Chapter 2
University Ecosystems Design Creative Spaces for Start-Up Experimentation

Martin Curley and Piero Formica

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

Introduction

Religious roots marked the medieval university, *alma mater* of the Second Millennium higher education institutions. For centuries, the '*ivory tower'* syndrome, a reminiscence of their monastic lineage, has affected academic institutions. Einstein said, "The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created universities (society) that honors the servant and has forgotten the gift". This kind of thinking pervaded, limiting the scope of some universities to knowledge and student production. It seems that analysis has

M. Curley · P. Formica (✉)
Innovation Value Institute, National University of Ireland, Maynooth, Co. Kildare, Ireland
e-mail: piero.formica@gmail.com

M. Curley
Intel Labs Europe, Collinstown Business Park, Leixlip, Co. Kildare, Ireland
e-mail: martin.g.curley@intel.com

P. Formica
Master in Entrepreneurship and Technology Management, University of Tartu, Tartu, Estonia

International Entrepreneurship Academy, Via Altaseta 3, 40123 Bologna, Italy

M. Curley and P. Formica (eds.), *The Experimental Nature of New Venture Creation*, Innovation, Technology, and Knowledge Management, DOI: 10.1007/978-3-319-00179-1_2,

taken precedence over synthesis/creation (in addition to theory always taking precedence over practice). This dissonance between the work of a university and value creation was hinted at by CK Prahalad at the 2010 Global Drucker Forum when he said, "I have never seen a next practice emerge from a regression analysis".

Increasingly, universities are moving to or are being encouraged to move to more so-called *mode 2 knowledge generation* (Gibbons et al. 1994), where knowledge is co-created in an area that is interdisciplinary, problem focussed, and context sensitive. *Mode 3 knowledge generation* "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 are typically knowledge generated by collaboration with practitioners who deal with real problems in a real context, as distinct from knowledge that is generated from traditional research (called mode 1)—which is academic and based within a particular discipline (Gibbons et al. 1994).

In developments in fields such as management research the relevance problem has been highlighted (Van Aken 2005; Galavan et al. 2008). Van Aken proposed increasing the use of mode 2 knowledge production in management research in order to increase the relevance and utility of the research. Additionally, he advocated a focus on output that is field-tested and grounded.

Therefore, in these early decades of the twenty-first century a new type of university is emerging that resembles a windmill whose power is provided by the collective energy of multi-integrated players, each player corresponding to one or more blades on the windmill. This is the entrepreneurial university (Etzkowitz 2004; Andersson et al. 2010), which results in a harmonic coupling 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 enlarges the non-conflict area between research and entrepreneurship.

Once upon a time, the monks were the forerunners of the modern university. Today, at the forefront are the corporations that, having experimented throughout the twentieth century with extensive university research outreach programs, are helping to sow the seeds for the Third Millennium of higher and advanced eduction with a new type of academic institution underpinned by a *university ecosystem*. Such an academic institution is an entrepreneurial University whose mission is cross-disciplinary research and education, often in the fields of convergence science[1] and technology.[2] Universities with this paradigm create a type of ecosystem

[1] Science: from Latin *scientia*, meaning knowledge.

[2] Examples are nanoscience and technology, digital contents convergence, intelligent convergence system. 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).

that spawns technologies with the potential for exponential growth and societal transformations. Examples include 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 Maynooth, IVI has 75 member organizations drawn from major global corporations such as including BP, Chevron, Cisco, Fujitsu, SAP, Chevron, Ernst & Young, and Genzyme. IVI's is "to drive a structural change in the way companies and governments get value from IT" and also "to drive the transformation of management of the IT discipline through creating a global gold standard for IT professionalism". Through the use of collective and collaborative intelligence, IVI has developed an integrated set of artifacts that are beginning to be widely adopted. There is evidence of triple helix innovation (Etzkowitz 2003, 2008) at work where Industry, Government, and Academia collaborate to drive a structural improvement that exceeds what any one organization could achieve on its own.[3] IVI's funding sources include contributions from companies, universities, an Irish Government agency, and EU research funding. IVI's goal is to connect research, education, and practice in a continuous improvement loop as results and learning from field deployment of research artifacts and education programs are fed back into the research process.

