

Vortex Versus Waypoint Campuses: *How Universities Drive the Creation of Massive Regional Innovation Ecosystems*

White Paper by:

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Introduction

The most fundamental and critical attribute of world-class innovation and entrepreneurship (IE) ecosystems is establishing a supercritical mass of high quality, diversified human talent. That means not only lots of high quality people, but also lots of those quality people diversified across skillsets such as science, engineering, manufacturing, management, business, finance, and marketing, etc.

Establishing a supercritical mass of diversified, quality IE-oriented human talent is challenging and therefore rare. However, one formula that is responsible for many (if not most) of the planet's world-class IE ecosystems is a set of complementary dynamics between a university and its adjacent metro area. This paper characterizes those dynamics as a *vortex university* (in contrast to a *waypoint university*), along with a series of metro area economic development strategies that leverage (as opposed to squander) the innovation and entrepreneurship flowing from a university. Where these complementary dynamics occur, they create massive regional innovation ecosystems that transcend university campuses, address our toughest problems, and drive economic vitality.

This white paper describes the dynamics that create vortex universities and massive regional innovation ecosystems. It also highlights examples, particularly from UC Berkeley and the City of Berkeley – a university and city that have been transitioning from a waypoint to a vortex paradigm.

Vortex Versus Waypoint Universities

In general, the interaction between IE-oriented students and their university campuses can be segmented into two paradigms: the waypoint university and the vortex university. Each is summarized below.

Waypoint Universities: The relatively typical interaction between IE-oriented students and their universities is the waypoint campus. In this paradigm, a university's IE-oriented students learn, contribute to the campus ecosystem, graduate and then mostly disperse to work and live (as conceptualized in Figure 1). These alumni might periodically return to the campus (e.g. for reunions and other special occasions); and they might donate money to the campus. However, they don't contribute to building the university's critical mass of IE ecosystem talent. This alumni flight is a lost opportunity for the campus ecosystem (and metro area). Examples of universities that have strong STEM programs but the waypoint dynamic include urban campuses such as University of Pennsylvania in Philadelphia, Brown in Providence, Rhode Island, and Yale in New Haven, Connecticut, as well as suburban/rural campuses such as Dartmouth in Hanover, New Hampshire and Princeton in Princeton, New Jersey.

Vortex Universities: A relatively rare but highly desirable interaction between IE-oriented students and their universities is the vortex campus. In this paradigm, a university's IE-oriented students learn and contribute to the campus ecosystem; however the key difference is that when they graduate, many of these alumni stay in the vicinity of the campus to work and live. As a result, these alumni continue to contribute to the university's critical mass of IE ecosystem talent (as conceptualized in Figure 2). These IE-oriented alumni continue to contribute via collaborations (informal and formal), mentoring, investing, hiring, licensing, sponsoring research, teaching (via guest lectures and as adjunct professors), as well as donating money (in addition to volunteering time). Furthermore, their proximity to the campus makes them conducive to serendipitous discussions with university people that lead to new products and companies.

Vortex Effect: In contrast to the waypoint campus paradigm, the vortex campus paradigm is a formulaic engine for scaling an ecosystem's talent pool. For vortex campuses, year after year of attracting quality students and retaining many quality graduates leads to a steady annual growth in its IE human infrastructure – thereby “spinning-up” a large vibrant ecosystem. This dynamic can be studied via a new metric for university IE ecosystems called, *the vortex effect*. It's defined as, the number of alumni that came to the university from outside of the university's metro area, and then stayed in the metro area after they graduated. This metric is a focus of further research.

Vortex Magnet: Eventually (as depicted in Figure 3), vortex campus ecosystems reach a supercritical mass – at which point the university's region becomes a magnet for R&D-oriented startups, established companies, entrepreneurs, early stage investors, and other professionals who are not affiliated with the university, but who augment the university's IE ecosystem. Examples of top vortex universities are Stanford in Palo Alto California (Silicon Valley), University of Cambridge in Cambridge UK, as well as MIT and Harvard in Cambridge and Boston Massachusetts.

