), and the implications of these phases for resource orchestration.

There is a need for university spin-offs to consider how they can access sufficient human capital, finance, technological and network resources for different strategies and life-cycle phases. With respect to human capital, different experience and expertise may be appropriate at different phases. Different forms of technological resource may be needed to operate in technology or product markets. The emphasis on technology and product markets may change over life-cycle phases. For example, the spin-off may initially develop the value of technology before generating revenue from selling in the product market at a later stage (Clarysse et al. 2011). Different amounts and types of finance may be needed over the life-cycle, as the firm moves from proof of concept funding to financing long periods of development of the technology involving, for example, clinical trials. Networks need to be developed to facilitate links with financiers but also with alliance partners who are industry incumbents further along the value chain and closer to market.

2.4 Institutional

Innovation Policy is an important dimension of institutional context that traditionally only recognized pioneering innovation as innovation. Yet policies have often failed by focusing (solely) on funding major innovative technology. Even when trying to fund innovative technologies, policy makers usually pick the wrong ones. While this approach may provide for long term commitment, the corollary is that it introduces problems of path dependency and rigidity as a result of being locked into such programs.

The notion of innovation has, however, changed to become broader and more differentiated. Besides radical aspects, innovation can be differentiated to include service, business model and fast follower innovation. These aspects give closer recognition to firm and market-related dimensions of innovation. Indeed, more value creation may emanate from low tech business model innovation than through high tech science push innovation (Christensen 2010). It also needs to be recognized that the nature of innovation may change over the venture life-cycle. From a policy perspective, questions are raised concerning how more fine-grained policy can be designed that relates to these different types of innovation?

A second institutional level aspect concerns the need for policymakers to consider the kind of entrepreneurship they want to see (Zahra and Wright 2011). Is the aim of policy to promote start-ups to meet immediate local needs? Such firms may be life-style businesses that require little if any venture capital funding and which do not involve formal IP from universities. Alternatively, is the aim of policy to build capacity and competence in order to be able to compete globally? Such ventures likely need large amounts of venture capital

and possess formal IP. More specifically in the context of academic entrepreneurship, is the aim directly to promote spin-offs from universities or to adopt a more indirect approach that supports graduates of universities in creating ventures.

I suggest that in the light of this discussion there are important inconsistencies between innovation and entrepreneurship policy that need to be resolved. Innovation policy typically focuses on addressing (perceived) market failures in radical innovation, with a highly uncertain pay-off. Yet, stimulating new ventures with business model innovation and/or fast-follower innovation may be especially important for societal wealth generation. Such a differentiated approach, which integrates aspects of innovation and entrepreneurship policy may be help introduce more fine-grained policies that are appropriate in particular sectors and regions. For example, while political devolution may lead to attempts to introduce policies aimed at developing world-leading innovation, this would seem to be highly questionable in many smaller regions that do not possess an infrastructure of world leading research. Rather, more nuanced policies that play to the comparative advantage of such regions may be appropriate.

This has implications for processes of resource orchestration. For example, we know little about whether and how different institutional contexts provide a conducive institutional context that enables the resources required for academic entrepreneurship to be acquired and configured. Further research could usefully shed light on the extent to which resource deficiencies in some institutional contexts are substituted by other resources, and what the impact is for the performance of academic entrepreneurship.

Analysis is therefore needed of the appropriate balance between innovation and entrepreneurship policies and firm types. Further, these developments suggest there is a need to move beyond the notion of innovation systems as "the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies" (Freeman 1987), to stimulate innovation ecosystems. Innovation ecosystems concern the "network of diverse actors, including emerging young firms, as well as established medium-size and large enterprises, NGOs, and government" (Carayannis and Campbell 2009). While research on innovation systems began to emerge in the late 1980s and accelerated from the mid-1990s, research on innovation ecosystems has only begun to emerge in the past 5 years (Fig. 2) and further research is warranted.

A third institutional dimension concerns the nature of universities sought by government since this influences the nature of research that will lead to the technology endowments provided to spin-offs (Clarysse et al. 2011).

A fourth relevant institutional dimension concerns the availability of finance to fill the so- called equity gap for early stage high growth ventures. Various policy measures have been developed over a long period as attempts to address this gap (Martin et al. 2005). Yet, venture capital funding for early stage ventures remains at a low level and has failed to recover from the 2008 credit crisis, unlike funding for later stage management buyouts (Fig. 3).

