

Introduction to special issue

Building the entrepreneurial university: a global perspective

Henry Etzkowitz and Chunyan Zhou

The entrepreneurial university is the next stage in the development of a medieval institution. Integrating a commitment to economic growth and social development with research and teaching, the entrepreneurial university supersedes the late 19th century Humboldtian synthesis that aligned research with teaching as the two primary academic missions (Etzkowitz, *Minerva*, 1983, 21, 198–233). From its medieval origins, whether a student- or faculty-led foundation as in Paris or Bologna, the university has proved to be a flexible and evolving organizational form capable of reconciling conservatism with innovation. The passage of student generations combined with relative faculty autonomy is the basis on which these two institutional characteristics co-exist in a creative tension.

THE SUCCESSIVE RE-INVENTION and renewal of the university occurs in tandem with societal change such as the growth of the nation state and the emergence of a knowledge-based economy. The university played a secondary role in industrial society, providing trained personnel and basic research. However, the university plays an increasingly prominent role in a knowledge-based society, contributing the basis on which new industries and firms are built. Thus, the university becomes a primary institution as its social function becomes more fundamental. Ancient foundations, like Oxford and Cambridge, based on their stellar research and training capabilities, have added entrepreneurial capacities to encourage technology transfer and firm formation in contemporary society. Universities in Asia, Latin America and elsewhere have taken similar steps.

Although the study of the entrepreneurial university has gone deep into the nature and sources of the phenomenon, there are some problems left to

explore. For example, what are the necessary and sufficient conditions to form an entrepreneurial university? Who or what factors play important roles in developing an entrepreneurial university? Must a university be autonomous to be entrepreneurial or may enhanced autonomy follow from successful entrepreneurship? In this special issue, we try to find the answers for these questions. The topic is the different pathways that the entrepreneurial university transition has taken across nations, regions and

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cultures. We hope that these papers, primarily drawn from the 6th Triple Helix Conference held in Singapore in May 2007, advance the debate taking place around the world over how a university can best reach an entrepreneurial mode.

The origin and nature of an entrepreneurial university

Encouragement of spin-off activities is in the core of academic entrepreneurial activities, exemplified by the MIT experience (O'Shea *et al.*, 2007). However, the role of the MIT administration in the 1930s, in conceptualizing a 'research row' along the Charles River, the precursor of Route 128, and leading the implementation of high-tech regional economic development, through the invention of the venture capital firm in the early post-World War II years went beyond even the broadest definition of mere business development. The project to take the New England region out of an economic depression that had begun in the early 20th century, with loss of significant industries to other parts of the country, exemplified the emergence of a broader framework of university roles as regional innovation organizer, in collaboration with business and government actors (Etzkowitz, 2002). MIT, under President Karl Compton, took the lead in creating a new economic and social development strategy, translating advanced research into new industries and jobs, with the university as source and engine of regional transformation (Bank of Boston, 1997).

Entrepreneurial activities at MIT pre-dated its rise as a major technological university even as it

contributed to this development, with a similar dynamic emerging at Stanford, a liberal arts university with an engineering school, which was partly modelled on the MIT experience. Nevertheless, the MIT and Stanford cases are often taken to represent the necessity for a highly developed research university prior to the emergence of academic entrepreneurship in either its narrow economic or broader social formats. Both schools emerged from the chrysalis of teaching colleges by developing an entrepreneurial strategy in tandem with a research development strategy. Each focus enhanced and supported the other as entrepreneurial activities produced the resources to support research and research provided the basis for firms to be formed and grow. Regional development provided a framework to bring university, industry and government actors together behind a common project, which was beneficial to all.