Other Types of Research Institutions: Other types of research institutions can match the quality of R&D at universities, but those other types of institutions lack the large, yearly churn of human talent that universities have with their incoming undergraduates, graduate students and post docs. This is exemplified by the fact that none of the 17 US national labs have become vortexes that have created a massive regional IE ecosystem.

(These other research institutes also lack other characteristics that help build IE ecosystems – such as business schools with entrepreneurship-oriented MBA students.) Nonetheless, these other types of research institutions can augment a nearby university's capacity to drive a vibrant IE ecosystem. The Lawrence Berkeley National Lab adjacent to UC Berkeley exemplifies this, as does the growing number of private, non-profit research institutes around UC San Francisco's Mission Bay campus.

R&D-Intensive Corporations: Large R&D-oriented companies can materially contribute to the rise of a regional IE ecosystem – especially if they are growing fast (and thereby hiring lots of employees) such as today's Google and Facebook. However, in contrast to the relentless, recession-resistant matriculation of students at universities, the hiring growth of these R&D-oriented companies can slow, or be diluted by the advent of branch offices in other regions. This is exemplified by HP, IBM, Cisco and other R&D-oriented corporations that grew fast years ago, but now are growing slowly (if at all).

How to Transition a Waypoint University Into a Vortex University

There are several types of programs and best practices that can improve a university's IE ecosystem, but only a subset of those programs can help a waypoint university transition towards a vortex university. Over the past several years, this subset of programs has been helping several universities transition on the continuum from waypoints to vortexes. Examples of these transitioning universities include, UC Berkeley in Berkeley CA (East Bay), University of Michigan in Ann Arbor MI, and Purdue University in West Lafayette IN. However, before highlighting those programs, it's important to realize that not all university campuses have the potential to become vortexes.

Vortex-Challenged Campuses: While many universities have quality STEM programs that attract IE-oriented students, many are located in regions that have impediments to the economic developments that are necessary for retaining IE-oriented alumni throughout their careers. These impediments include (but are not limited to): (1) lack of a major airport in the region – thereby precluding accessibility to non-stop flights; (2) lack of a major population center near the campus, (3) lack of a high quality of life in the community – due to, for example, high crime rates or environmental pollution; and (4) insufficient commercial areas (which are not the same as retail areas) in the vicinity of the campus – that is sometimes due to a preponderance of local citizens who have an anti-growth, anti-university, and corresponding anti-business mentality.

For example, Cornell at its Ithaca campus, and Carnegie Mellon at its Pittsburgh campus aren't likely to become large centers of startups. That's why Cornell has been building a branch campus (in conjunction with the Technion – Israel Institute of Technology) in New York City; and CMU has grown a branch campus in Mountain View CA (in the heart of Silicon Valley). New York City has the attributes that don't impede Cornell from creating a vortex there – especially in combination with the other universities in the City including Columbia and New York University. Similarly, Silicon Valley already has a world-class IE ecosystem that CMU can leverage to establish a vortex with its alumni. These two

universities exemplify a branching strategy that universities can use to establish vortexes¹.

Vortex-Enabling Programs: There are a variety of programs that bolster a university's IE ecosystem, but there are four programs in particular that can transition university ecosystems from waypoints toward vortexes. Each is described below, and examples are provided at UC Berkeley – a university that over the past 5-10 years has been transitioning to a vortex from a waypoint (that lost most of its entrepreneurs and startups to Stanford's vortex – 50 miles south in Silicon Valley).

1) Startup Accelerators:

Startup accelerator programs provide burgeoning companies with office space, access to mentor and investor networks, as well as other resources and ongoing support. They enable university spinouts to remain in the campus ecosystem while the companies are still gaining traction. As these spinouts grow, they establish roots in the university's region (e.g. employees) and that makes them more likely to stay when they graduate from the accelerators and expand their businesses. These accelerators can be operated either privately, by the university, by the government, or via a combination of those three.