There may be a need for more fine-grained analysis of the nature of equity gaps and the targeting of policy to fill these specific gaps. For example, how do equity gaps vary between sectors, regions and stages of finance? Preliminary analysis by Wilson and Wright (2011) based on UK data covering three million company years for the period 1999–2010 showed that the actual amounts funded by venture capital in health, pharmaceuticals, household products, insurance, information technology, investment companies and speciality finance were significantly below expectations.

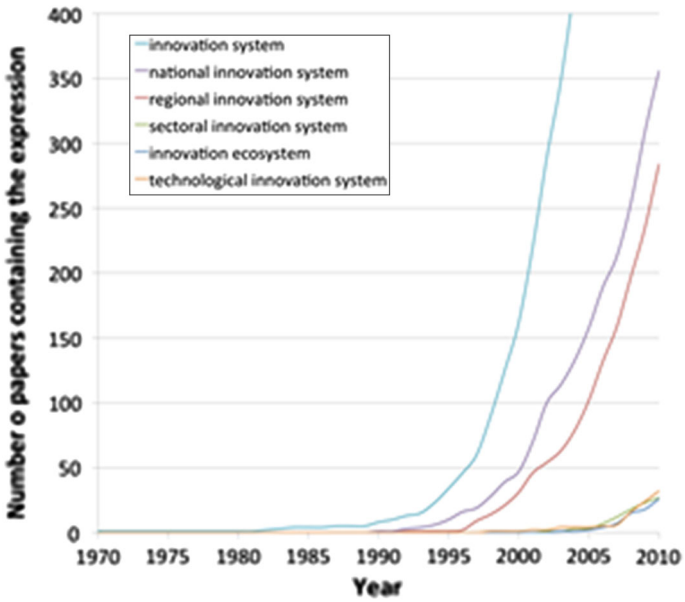

Fig. 2 Publications on innovation systems and ecosystems

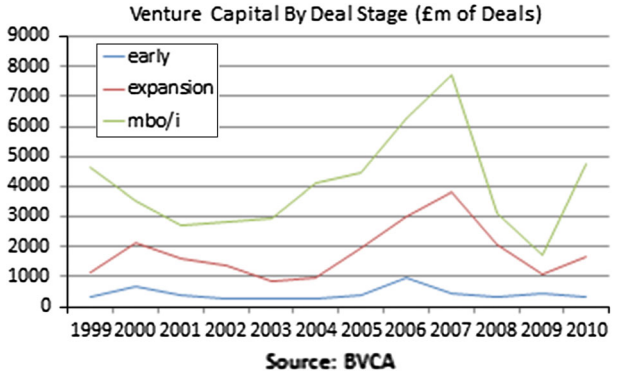

Fig. 3 Early stage high tech financing value has not recovered from credit crisis

2.5 Social

Parallel to research on innovation ecosystems, studies are also emerging in the management literature on business ecosystems. A business ecosystem has been defined as "an economic community supported by a foundation of interacting organizations and individuals… The economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organisms also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies" (Moore 1996). These ecosystems therefore focus on potential customer and supplier networks for high tech firms. Business ecosystems introduce the

customer (demand) side which is either absent or receives little emphasis in innovation ecosystems.

From the perspective of academic entrepreneurship important issues where we need greater insight concern how the business ecosystem co-evolves with academic spin-offs but also within a wider innovation ecosystem. Business ecosystems may vary between different sectors and disciplines as well as the life-cycle phase of the development of a new technology and spin-off. There is a need, therefore, to consider the different configurations of business ecosystems in academic entrepreneurship. Further, as new innovations, technologies and spin-offs emerge, they may need to enter and disrupt already pre-existing business eco-systems. The challenges involved in this entry process and how they are overcome warrant further detailed study.

Social capital is a key enabler of academic entrepreneurship (Mosey and Wright 2007). Links with financial providers also constitute a central element of a social context. Resolving the claimed spatial mismatch between investors and investees has been an important dimension of policy (Babcock-Lumish 2009). However, recent research has begun to question the traditional view that spatial proximity benefits can be leveraged if a venture is located close to centers of VC finance. Mueller et al. (2012) find that university spin-offs located in 'Star' South East England golden triangle universities are not more likely to receive venture capital funding than those located outside this area. Rather, university spin-offs located outside these areas can signal venture quality to venture capital firms in order to substitute for their lack of proximity benefits. For example, if such spin-offs have a founder with previous venture creation experience, they are more likely to received venture capital funding. Adding to the evidence of the benefits of the social context, the ability to draw upon surrogate entrepreneurs can also facilitate access to VC finance (Mosey and Wright 2007).