In a similar broad view of new patterns of connections between Industry and Academia, Intel is striving to develop a worldwide network of university research communities, which the Santa Clara-based chip-making giant calls "multi-university communities". "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," according to Justin Rattner, Intel's CTO.[4] In the USA, Intel has created a network of Intel Science and Technologies Centres (ISTCs), while outside the USA these centers are called Intel Collaborative Research Institutes (ICRIs) Anchored at specific leading universities, a key goal is to create a research community of academics and industrialists in specific areas in order to accelerate collective progress.

---

[3] Carayannis and Campbell (2011) have proposed the concepts of 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 Helixemphasizes the natural environments of society, also for the knowledge production and innovation. Therefore, the Quadruple Helixcontextualizes the Triple Helix, and the Quintuple Helix contextualizes the Quadruple Helix. Features of the Quadruple Helixare: 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.

Co-founded in 2008 by Autodesk, Cisco, Google, ePlanet Ventures, Kauffman (the Foundation of Entrepreneurship), and Nokia, the Singularity University "assembles, educates, and inspires a cadre of leaders who strive to understand and facilitate the development of exponentially-advancing technologies". Such is its popularity that in 2011 there were more than 2,200 applicants for eight graduate student slots.

The Emerging University Ecosystem

To transition from standalone research and education to integrated solutions along the knowledge value chain (from ideation to exploitation of scientific discoveries) requires universities to be reconfigured in order to construct the necessary new rules, roles, actors, and links for such a transition. It is no longer sufficient to manage in-house research and education; the university must manage an ecosystem, which is the outcome of an increasing interdependence among all partners—both internal and external to the university—that are involved in the knowledge process.

A body of knowledge, research, and education is a key part of a university. Yet, a detailed understanding of each constituent component fails to convey an understanding of the whole. The whole, which is greater than the sum of its parts, is the *University Ecosystem (UE)*—a community of personnel (professors, researchers, students, external practitioners, etc.) that interacts with one another and with other personnel from the external environment, who are pulled into its sphere of influence. The flow of knowledge is the medium that links all the personnel. 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 the UE achieves truly meaningful success.

Box 1: The Rise of the University Ecosystems

Academic barriers are being overcome, with some universities reconfiguring their intellectual property rights policy in order to facilitate the formation of a more powerful ecosystem. For example, Penn State University 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 University'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"

(*"Jumpstarting University Technology Innovation Ecosystems", Innovation Daily, April 11, 2012*).

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, a professor of neurology at the University of California, has highlighted the effectiveness of pooling together 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 at 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" (www.innovocracy.org).

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".

(http://twas.ictp.it/news-in-home-page/istitutional/global-research-council-launched)

To land on the entrepreneurial planet—"the convening place for participants in today's global entrepreneurship movement", as imagined by Babson College—,the University Ecosystem (UE) needs a 'spacecraft' that harbors knowledge for a time while different stages of business development are completed: from entrepreneurial opportunity recognition to the setting up of a new venture. Science-driven entrepreneurs are the 'pilots' who convert such knowledge into innovative products and services. Their skill set is multifaced, and includes the skills of academics, scientists (the scientific entrepreneurs who start out doing university-based research) and emerging postdoctoral entrepreneurs, researchers and students, or those of leading experts from idea factories and industrial labs, R&D managers and innovation facilitators.

Search for Identity

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

A centralized identity is the outcome of higher order social norms, codes, and power relations that favor the command-and-control regulation of the ecosystem. Borrowing the metaphor of (Brafman and Beckstrom 2006), we call it a "spider-like" identity. Under these circumstances, the ecosystem is configured as a centralized 'linear machine', which is set in motion by a policymaker's toolkit that encompasses regional and local clusters, science and technology parks, incubators, and other initiatives—all of which put a big emphasis on public spending. Under the jurisdiction exercised by the CEOs of those organizations and filtered through top-down bureaucracies, the emphasis is placed on the command-and-control regulation.

