Viewpoint

Designing creative spaces for idea generation and start-up experiments

The role of university ecosystems

Martin Curley and Piero Formica

'When the winds of change come, some people build walls, others build windmills.'
(Brian and Sangeeta Mayne, Founders of Lift International)

Abstract: *The role of universities is changing. In the last century the primary focus of universities was on education and research, with the key goals of creating and diffusing information and knowledge. A third and equally important role is now emerging, with its accompanying expectations and responsibilities – that of value creation. 'Value' in this context refers to both business value and societal value. With tertiary sector funding coming under increasing scrutiny, governments and the public alike are demanding more accountability and proof of added value from universities. A 'university ecosystem' approach can unleash much of the potential energy in universities and transform it into kinetic energy, with graduates emerging not just in a state of readiness to be employees, but often as highly motivated entrepreneurs with business or social innovation initiatives in flight. An ecosystem can be defined in this context as a network of interdependent organizations or people in a specific environment with partly shared perspectives, resources, aspirations and directions. This new form of positioning equates to what Etzkowitz (2004) and Andersson et al (2010) have called the 'entrepreneurial university'.*

Keywords: *university ecosystem; value creation; entrepreneurial university; networks; new venture creation*

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The roots of the medieval university, *alma mater* of the second millennium higher education institutions, lie in religion. For centuries, the 'ivory tower' syndrome, harking back to their monastic lineage, has affected academic institutions. We might substitute 'university' for 'society' in the following quotation, generally attributed to Einstein: 'The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created a society that honours the servant and has forgotten the gift.' This approach has severely limited the scope of some universities in terms of the knowledge produced and the quality of education provided. Analysis has taken precedence over synthesis and creation and theory have been prioritized over practice. This dissonance between the work of a university and value creation is reflected in C.K. Prahalad's comment at the 2010 Global Drucker Forum: 'I have never seen a next practice emerge from a regression analysis.'

Increasingly universities are moving towards, or are being encouraged to move towards, so-called 'Mode 2' knowledge generation (Gibbons *et al*, 1994), in which knowledge is co-created in an area that is interdisciplinary, problem-focused and context-sensitive, and 'Mode 3' knowledge generation that '. . .focuses on and leverages higher order learning processes and dynamics that allow for both top-down government, university, and industry policies and practices and bottom-up civil society and grassroots movements initiatives and priorities to interact and engage with each other toward a more intelligent, effective, and efficient synthesis' (Carayannis and Campbell, 2012). Mode 2 and Mode 3 knowledge are typically generated by collaboration with practitioners dealing with real problems in a real context, as distinct from knowledge generated from traditional research ('Mode 1'), which is academic and based within a particular discipline (Gibbons *et al*, 1994).

In the field of management research, for example, the relevance problem has been highlighted (Van Aken 2005; Galavan *et al*, 2008). Van Aken proposed an increase in the use of Mode 2 knowledge production in management research to increase the relevance and utility of the research carried out. In addition, he advocated a focus on output that is field-tested and grounded.

Thus, in these early decades of the 21st century, a new type of university is emerging. This new style of institution resembles a windmill whose power is provided by the collective energy of many integrated players, each one the maker of one or more blades of the mill. Such is the entrepreneurial university (Etzkowitz, 2004; Andersson *et al*, 2010), which results in a harmonious partnership between scientific research and academic entrepreneurship. From a broader perspective, 'entrepreneurship and scientific research are not in conflict after all, according to a study of university spin-outs in Italy, which found researcher-entrepreneurs are more productive than peers that are wedded to academe' (Kenward, 2012; Abramo *et al*, 2012). The entrepreneurial university reduces the area of potential conflict between research and entrepreneurship.

As noted at the outset of this article, monks were predominant amongst the founders of the model of the university that persisted into the 20th century. Now, the winds of change bring to the forefront corporations that, having experimented throughout the 20th century with extensive university research outreach programmes, are helping to sow the seeds for the third millennium of higher and advanced education with a new type of academic institution underpinned by a 'university ecosystem' – the entrepreneurial university, whose mission is cross-disciplinary research and education, often in fields in which science and technology converge.[1,2]

This new breed of university institution creates an ecosystem that can ignite exponential-growth technologies and societal transformations. Examples of such institutions, summarized below, are the Innovation Value Institute (IVI), Intel's multi-university communities and the Singularity University.