Similar dual strategies may be identified in developing countries such as Brazil where at the Catholic University of Rio Grande del Sul, an incubator facility hosts a joint research group and firm, sharing facilities and personnel. The willingness of the university to allow a hybrid research group and firm was the basis for attracting a leading research group from the Federal University of Rio Grande del Sul, a more highly developed research university than the Catholic University which was largely a teaching institution. A joint project was willingly accepted by the university administration as a means of enhancing research. Whether complete integration is sustainable in the long term, especially if the business activities grow, may be questioned. The Chinese case suggests a process of gradual extrusion of enterprises from the academic homeland as they grow in scale. Nevertheless, extending the reach of academic research into translational research and the early stages of firm formation is increasingly accepted in many academic systems, suggesting a continuous process of drawing and redrawing the boundaries in defining what is and is not acceptable as an academic task.

Normative change involves resolution of a controversy and legitimation by re-interpretation of the new activity as broadly compatible with existing elements of the academic enterprise. A faculty member's attempt to institute a similar joint project at a Finnish university was rejected by the university administration, forcing the faculty entrepreneur to divide the two activities into separate entities (Tuunainen, 2005a). Nevertheless, it may be hypothesized that this initial negative reaction may not hold in the long term, due to both the closing gap between academic research and the early stages of commercialization and Finnish government policy to encourage economic development from its universities. In an earlier era, MIT hosted faculty-formed firms in its academic facilities although at present, this is viewed as unacceptable. The balance between

the separation and integration of missions is a continuing debate in the development of the university, with teaching and research largely separated in the Swedish university even as it is typically integrated in the American university. Controversy over the degree of acceptable integration is an indication that transformation is underway, whether from a teaching to a research university or to an entrepreneurial university (Vestergaard, 2007).

The internal structure of the university is transformed by multiple tasks, initially at the administrative penumbra and then in its educational core. Teaching is expanded from lecture and discussion to a project mode in which participants exchange ideas and formulate a common objective, with the teacher serving as guide. Universities have developed technology transfer capabilities and extended their teaching from educating individuals to shaping organizations through entrepreneurial education and incubation. University incubators educate a group of people to act as an effective organization. The Popular Cooperative Incubator in Brazil, originated by technology transfer professionals with a social vision, extended organizational education beyond the formation of high-tech firms to excluded populations (Etzkowitz *et al.*, 2005). The university's new economic and social development mission thus connects back to its original teaching mission.

Academic entrepreneurship is also a means of attaining independence, whether of the academic from total dependence on research councils and firms or of the university from its traditional patrons. Indeed, the notion of the entrepreneurial university has been utilized to denote the movement of the European university towards relative autonomy from its national government sponsors (Clark, 1998). The objective of business entrepreneurship typically includes enhanced autonomy for the entrepreneur wishing to control their destiny as well as make money. Academic firm founders eager to generate an independent source of support for their academic research have expressed similar sentiments. However, such wishes fly in the face of desires to separate academia from industry, through strict conflict of interest regulations, because of fears of contamination (Slaughter *et al.*, 2002).

While separation is warranted when direct financial interest may be involved, such as conducting clinical trials of one's own drug discovery, more general forms of research support may not incur negative consequences. Perhaps ironically, the degree of separation often increases over time as early integrated formats, impelled by the necessity to utilize available resources sparingly are superseded by entrepreneurial success. Whereas MIT facilities were utilized as incubator space in the early post-World War II years when firm formation was introduced as an organized phenomenon supported by early venture capital; today such arrangements would be found to be against the rules (O'Shea *et al.*, 2007).

The entrepreneurial university as an engine of the regional economy

The university's contribution to innovation in economic and social development is the heart of the entrepreneurial university concept. Academic entrepreneurship transcends simple knowledge capitalization as the university interacts with innovative actors from other institutional spheres to promote regional growth. The interactions form a university–industry–government triple helix. The transformation of the university from a secondary to a primary institutional sphere is a key element in the triple helix (Etzkowitz, 2008). When a university engages in entrepreneurship it plays a more important role on a broader societal stage. The role of the university in the triple helix is expected to be generative and proactive, with the university taking a leadership stance. For some, the entrepreneurial university is a contradiction in terms; a movement to be resisted; while for others it is the fulfilment of a potential inherent in a medieval institution that is only capable of being realized in a post-modern knowledge-based society. For still others, especially in developing countries, the building of an entrepreneurial university is a means to promote economic growth.