Appreciation of this point introduces potential new directions for policy to promote financial availability for academic entrepreneurship. For example, policy may need to be directed towards enabling practitioners in different university contexts to facilitate local networks to encourage USO founders to assemble resources that signal credible quality to venture capital firms. More research is needed that examines the nature of these networks.

2.6 Spatial

Spatial dimensions of context relate to location and mobility. In the academic literature, current treatment of location is quite limited. Universities are generally spatially fixed. Although some are establishing overseas campuses, it is unlikely that a university will move its core campus to a new city.

Much initial research on academic entrepreneurship focused upon elite universities such as MIT and Stanford in the US (e.g. Shane 2004). Policy typically attempted to draw general lessons from these contexts that could be applied to other universities. However, it is now recognized that the transfer of such lessons may be highly problematical for Mid-Range universities located in more peripheral regions that do not have a wealth of world class research or strong commercial networks (Wright et al. 2008a, b). As such, technological endowments for spin-offs are likely to be limited.

Resource orchestration in these cases may be aided by teaching and development programs that inculcate entrepreneurial capabilities relating to opportunity recognition and championing skills (Rasmussen et al. 2011). Mustar (2009) and Clarysse et al. (2009) provide some novel examples of practical entrepreneurship-related courses in the technology area that also involve the incorporation of cutting edge research into teaching.

These authors point out that an important way forward is to move from traditional MBA focused programs to ones with more entrepreneurial content; from a case-study oriented teaching style towards a mentoring one; to experienced-based learning in a high tech entrepreneurial context; from a general business approach towards working across disciplines yet being sensitive to the underlying technology; and to embed business education in the specificities of the technology and industry which may require collaboration and/or integration between business schools and technology departments.

As noted earlier, universities in regional golden triangles have been argued to benefit from host universities' reputational capital, and proximity to formal VC firms, especially in London, who may exhibit strong spatial proximity effects in their investment behavior (Acworth 2008; Harrison and Leitch 2009). However, even within golden triangles, universities within a locality or region are not homogeneous (Huggins 2008), with there often being major differences in international-national-regional status and the specialisms and objectives that those differences imply (Boucher et al. 2003). Further research is needed to tease out the interactions between regional and university characteristics.

In particular, we have limited understanding of how the location of universities is related to innovation and business eco-systems. Further analysis is needed to develop policy that recognizes the link between universities and eco-systems in different spatial contexts. To what extent are there different eco-systems for different types of universities in different regions? To what extent do these particular ecosystems involve different forms of academic entrepreneurship? For example, what are the forms of the portfolio of university-industry linkages in relation to spin-offs, licensing, consultancy, etc.?

In contrast to universities, academics are quite highly mobile. While there has been some attention to international mobility of academics, there is little hard evidence on the extent of academic mobility in the context of academic entrepreneurship. Yet, the mobility of scientists raises important issues concerning academic entrepreneurship. First, academics may move universities and enter new ecosystems that may be more conducive to their research and their efforts to commercialize that research. These moves may involve individual scientists or teams of researchers. The moves may be ad hoc or part of a policy aim to create centers of excellence. The extent and nature of these moves may be discipline specific.

Second, academics may be encouraged to move into industry and back to universities after their secondment. A major concern, however, relates to the incentives for both academics and industry to make such moves. It is by no means clear that such moves will be beneficial to academics' career development if the emphasis in promotion and tenure decisions on publications continues to be disconnected from policy pressures to become more business engaged. Academics seconded to industry may find it hard to find a way back unless they can continue to publish while working for industry.

These observations suggest a need for more fine-grained and less contradictory policy towards academic mobility that allows for multiple performance measures. Such an approach may be especially important in light of some recent policy pronouncements regarding universities that stress business engagement.

3 Discussion and conclusions

In this article, I have tried to argue that it is important to recognize both the heterogeneity of academic entrepreneurship and the heterogeneity of the context in which it occurs.