Co-founded in 2006 by Intel and the National University of Ireland at Maynooth, IVI embraces 75 members drawn from major global organizations, including BP, Chevron, Cisco, Fujitsu, SAP, Chevron, Ernst and Young and Genzyme – to name but a few. IVI's mission is to drive structural change in the way companies and governments obtain value from information technology (IT) and to bring about the transformation of the IT management discipline by creating a global 'gold standard' for IT professionalism. Through the use of collective and collaborative intelligence, IVI has developed an integrated set of products and services (see: http://ivi.nuim.ie) that are beginning to be widely adopted. This is evidence of Triple Helix innovation (Etzkowitz, 2003 and 2008) in practice, with industry, government and academia working together to drive structural improvement well beyond the scope of what any one organization could achieve on its own.[3] IVI is financed through contributions from companies, universities, the Irish Government and European Union research funding. It aims to connect research, education and practice in a continuous improvement loop as results, together with learning from the field deployment of research outcomes and education programmes, are fed back into the research process.

In a similar broad view of new patterns of connections between industry and academia, Intel, the Santa Clara-based chip-making giant, is weaving together a worldwide network of university research communities which it calls 'multi-university communities'. As Justin Rattner, Intel's CTO, said, 'Forming a multidisciplinary community of Intel, faculty and graduate student researchers from around the world will lead to fundamental breakthroughs in some of the most difficult and vexing areas of computing technology'.[4] In the USA the company has created a network of Intel Science and Technologies centres; outside the USA, these centres are known as Intel Collaborative Research Institutes. Anchored at leading universities, a key goal of the network is to create a research community of academics and industrialists in specific areas to accelerate collective progress.

Co-founded in 2008 by Autodesk, Cisco, Google, ePlanet Ventures, the Ewing Marion Kauffman Foundation and Nokia, the Singularity University aims to 'assemble, educate and inspire a cadre of leaders who strive to understand and facilitate the development of exponentially advancing technologies' (see: http://singularityu.org/about/overview/). Evidence of its popularity is the fact that in 2011 there were more than 2,200 applicants for eight graduate student vacancies.

The emerging university ecosystem

In making the transition from stand-alone research and education to integrated solutions along the knowledge value chain (from the ideation – the creative process of generating, developing and communicating new ideas – to the exploitation of scientific discoveries), universities will have to reconfigure themselves in order to construct the necessary new rules, roles, actors and links. It is no longer sufficient to manage in-house research and education. The university must manage an ecosystem, the outcome of increasing interdependence among all partners, internal and external to the university, involved in the knowledge process.

A body of knowledge, research activity and educational programmes are key parts of the university. However, a detailed understanding of each constituent part fails to produce an understanding of the whole. The whole, greater than the sum of its parts, is the 'university ecosystem' (UE) – a community of organisms (professors, researchers, students, external practitioners, etc) interacting with one another and with other organisms in the external environment that are pulled into its sphere of influence. The flow of knowledge is the medium that links all the organisms. In the university, knowledge is attained through study and practice, observation and experimentation. Discovery (the act of observing or finding something unknown) and invention (the process of creating a new technology), which are products of science, are turned into entrepreneurial innovation (the process of effectively bringing discovery and invention to market). This is the knowledge value chain through which a UE achieves truly meaningful success, as the examples of the rise of university ecosystems included here clearly illustrate.

To land on the entrepreneurial planet – 'the convening place for participants in today's global entrepreneurship movement', as imagined by Babson College (see: http://www.babson.edu/) – the UE needs a 'spacecraft' that harbours knowledge while various stages of business development are completed – from the entrepreneurial opportunity recognition to the setting up of a new venture. Science-driven entrepreneurs are the 'pilots' who convert that knowledge into innovative products and services. They might be academics, scientists (the scientific entrepreneurs who start out doing university-based research), emerging postdoctoral entrepreneurs, researchers, students, leading experts from idea factories and industrial labs, R&D managers or innovation facilitators.

Search for identity

The sustainability of a university ecosystem is determined both by its intellectual identity and its emergent culture. This depends on the social norms and beliefs that prevail in the ecosystem. UEs oscillate in identity between the more ordered ('centralized') and the less ordered ('decentralized').

A centralized identity is the outcome of higher-order social norms, codes and power relations that favour a command-and-control regulation of the ecosystem. Borrowing the metaphor from Brafman and Beckstrom (2011), we call this a 'spider-like' identity. The ecosystem is configured as a centralized 'linear machine' set in motion by a policy maker's toolkit that encompasses regional and local clusters, science and technology parks, incubators and other initiatives – all of which place major emphasis on public spending. Under the jurisdiction exercised by the CEOs of those organizations and filtered through top-down bureaucracies, the emphasis is on command and control. In contrast, a decentralized identity (a 'starfish' in the language of Brafman and Beckstrom) comes from non-hierarchically ordered social norms and spontaneous social interactions that change when new forces are applied in the ecosystem. An example of such an ecosystem is the Smartbay cluster that has emerged around the Irish Marine Institute in Galway, Ireland.