University commercialization focused on applied research and short-term application, subordinate to existing industry, is neither an inevitable development nor the most desirable goal (Faulkner and Senker, 1995; Slaughter and Rhodes, 1997). Although some local academic institutions may usefully perform these tasks, the university has a more significant function to perform as a source of new intellectual fields and regional renewal. The potential for enterprise development is broader than the natural sciences and engineering; the social sciences have been a significant source of enterprise from survey research, focus groups and econometrics. The entrepreneurial university contributes to industry in

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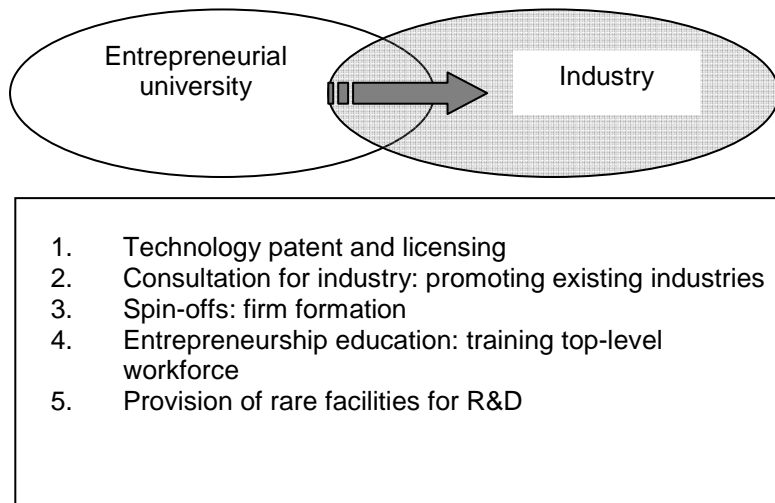


Figure 1

many ways (see Figure 1). Academics may play a role in firm formation in ways compatible with research and training through generous leave policies and a ‘one-fifth rule’ regulating consultation; allowing an advisory but not an executive position while holding a full-time academic job.

University development is nonlinear as regional academic clusters evolve in an entrepreneurial direction (see Figure 2). Entrepreneurial universities have arisen from strikingly different academic missions, even with the ‘first revolution’ of research, occurring simultaneously with the ‘second revolution’ of economic and social development. An entrepreneurial mode is typically an overlay on a research university but it can also be a strategy for development from a teaching university, with the phases accomplished simultaneously or even in reverse order to the usual progression. For example, the State University of Rio de Janeiro Friburgo campus began with a PhD programme in information technology, accompanied by an incubator, in an innovative academic and regional development strategy.

Various types of institutions of higher education contribute to regional innovation in different ways.

Universities have different missions: the teaching university is based on education and dedication to the personnel market; the research university engages in the production of knowledge, as well as teaching; the entrepreneurial university encompasses teaching, research and service to society. In practice, any university has the potential to assist industrial development, irrespective of its level and mission. Only the entrepreneurial university has the capacity to complete the circle of trilateral cooperation.

The requisite for creating an entrepreneurial university is a ‘critical mass’ of research with commercial potential, although limited entrepreneurial initiatives can also be built from an educational base. The major factors in creating an entrepreneurial university are internal culture and external environment, especially the industrial environment. Both of these factors are amenable to change through initiatives to encourage entrepreneurship and regional development. Neither lack of an industrial environment nor an entrepreneurial culture is an inevitable impediment. Stanford exemplifies development of an entrepreneurial university at a green-field site, while the recent history of the Pontifical Catholic University of Rio