From a research perspective, such recognition provides opportunities to build typologies and for conceptual development of the interactions between the heterogeneity of academic entrepreneurship and context. The framework I have outlined also creates opportunities for new approaches to empirical studies. Table 1 summarizes some potential research themes. Work on where resources come from and how they are configured in the academic context also offers potential for management scholars due to the critical differences in the academic context from the contexts they normally study.

In some jurisdictions, databases are available that provide measures to enable quantitative studies of academic entrepreneurs that take account of individual characteristics. For example, in Sweden the LISA database maintained by Statistics Sweden provides data on individual founders, including annual data on education, employment and changes in employment. Further, the development of university and department websites provide means to access resumes of individual academics.

The research questions and topics I have identified, suggest there is a need for more in-depth process oriented and longitudinal studies to explore how resources are orchestrated in academic entrepreneurship ventures in the different contexts discussed here. There is also scope for further examination at the within-university level both with respect to individual departments but also in relation to cross-department multi-disciplinary institutes and centers. In addition, the need for greater understanding of the role of individual academics in resource orchestration and the processes it involves suggests a need to develop research at this level.

I would also suggest that the arguments I have outlined call for a more nuanced approach to developing research and publication strategies on academic entrepreneurship. While the view that research should display both rigor and relevance has much to commend it (Pettigrew 2002), the implication that all research should pass this double hurdle is too simplistic. Indeed, conceptual research can help to reframe policy issues in a way that opens up new policy options (Pettigrew 2011). This also suggests the need to develop a differentiated approach to publication that embraces both traditional academic journals as well as more 'applied' outlets that enables communication to a wider audience.

A second, more general policy implication follows in that there is a need to reconcile different perspectives on universities' roles. Recent developments in academic entrepreneurship are part of a movement to rethink the role of the university. Longstanding debate about the role of the university contrasts the education for education's sake perspective (e.g. Newman 1852) with a more utilitarian purpose (e.g. Smith 1776/1999). In debate, these are seen to be in competition. I would argue that this approach is misplaced.

The evolution of academic entrepreneurship and research commercialization are part of policy moves to strengthen university-industry links, which give pre-eminence to the utilitarian perspective. In the UK, for example, government policy is placing increased emphasis upon "Business Engagement" by universities. The 2013 Research Excellence Framework requires departments to develop Impact Cases showing how research impacts practice. Notwithstanding the challenges in actually demonstrating such impact in some areas, the debate has moved further to question the publication of research in academic journals. In 2011, the Minister for Higher Education criticised business school academics for publishing in 'obscure US journals', by which was meant anything besides the Harvard Business Review:

> "It's not clear that rewarding our leading academics in business schools for producing research is in the long term interests of the performance of business…"

And

Table 1 Summary of potential themes for a research agenda

Temporal	Institutional	Social	Spatial
How can sufficient human capital and sources of finance with appropriate experience and expertise be accessed for different strategies and life-cycle phases?	How can more fine-grained policy be designed that relates to different types of innovation that will eventually support academic entrepreneurship?	What challenges are involved in the process of entry into business ecosystems and how are they overcome?	To what extent are there different local eco-systems for different types of universities?
How can different forms of technological resource operate in technology or product markets and over life-cycle phases?	What is the appropriate balance of policy aimed at directly promoting spin-offs from universities and a more indirect approach that supports graduates of universities in creating ventures?	How do practitioners in different university contexts facilitate local networks to encourage USO founders to assemble resources that signal credible quality to venture capital firms?	To what extent do particular ecosystems involve different forms of academic entrepreneurship? For example, what are the forms of the portfolio of university-industry linkages in relation to spin-offs, licensing, consultancy, etc.?
How can networks be developed to access resources for different strategies & life-cycle phases?	What is the appropriate balance between innovation and entrepreneurship policies and academic spin-off types?	How do academic entrepreneurs draw upon their social context to develop boards as the venture develops?	What is the extent, rationale and effect of academics moving universities and entering new ecosystems?
How can the initial research idea be refined (and re-refined) into a viable business concept?		How the business ecosystem co-evolve with academic spin-offs but also within a wider innovation ecosystem?	To what extent do moves involve individual scientists or teams of researchers?
How (and when) can resources from industrial and financial partners be accessed and communicated to external investors?	How does the appropriate balance vary across regions with different make-ups of universities?		To what extent are moves ad hoc or part of a policy aim to create centers of excellence in particular disciplines?
How can appropriate individual(s) to champion USO be identified over its life-cycle?	What are the implications for different approaches to resource orchestration in these different institutional contexts?		How can incentives and support be designed to facilitate mobility of academics to entrepreneurial corporate contexts?
How can appropriate networking competency be developed over the life-cycle?	How do equity gaps vary between sectors and regions and how do these influence finance availability for different types of spin-offs in different universities?		