The rise of university ecosystems

Academic barriers are being overcome, with some universities reconfiguring their intellectual property rights policies to facilitate the formation of a more powerful ecosystem. Penn State University, for example, no longer owns intellectual property created by industry-sponsored research. 'In short we consider the net present value of the interactions and relationships that our faculty and students have with industrial professionals to be real and therefore greater than the apparent future value of the proceeds from such IP,' wrote Hank Foley, Penn State's Vice President for Research. 'Our goal. . .is to flatten any and all barriers or impediments to innovation and that includes our own past stance on intellectual property.' (Source: 'Jumpstarting university technology innovation ecosystems', Innovation Daily, 11 April 2012)

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Other universities start and sustain a movement toward social networking in science or help the scientific community to bridge the gap between high-powered ideas and their beneficial impact on the market. Paul Thompson, Professor of Neurology at the University of California, has highlighted the effectiveness of pooling together the world expertise of more than 200 scientists in the field of brain function. 'This is not usually how scientists work, and it gives us a power we have not had,' said Thompson, Chairman of Innovocracy, a 'network of universities, colleges, innovators and supporters that connects people who want to support innovation in academic research and those innovators found on campuses around the world.' (Source: www.innovocracy.org)

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In May 2012 the US National Science Foundation launched the Global Research Council, a knowledge commons ecosystem. This knowledge-based interactive global community, '. . .which will work virtually, is designed to foster discussion on how the principles and aspirations of science might be unified across the globe. The Council's first product is a set of common principles for the peer review of project proposals that will ensure that the most worthy research projects are selected.' (Source: http://twas.ictp.it/news-in-home-page/institutional/global-research-council-launched)

In today's economic environment there are several mutating, non-linear forces that impact adversely on the effectiveness of a linear-machine model in producing a knowledge chain reaction – that is, the process of converting the latest research outputs into new entrepreneurial ventures, which, in turn, fuel further rounds of research from their success (via both tangible and intangible resources). Today, the prevailing forces in the knowledge economy are surrounded by uncertainty, ambiguity and ignorance about the likelihood of occurrence (if and how the new ventures will grow, shrink, expire, re-emerge).

Strongly affected by forces such as information asymmetry, fast-changing research and market dynamics, barriers to research and market entry, the sustainability of a UE depends on its ability to alternate, with some agility, between a closed and centralized approach and an open and decentralized model. Shifting to the latter, for example, will enable the UE to respond rapidly to the challenges or needs of the mutating forces, and, once that is done, it can return to centralization. Thus a sustainable UE works according to the accordion principle, changing its norms from those appropriate to a spider-like centralized entity to those of the starfish-like decentralized identity, and vice versa.

Finally, it is recognized that 'culture eats strategy for breakfast', in the words attributed to Peter Drucker. A crucial factor in successfully establishing a UE, therefore, is visible promotion, recognition and support for collaboration and entrepreneurship. Universities that measure success only by the research funding won and the number of peer-reviewed papers published are unlikely to be successful in establishing high-performing UEs.

Trading ideas in the global knowledge economy

Business communities trade mainly in goods and services. In contrast, the trading commodity of academic communities is ideas, and the domain in which they are traded has been transformed by a process of knowledge-intensive globalization, which has accelerated the already high mobility of ideas disembodied from goods or services. Quasi-perfect

mobility moves the centre of gravity of university ecosystems from a centralized to a decentralized identity. In a world without walls raised to protect the good ideas, UEs operate as starfish-shaped organizations that replace purely competitive mechanisms with openness and connectivity. By sharing, communicating and renting out cutting-edge ideas to each other in a variety of forms (common research projects and papers, people-to-people and patent exchanges, cross-licensing agreements, shared copyrights, blueprints and intellectual brands), decentralized UEs are the entities that spread knowledge more evenly around the world and, in turn, drive the flows of global trade with ever greater speed.

Research and entrepreneurship: a double trust dilemma

To be effective, university ecosystems need to overcome a double trust dilemma. First, the 'thinkers' who generate and refine ideas for research projects and papers must trust the 'doers' who bring research results into the entrepreneurial light. In turn, a stream of confidence must pass from the doers, with their ability to start knowledge-intensive businesses, to the thinkers, with their new ideas. This virtuous circle is essential in facilitating the sustainability of the process in the longer term.

The compartmentalization of thinkers and doers must be eliminated. From the idea generation perspective, new discoveries bring together chemists, physicists, biologists, physicians, engineers, economists and other researchers. From the entrepreneurial perspective, innovations in business models create convergent spaces in which scientific entrepreneurs and technological artisans, graduate and postgraduate entrepreneurs, enterprising graduates and drop-out entrepreneurs work shoulder to shoulder. The importance of developing an interdisciplinary environment that is functional cannot be overemphasized.