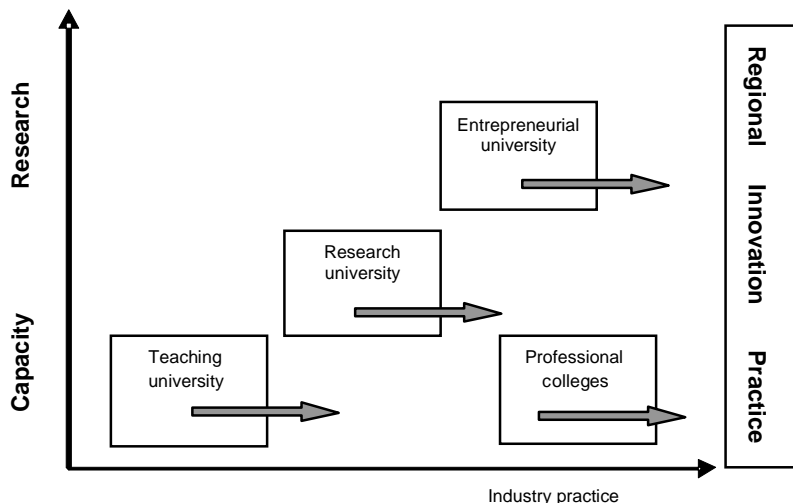


Figure 2 University clusters’ polarization to regional innovation

de Janeiro demonstrates that academic culture can be changed through entrepreneurial education and incubation projects.

Entrepreneurial universities play different roles in various triple helix models. In a university-pushed model, entrepreneurial universities jump-start regional innovation. In a government-pulled model, entrepreneurial universities help the development of existing industries and creation of new industries at the behest of government. In the corporate-led model, such universities typically collaborate with industry in product and process innovation. Innovation organizing and initiation capacities, among the triple helix are the basis for projecting regional strategies, with different starting points due to unbalanced development.

The entrepreneurial academic transition: a global perspective

The entrepreneurial university is realized at three levels: (1) the policy dimension of how a university and its members may contribute to economic and social development as well as research and education; (2) the organizational structure of the university and the extent to which it reconfigures itself to support entrepreneurship and innovation; (3) the motivations and interests of the individual academic. Some or all of these dimensions come into play in various empirical cases of entrepreneurial academic transition.

The entrepreneurial university emerges from diverse sources: endogenous, exogenous and mixed. Governments at the national, transnational and regional levels increasingly expect universities to play a greater role in economic and social development. Some universities pre-empt these pressures and take the initiative on their own, viewing mission extension both as a means to gain additional support for traditional missions and as an approach towards playing a larger role in their societies. Internal impetuses arise from extension of the university's traditional mission of teaching or professional training for entrepreneurship. Moreover, entrepreneurship is built into the internal structures of the research university, consisting of research groups of quasifirms competing for external funds (Etzkowitz, 2003). Thus, the research university has already taken implicit steps towards operating in an entrepreneurial format prior to explicit initiatives. There are also mixed formats such as the incubator, a format for organizational training and spin-off firm support.

The discussion on the entrepreneurial university encompasses diverse strategies and different evaluations of the validity of the concept. Some critics have suggested that the entrepreneurial academic model is of limited relevance to the European public university and will be rejected in favour of continuing with traditional formats (Tuunainen, 2005a). Others have recognized the global reach of the

entrepreneurial university model, identifying such diverse instances as the University of Nizhni Novgorod in Russia and the National University of Singapore though a web search across '... Western Europe, North America and Australia but also from Eastern Europe and Asia' (Mautner, 2005: 99).

Some argue that any university can be an entrepreneur, no matter that it is a professional college, teaching university or research university; others insist that only a research university can go into this mode. Zhou and Peng, in their contribution, have defined an entrepreneurial university as a university that strongly influences the regional development of industries as well as economic growth through high-tech entrepreneurship based upon strong research, technology transfer and entrepreneurship capability. They emphasize its high-tech entrepreneurship and distinct contribution to regional development, and consider that only the research university is ideally qualified to become a fully fledged entrepreneurial university. Nevertheless, their empirical case study shows a nonlinear pathway from teaching to commercial activities to the development of research in the Chinese case suggesting that universities in developing countries and regions do not have to wait to achieve research university status before contributing to regional development. Building an entrepreneurial university is a process. It may follow both paths simultaneously or even in reverse order as they build research and entrepreneurship capacities.