Over the past 5-10 years, UC Berkeley has established a suite of startup accelerators including SkyDeck, the CITRIS Foundry, and the QB3 Garage. Examples of startups that entered those accelerators, graduated, and then stayed in the vicinity are: Eko Devices (SkyDeck to 2600 10th Street, Berkeley), Picoyune (SkyDeck to 950 Gilman, Berkeley), Kloudless (SkyDeck to 1936 University Ave, Berkeley), Chirp Systems (SkyDeck to 2070 Allston Way, Berkeley), and Go Overseas (2040 Bancroft Way, Berkeley).

2) Shared Office Spaces and R&D Office Parks:

These programs enable startups spinning-out of accelerators (or blasting out of the campus and thereby bypassing accelerators) to stay near the campus while incrementally growing their office footprints. As with the accelerators, these facilities can be operated either privately, by the university, by the government, or via a combination of those three.

Over the past several years, a variety of shared spaces and R&D office parks have been established in the vicinity of UC Berkeley. The shared office spaces that are walking distance to the UC Berkeley campus include WeWorks, NextSpace, and Sandbox Suites – all of which are private, for-profit operations. The Berkeley ecosystem's office parks are in the industrial western section of Berkeley and in the adjacent cities of Emeryville and Oakland. The quintessential example of university-owned office parks is how Stanford developed the commercial real estate on the southern edge of its campus (along Page Mill Road). Similarly, Yale ([Science Park Development Corporation](#)) and Georgia Tech

¹ For more information about the grow versus branch strategies for university IE ecosystems, see: [The Strategic Value of a University's Hyper-Local Innovation Ecosystem: Grow, Branch or Envy.](#)

(<http://www.news.gatech.edu/features/tech-square-celebrates-decade>) have developed R&D-oriented office buildings near their campuses.

3) Shared User Facilities & Maker Spaces:

These programs enable highly specialized R&D equipment owned by the university to be accessed by entrepreneurs and companies in addition to faculty and students. Typically these facilities have fees for commercial use that are considered fair market value, and accordingly, the companies paying the fees own any resulting intellectual property (not the university).

For example, UC Berkeley and Lawrence Berkeley Lab have several shared user facilities such as the [Biomolecular Nanotechnology Center](#), and [Marvell Nanofabrication Lab](#). In 2015 UC Berkeley opened Jacobs Hall, a maker space for the College of Engineering. At a regional scale, MIT's new initiative call *The Engine* aims to create a marketplace for shared facilities ([engine.xyz](#)).

4) Engineering Entrepreneurship in Residents Programs:

Research universities have a plethora of students and faculty who are focused on research, but they typically have a dearth of engineers and scientists who are focused on transitioning prototypes into beta versions of products, or bench/lab-scale processes into and production-scale processes. Engineering Entrepreneurs in Residence (EEIRs) fill that hole in a university ecosystem. EEIR programs enable entrepreneurs with engineering-intensive experience (in contrast to entrepreneurs with mostly business-intensive experience) to use the campus for R&D that shows high potential for leading to new products and companies. In that respect, EEIR programs have similarities to startup incubators and accelerators.

In the UC Berkeley IE ecosystems, the Cyclotron Road program (started in 2013 by the Lawrence Berkeley National Lab) serves as a form of EEIR program.

The Relationship Between a University & Its Metro Area

Importance of a Metro Area to a University's Innovation Ecosystem

The metro areas in which universities are located play important roles in determining the extent to which universities can become vortex campuses. Metro areas can squander the opportunity thereby incurring innovation drain (which is tantamount to the brain-drain dynamic). Alternatively, metro areas can take advantage of the opportunity by leveraging the enviable position of having a large research university in their environs.

For decades the City of Berkeley squandered the opportunity to leverage the innovation and entrepreneurship flowing from the UC Berkeley campus and Lawrence Livermore National Lab. Practically none of the campus's spinout companies setup shop or stayed for long in Berkeley. Many exited to the Stanford vortex – 50 miles south of Berkeley.