A decentralized identity (a "starfish" identity in the language of Brafman and Beckstrom) comes from non-hierarchically ordered social norms and spontaneous social interactions that change when new forces take action in the ecosystem. An example of such an ecosystem is the Smartbay cluster that has emerged around the Irish Marine Institute in Galway, Ireland.

In today's economic environment there are several mutating, nonlinear forces that impact adversely on the effectiveness of a linear machine model in producing a knowledge chain reaction: that is, on 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 grow, shrink, expire, re-emerge).

The sustainability of the UE—which is greatly affected by forces such as information asymmetry, fast-changing research and market dynamics, and barriers to research and market entry—depends on its ability to oscillate a closed and centralized approach to an open and decentralized model. This will facilitate the UE in, for example, quickly tackling the challenges or needs of the mutating forces, and back again to centralization once those forces are appeased. Therefore, a sustainable UE works according to the accordion principle; by changing its norms from those appropriate to a spider-like centralized approach to those that fit with a starfish-like decentralized model, and vice versa.

Finally, it is recognized that "Culture eats strategy for breakfast"[5]—so a crucial factor in successfully establishing a UE is visible promotion, recognition, and support for collaboration and entrepreneurship. "You get what you measure"—so universities that measure success only by the value of research funding won and the number of peer-reviewed papers published are unlikely to be successful in establishing high-performing UEs.

[5] "A remark attributed to Peter Drucker and popularized in 2006 by Mark Fields, president of Ford Motor Company. As the Leader of Ford, Fields was keenly aware that no matter how far reaching his vision or how brilliant his strategy, neither would be realized if not supported by the culture" (see http://www.relationaldynamicsinstitute.com/?p=48).

Trading Ideas in the Global Knowledge Economy

Business communities trade mainly in goods and services. In contrast, the trading commodity of the academic communities is ideas, and the domain in which they are traded has been transformed by a knowledge intensive globalization process that accelerates the already high mobility of ideas disembodied from goods or services. Quasi-perfect mobility moves the center of gravity of the UEs 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-intensive contents 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 (UEs) must 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 to the entrepreneurial light. In turn, a stream of confidence must pass from the latter (with their ability and capacity to start knowledge-intensive businesses) to the former (with their new ideas). This virtuous circle is essential in order to facilitate the sustainability of the process in the longer term.

The categorization of thinkers and doers into specific compartments must be eliminated. From the idea generation perspective, new discoveries bring together chemists, physicists, biologists, physicians, engineers, economists, and other researchers. From an entrepreneurial perspective, innovations in business models create convergent spaces where scientific entrepreneurs and technological artisans, gradpreneurs (postgraduate/graduate entrepreneurs), enterprising graduates, and dropout entrepreneurs all work in harmony. The importance of developing an transdisciplinary environment that is instrumental to idea generation and idea implementation and exploitation cannot be overemphasized.

Experimentation Spaces

For the purpose of exploring problems and their solutions from multiple perspectives, UEs set up cross-disciplinary experimentation spaces where the interdependent partners are put 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, actions are also taken to reduce the gap between idea generation and idea exploitation, and how to mediate the conflict between the high cost of producing knowledge and the low cost of using it (Lerner and Stern 2012). As those actions that involve the complexity of human behavior fall short of the physical sciences' standard of controlled experiments, in the experimentation spaces people experience a multiplayer game of sharing ideas.