Realization of the potential of the university as a significant actor in regional economic and social development may precede any specific valorization of academic knowledge. The entrepreneurial university concept has been introduced to faculties where it was previously ignored and thought to be well beyond the university's purview. A senior academic administrator at the National University of Singapore expressed this view several years ago in response to a conference presentation on 'The entrepreneurial university'. More recently, the university has identified itself as an entrepreneurial university, having developed an entrepreneurship centre in the interim. The decision by the Singapore government to shift from a manufacturing to a knowledge-based economy was a key factor in instigating this particular academic entrepreneurial transition.

New organizational capacities, integrate business roles and activities within the university in formats that do not detract from traditional academic missions. The contribution by Leong *et al.* shows the transition from a *laissez faire* model of hands off towards academic entrepreneurship to establishing an internal support structure to assist academic with the tasks of firm formation. They utilize 'before' and 'after' the introduction of the support structure as the basis for a comparative analysis of the utility of such an intervention and extend the comparative analysis to Sweden, where such a support structure has been introduced to a much more limited extent. Their contribution dovetails with Goktepe-Hultén's analysis

of the relationship between the neophyte and experienced academic entrepreneur.

A nuanced policy regime is indicated to accommodate the needs and requirements of academics with different levels of entrepreneurial experience and interest. From her study of serial academic inventors and entrepreneurs in a research intensive Swedish university, Goktepe-Hultén, emphasizes the importance of role models and developing a culture of academic entrepreneurship based on the motivations of scientists who wish to see their discoveries put to use. She argues that the development of a culture of entrepreneurship is the key to developing an entrepreneurial academic mode and that government policies that insert organizational structures between entrepreneurially motivated academics and their objectives can be counterproductive. On the other hand, younger investigators may lack the necessary social ties and experience and may need the assistance of university support structures in order to valorize their research. Still other scholars may wish to see their research put to use but may not wish become as entrepreneurially involved as the serial inventors. An organization that can take their findings and translate them into use would be compatible with their stance.

Reconciling multiple academic tasks is another aspect of the entrepreneurial academic transition. Meyer *et al.* in their contribution identify the scale of a research group as an important factor in allowing faculty members to make teaching, research and entrepreneurial activities compatible with each other. Small groups, not surprisingly, find it more difficult to assume additional tasks while larger ones can more easily manage to integrate additional tasks. Like the government of Singapore, the European Commission is an important driver of the entrepreneurial transition. Provision of resources, such as the assumption of the costs of patenting and availability of seed funds were similarly important in enhancing entrepreneurial activity. Entrepreneurship at this relatively early stage is concentrated in a relatively few areas of the university, primarily engineering and the life sciences and involves a relatively small number of faculty members.

The development of a culture of entrepreneurship is the key to developing an entrepreneurial academic mode. Government policies that insert organizational structures between entrepreneurially motivated academics and their objectives can be counterproductive

Are these developments peculiar to a relatively few universities or do they augur a general trend? In their contribution, Etzkowitz *et al.* provide an additional range of cases of transition to an entrepreneurial academic mode which encompass a bottom-up response to funding stringency supported by top-down initiatives from national government; strong initiatives from Japan, changing the legal framework and subsidizing university transfer offices; government initiatives in Brazil to promote technology development and incubation of firms with Brazilian universities that had experienced a decline in research support attempting to recoup their position through entrepreneurial initiatives. Finally, the US has relied on bottom-up initiatives from a few universities, enhanced by a change in the legal framework instigated by the academic institutions themselves.