Experimentation spaces

To enable the exploration of problems and their solutions from multiple perspectives, UEs set up cross-disciplinary experimentation spaces in which the interdependent partners are brought together in a very free environment. On the one hand, by manipulating objects of the physical sciences, controlled experiments are conducted with the intention of pushing the scientific frontier; on the other hand, actions are also taken to reduce the gap between idea generation and idea exploitation, and to mediate the conflict between the high cost of producing knowledge and the low cost of using it (Lerner and Stern, 2012). Because such actions entail the complexity of human behaviour, which falls short of the requirements for controlled experiments in the physical sciences, in these experimentation spaces participants become engaged in a multi-player game of idea-sharing.

The frontrunners are innovation-based industrial partners who leverage the UE to accelerate and amplify technologies that have been identified and investigated within the ecosystem. For example, Intel's 'Lablets' were experimentation spaces that crossed different UEs in which both academic and Intel scientists met. According to Van Dyck (2012), 'The space allows the two groups to explore new technological fields. As soon as a marketable idea emerges it is taken out of the Lablet and potentially incubated using corporate venture funds or transferred to one of Intel's business units.' Intel had no claim on the intellectual property produced by the labs, because it was interested in 'helping to grow the technology and seeing where there is a usage for it within Intel' (Van Dyck, 2012). Intel's Lablets were superseded in 2011 by new Intel Science and Technology Centres (ISTCs) and Intel Collaborative Research Institutes (ICRIs). ISTCs in the USA and ICRIs internationally are Intel-funded, jointly-led research collaborations between Intel and the academic community. Based at leading universities across the globe, they form the foundations for building research communities that each focus on a specific area of technology. The combination of onsite, co-located Intel and Academic Principal Investigators with strong links to Intel Labs and business units increases the possibility of a stronger yield than from the earlier Lablets. Intel continually strives to innovate by way of the process of collaborative research in order to optimize progress and output. Consequently, in the longer term, the possibility exists of establishing a dedicated research community which will mature into an ecosystem that generates value for many partners, well beyond the scope of the initial community.

Conclusion: the process of accretion

UEs are considered accretive if they add to a discovery the commercial potential for rapid deployment on a large scale as a viable business. The process of accretion is put in motion by the co-existence and collision of diverse talents – in particular, of two personality types, which Nicholas Donofrio, a Senior Fellow of the Ewing Marion Kauffman Foundation, has called 'I'-shaped and 'T'-shaped (Donofrio, 2011). The first type, having a deep but narrow knowledge of a specialized field, is locked-in by their expertise. The 'T-shaped' personality, by contrast, while having deep

knowledge of a specific field also has broad and wide-ranging interests beyond that specialization. From encounters and clashes between 'I' and 'T' types the creative expertise, that will push both knowledge and market boundaries, emerges.

The process of accretion demonstrates the utilitarian aspect of UEs. Study and research are not simply opportunities for learning for the sake of learning, in accordance with the classical liberal-arts model of the university that prevailed until the late 20th century. Rather, the expertise gained through study and research is expected to lead to and forge fresh connections with the entrepreneurial experience. Contemplation and investigation are not compartmentalized and confined to a 'disinterested pursuit of truth', but are intertwined with different interests and motivations that encourage faculty members and students to launch start-ups or invest in those created by peers and outsiders orbiting around their ecosystem.

Since they are open to performing any act which has the consequence of bridging the gap between intellectual ideations and commercial exploitations, members of UEs are 'entrepreneurial consequentialists' who are at the centre-stage of the accretive process.

Notes

[1]Science: from Latin *scientia*, meaning knowledge.
[2]Examples are nano science and technology, digital content convergence, intelligent convergence systems. See the case of the Graduate School of Convergence Science and Technology at Seoul National University (http://gscst.snu.ac.kr/introduction/aboutus_eng.php).
[3]Carayannis and Campbell (2011) have proposed the concepts of the Quadruple and Quintuple Helix as an extension and completion of the Triple Helix: 'The traditional Triple Helix innovation model focuses on university–industry–government relations. The Quadruple Helix innovation systems bring in the perspectives of the media-based and culture-based public as well as that of civil society. The Quintuple Helix emphasizes the natural environments of society, also for the knowledge production and innovation. Therefore, the Quadruple Helix contextualizes the Triple Helix, and the Quintuple Helix the Quadruple Helix. Features of the Quadruple Helix are: culture (cultures) and innovation culture (innovation cultures); the knowledge of culture and the culture of knowledge; values and lifestyles; multiculturalism, multiculture, and creativity; media; arts and arts universities; and multi-level innovation systems (local, national, global), with universities of the sciences, but also universities of the arts'.
[4]http://newsroom.intel.com/community/intel_newsroom/blog/2012/05/24/intel-invests-more-than-40-million-in-worldwide-network-of-university-research-centers-to-drive-innovation.

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