Front-runners are innovation-based growth industrial partners who leverage UEs to accelerate and amplify technologies that have been identified and investigated within the ecosystems. For example, Intel's earlier 'Lablets, were experimentation spaces that crossed different UEs where academic and Intel scientists meet. "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 has no claim on the intellectual property produced by the labs, because it is interested in "helping to grow the technology and seeing where there is a usage for it within Intel" (Van Dick 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 US and ICRIs internationally are Intel-funded, jointly-led research collaborations between Intel and the academic community. Anchored at leading universities across the globe, these collaborations form the foundations for building research communities that each focus on a specific technology area. 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 the earlier Lablets. Intel continually strives to innovate via 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 discoveries with a commercial potential such that they can be rapidly deployed on a large scale as a viable business. The process of accretion is enabled by the co-existence of and collision between diverse talents; in particular, two personality types: respectively, those individuals whom Nicholas Donofrio, Senior Fellow of the Ewing Marion Kauffman Foundation, has called "I"- and "T"-shaped (Donofrio 2011). The first (I-shaped personality type), which has a deep but narrow knowledge in a specialized field, is locked-in in its expertise. By combining depth with breadth across multiple disciplines, a chaotic mode is a distinguishing feature inherent to the latter (T-shaped

personality type). From the "I" and "T" encounters and clashes emerge the creative expertise that pushes both knowledge and market boundaries.

The process of accretion puts on display the utilitarian facet of UEs. Study and research are not only opportunities for learning for the sake of learning—which match the classic liberal-arts model of the universities that has continued to prevail until the late twentieth century. 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 the "the disinterested pursuit of truth"; instead they are intertwined with different spheres of interests that urge both faculty members and students to launch start-ups or invest in those created by peers and outsiders who revolve around their ecosystem.

Since they are open to performing any act that has the consequence of bridging the gap between intellectual ideations and commercial exploitations, members of UEs are entrepreneurial consequentialists who are central to the accretive process.

References

Abramo, G., D'Angelo, C. A., Ferretti, M., & Parmentola, A. (2012). An individual-level assessment of the relationship between spin-off activities and research performance in universities. *R&D Management, 42*(3), 225–242.

Andersson, T., Curley, G. M., & Formica, P. (2010). *Knowledge-driven entrepreneurship: The key to social and economic transformation*. New York and Berlin: Springer.

Brafman, O., & Beckstrom, R.A. (2006). *The starfish and the spider: The unstoppable power of leaderless organizations*. Portfolio:Penguin Books. England.

Carayannis, E., & Campbell, D. (2011). Open innovation diplomacy and a 21st century fractal research, education and innovation (FREIE) ecosystem: Building on the quadruple and quintuple helix innovation concepts and the 'Mode 3' knowledge production system. *Journal of the Knowledge Economy, 2*(3), 327–372.

Carayannis, E., & Campbell, D. (2012). *Mode 3 knowledge production in quadruple helix innovation systems: Twenty-first-century democracy, innovation, and entrepreneurship for development*. New York-Berlin: Springer.

Donofrio, N.M. (2011). Innovation that matters. In *Kauffman Thoughtbook 2011*. Kauffman Foundation: MO.

Etzkowitz, H. (2003). Innovation in innovation: The triple helix of university–government–industry telations. *Social Science Information, 42*(3), 293–337.

Etzkowitz, H. (2004). The evolution of the entrepreneurial university. *International Journal of Technology and Globalisation, 1*(1), 64–77.

Etzkowitz, H. (2008). *The triple helix: University–industry–government innovation in action*. New York: Routledge.

Galavan, R., Harrington, D., Kelliher, F. (2008). A work in progress. The road to relevance 15 years on—Are we there yet? EDiNEB Conference Paper, Malaga.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*. London: Sage.

Kenward, M. (2012, August 19). Entrepreneurship and scientific research by academic scholars are not in conflict: Turning entrepreneurial doesn't stunt academic research output. *Innovation Daily*.

Lerner, J. & Stern, S. (2012). *The rate and direction of inventive activity revisited*. The University of Chicago Press. Chicago: ILL.

Van Aken, J. E. (2005). Management research as a design science: Articulating the research products of mode 2 knowledge production in management. *British Journal of Management, 16*(1), 19–36.

Van Dick, V. (2012). *Building and leveraging your ecosystem to spark innovation-based growth*. March/April: Ivey Business Journal.

http://www.springer.com/978-3-319-00178-4

The Experimental Nature of New Venture Creation
Capitalizing on Open Innovation 2.0
Curley, M.; Formica, P. (Eds.)
2013, XXII, 164 p., Hardcover
ISBN: 978-3-319-00178-4