Balancing research and entrepreneurship

Transition to another academic format (entrepreneurship) is rarely a smooth process. It is typically accompanied by controversy, acrimony and debate. Originally, as at MIT in the 1920s, debate over the propriety of academic consulting eventually resulted in a compromise, which was more or less acceptable to its proponents and opponents, the so-called one-fifth rule, allowing consultation one day per week and retention of earnings by the involved faculty member. The long-term process involved normative change and incorporation of new missions earlier thought to be inimical to the academic culture, whether research or entrepreneurship. Over time, earlier controversial formats such as government funding of academic research in the US have become taken for granted as part of the academic enterprise. It often takes an explicit 'learning event' such as the experience of working with unlimited government resources largely under academic control in the US during World War II, or serving on the scientific advisory board of a firm and gaining a deeper knowledge of business practices, to reduce the lag between behavioural and ideological change.

There is a continuing debate over which aspects of academic research should be public and which private (McSherry, 2001; Bok, 2003; Mowery *et al.* 2004; Washburn, 2005; Leydesdorff and Meyer, 2006). Entrepreneurial science is controversial; it has been criticized as a socially inefficient 'privatization' of academic research and as a threat to the ethos of science itself. Other analysts suggest a 'more the more' thesis with patenting and publishing mutually reinforcing one another (Blumenthal *et al.*, 1986). There is a creative tension between missions, with the strongest universities embracing multiple missions. Stanford played a significant role in creating Silicon Valley but it is also a leading university in the humanities and the social, biological and physical sciences.

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In the absence of clear guidelines and the explicit invention and legitimation of new hybrid roles of entrepreneurial scientist, conflicts are inevitable, possibly driving entrepreneurial science out of the university, despite government funding policies designed to promote it. Tuunainen (2005b) has analyzed, and Vestergaard (2007) re-analyzed the case of Crop Corp at Helsinki University, an institution that in the abstract wished to encourage its faculty to commercialize their research but when they actually did so found that their institutional culture and organizational arrangements were inadequate to achieve this goal. The researcher and the firm departed from the university, leaving behind a negative rather than a positive precedent for future potential academic entrepreneurs, to consider. The lesson learnt was that, in practice, to pursue entrepreneurial science is a highly risky venture in a university bound by traditional principles of separation of research from commercialization, despite general guidelines which encouraged the commercialization of research.

Vestergaard (2007) proposes a partial solution, based on his reading of the website of a project at Newcastle University, the INEX Nanotechnology Centre. Following the INEX model to a degree, Vestergaard would allow commercialization of research within the core of the university, but strictly limit the participation of faculty members to an advisory role and preclude direct financial benefits flowing to the faculty member whose science is being commercialized. Indeed, reliance on students as entrepreneurs is a typical European solution to the problem of identifying an entrepreneur to move the commercialization of research forward through firm formation in instances where faculty members are uninterested and unwilling to play the entrepreneurial role. But what if they are interested and willing as at MIT and Stanford? Is there an organizational and institutional format that can accommodate the inter-relationship among basic and applied research and firm formation in the public European university?

Newcastle University has also instituted a professor of practice (PoP) model, attracting high-tech firm founders with an academic background and

interest to a new set of professorships allowing them to combine organizing an academic research group on a half-time basis with their firm roles (Etzkowitz and Dzisah, 2007). This reverse linear PoP model could be extended in a forward linear direction, and moved down the academic ladder, allowing both lecturers and professors, to maintain half-time academic positions while pursuing active engagement with a firm, probably after an initial full-time leave to accommodate the intensive commitment needed in the early stages of forming a firm. Academic positions combining set proportions of teaching and research have long been commonplace to accommodate the dual demands of the first academic revolution, although some academic systems, for example Sweden, maintain two distinct career paths.¹

A university education should include training in various disciplines, as well as specialization, with a few key topics being universal. As Cardinal Newman put it:

...if the various branches of knowledge, which are the matter of teaching in a university, so hang together that none can be neglected without prejudice to the perfection of the rest... (Newman, 1959: 102)

Just as graduates should be able to write an essay expressing their personal thoughts and a scientific paper, placing evidence against hypotheses; so should they write a business plan, setting forth an idea for a new project and a test of its viability. Conversely, MIT feared that if its students were only trained in narrow technical disciplines; they would end up working for people with a broader education: Harvard graduates would become managers; MIT graduates their employees. Thus, MIT built strong humanities departments, especially in fields relevant to technological issues, on the premise that it was necessary for its graduates to have a broad liberal education in order to become effective leaders.