> "There needs to be a more open debate about what we can do in our business schools to create the right environment for high quality practical teaching in creating businesses."

These moves turn on its head a policy trajectory over the last two decades that involved a much needed attempt to increase research quality, that probably still had some way to run. Such developments could also be quite counter-productive in terms of the intended audience of practitioner and policymakers seeking significant contributions to wealth creation from academic entrepreneurship. More could be done to strengthen the links between technology departments and business schools in the academic entrepreneurship area (Wright et al. 2009). Yet, placing too much emphasis on practical aspects without the concomitant development of analytical thinking skills based on cutting edge research may mean that skills and mental models quickly become obsolete in fast moving technology areas (Phan et al. 2009). We may do well to recall the words of Keynes:

> "Practical men, who believe themselves to be quite exempt from any intellectual influence, are usually the slaves of some defunct economist"

> And

> "The problems of the future cannot be dealt with simply by applying the solutions of the past, because the problems of the future are different from the problems of the past"

Academic research identifies gaps in policy design as practitioners and policy makers are typically too close to the action and focused on the short-term. Academic research makes a contribution by asking questions that practitioners want addressed such as rigorous policy evaluation studies. In contrast to consulting, the principal purpose of academic research is to provide objective analysis and seek to answer research question with potentially longer term pay-offs (Zahra and Wright 2011). The resource based and capabilities literature teaches us that competitive advantage is not achieved by doing what everyone else is doing. If research is to provide 'quality' practical business engagement leading to competitive advantage for industry and firms there is a need for more than practical or routine relevant involvement.

I envision two complementary roles for universities in the promotion of academic entrepreneurship. First is direct academic entrepreneurship in which novel, world class research plays an important role in creating innovations that lead to strategic competitive advantage. Typically, this activity concerns the creation of spin-offs involving academic scientists. Second is indirect academic entrepreneurship. University education and research experience may lead indirectly to entrepreneurial actions through corporate spin-offs and start-ups by alumni and students. Recent years have seen a large increase in graduate start-ups (HEFCE 2011) yet these have received little research attention (see e.g. Levie et al. 2010) and limited specific policy support, although one example is the UK government's Entrepreneur First scheme launched in 2011. However, while graduates may be more successful at setting up businesses than non-graduates, evidence suggests that corporate spin-offs created by university graduates who have gained commercial work experience outperform university spinoffs (Wennberg et al. 2011). Research is needed that examines the performance effects and processes involved in start-ups created by alumni directly after graduation versus those created after alumni have gained commercial experience.

From a policy perspective, further attention needs to be given to supporting indirect entrepreneurship by encouraging entrepreneurial skills development and industry

interactions for students and alumni. But these mechanisms need to take account of the dimensions of contextual heterogeneity that I have outlined and of the complexity of value creation processes, rather than simple one-size fits all business start-up advice.

This has highly important implications for the nature of teaching at universities, and of business teaching related to entrepreneurs in particular, that directly challenge views that business school academics should focus on practical teaching and avoid publishing in obscure US journals. I would suggest that it opens up a way to reconcile differing perspectives. On one hand, it is important for academic entrepreneurship to keep abreast of cutting edge technological developments. Indeed, Salter and Martin (2001) argue that for certain disciplines, the economic impact of research is most effectively delivered via teaching where graduate students go on to apply that knowledge in industry and society more generally. To this end, policy targets should be augmented to reflect this argument.

On the other hand, I would argue that it is also important for practical teaching aimed at assisting the creation and development of academic entrepreneurship to incorporate developments in the strategic entrepreneurship literature that I have outlined above in order to meet the challenges of successfully bringing the technology to market. There is, then, a need to find a subtle balance between these two activities. Indeed, these activities are more complementary than in competition and it is important to find forms for this complementary.

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