A triadic academic role is required to meet the requirements of the second academic revolution. Reformulation of educational programmes to include entrepreneurship and innovation training as well as science and technology is also indicated to prepare future scientists to fill these roles rather than leaving the attainment of managerial and organizations skills to happenstance. Just as the research university integrated the dual demands of teaching and research, finding them to mutually enhance, despite persisting tensions; a similar re-ordering of academic roles is required to institute organizational arrangements to realize the entrepreneurial university and moderate, if not eliminate, some of the conflicts associated with its birth.

Since it is better to anticipate issues rather than waiting for controversies to erupt, Frank Rhodes, former president of Cornell University, has suggested a protocol for university–industry government partnership based on ‘...respect [for] the

integrity and interests of all the institutional partners...' and participants, including students (Rhodes, 2001: 245). Several of his suggestions, such as general templates within which specific arrangements may be negotiated, are already in practice. In an iterative process, universities inquire about peer practices and adjust policies, such as royalty rates, to balance incentivizing inventors with maintaining good relations with firms.

Despite incorporating seemingly contradictory tasks, the university has maintained a core identity. Centripetal forces have outweighed centrifugal ones through organizational innovation in the form of departments and centres: the former allowing multiple professorships in a single discipline and the latter encouraging cross-disciplinary hybridization. Entrepreneurial activities enhance traditional missions contrary to the thesis of academic decline (Readings, 1997). Keeping the critical, investigative and entrepreneurial functions together in the same institution generates new disciplines such as environmental science as well as financial resources. Stanford has a center for the study of conflict of interest in its medical school and a technology transfer office that set the model for that profession. Just as research emanates from teaching: so new research ideas may arise from entrepreneurial activities, as Vannevar Bush found with his consulting practice as a young professor at MIT (Bush, 1970).

Policy Implications

The shortfall in building entrepreneurial universities in Europe has been identified as being responsible for Europe's innovation lag. The European Union has called upon Europe's universities 'to get their hands dirty' by working with industry. However, this call to arms is flawed as it appears to presume that the university should put itself at the service of existing industry rather than pursue advanced research and take the lead in forming new firms that will be the basis of future industry. The balance between service to existing firms and creation of new firms from academic research is a difficult one. Nevertheless, leading US technology conurbations such as Silicon Valley and Boston are based upon weighting that balance towards the latter objective, strongly supported by government research funding and venture capital.

The project to build a European MIT is an exemplar of the European dilemma. An ambitious call to create 50 new universities has devolved into a modest add-on feature to existing foundations. Although the collaborations encouraged by the European Institute of Technology will no doubt be useful, Europe already has a plethora of successful mechanisms to encourage academic collaboration. Europe needs startup universities, oriented in new directions to shake up the traditional academic systems.

Some fast developing countries think of building

'world class' research universities as an objective of their higher education policies. The implicit purpose is to enhance the university's contribution to regional economies. Building the entrepreneurial university undoubtedly has been or will also become a state goal or dream for them. Similarly, from a different standpoint, regions in advanced industrialized countries that have suffered significant industrial loss also focus on universities which have been 'left behind'² to provide a future base for economic development. A major issue in both cases is to create sufficient critical mass in advanced research and resources for firm formation and growth, such as venture capital, entrepreneurship training and collaboration links, simultaneously. A second academic revolution, the transition from research to entrepreneurial university is an emerging global phenomenon.

Notes

1. It should be noted that Newcastle University has a long tradition of providing support to local industry; indeed that was the original rationale for the founding and development of academic capacities in Newcastle upon Tyne, even before the university attained its independence from Durham University, a university in the Oxbridge tradition. Thus receptivity to innovations in university-industry relations had a strong cultural substrate to build upon.
2. A phrase used by Daniel Johnson, former president, University of Toledo (OH, USA) on 16 April 2008.

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