However, over the past several years, collaborations (informal and formal) between the City of Berkeley, the private sector (including the Chamber of Commerce and Berkeley Downtown Association), UC Berkeley, and Lawrence Berkeley National Lab have helped transition UC Berkeley into more of a vortex campus. For example, those collaborations led first to the East Bay Green Corridor in 2008 (now defunct), then the successful [Berkeley Startup Cluster](#) (BSC) and [Berkeley Emeryville BIO](#). In addition to helping brand Berkeley as a center for innovation, entrepreneurship and startups, the BSC provides entrepreneurs and startups with resources (such as where to find office space), IE events, local jobs board, as well as connections to local mentors and investors.

A vortex university's metro area government agencies need to also provide the infrastructure for a robust economy including a variety of housing and transportation options along with quality of life attributes such as excellent public safety, schools, parks and recreation.

The Importance of a University to its Metro Area's Vibrancy & Resiliency

A university metro area's economic development policies have a large impact on the extent to which the university can become a vortex. Conversely, the extent to which a metro area has a resilient economy and vibrant culture can be driven by whether the metro area has one or more large research universities (including medical schools and associated medical centers). Moreover, if a metro area doesn't have a robust research university in its environs, then that metro area is at risk of economic and related cultural decay.

This is dynamic is exemplified by the rust-belt cities of Detroit MI and Pittsburgh PA. Both cities had vibrant industrial bases – the auto industry in Detroit, and the steel industry in Pittsburgh. Both cities saw their industrial bases decline. Detroit hasn't recovered, and Pittsburgh is recovering. One big difference between these cities is that, Detroit doesn't have a research university in the top 100 by R&D expenditures² (Wayne State University was ranked 101 in 2015), but Pittsburgh has not just one, but two research universities in the top 100: Carnegie Mellon University (with \$240 million in research expenditures in 2015 and an excellence in information technology), and University of Pittsburgh (with \$860 million in research expenditures in 2015 with a focus on health sciences).

Massive Regional Innovation Ecosystems

When a university pursues the vortex campus paradigm, and the university's metro area pursues economic development strategies that leverage innovation and entrepreneurship, then a massive regional innovation ecosystem (MRIE) can arise. These MRIEs are often foundations for the most economically, culturally and socially vibrant communities on the planet. Examples of MRIEs include:

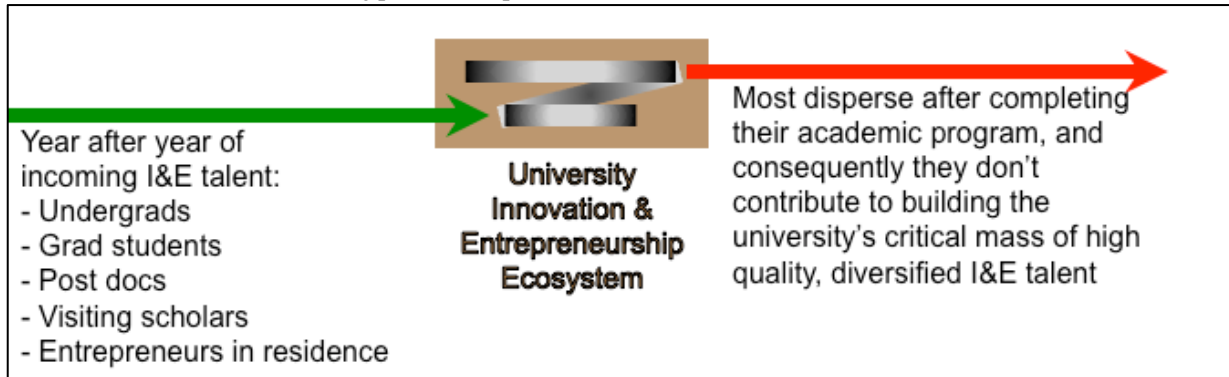
- The MRIE comprised of MIT, Harvard, Tufts, Northeastern, Boston University, as well as the cities of Cambridge and Boston (soon to be augmented by [Harvard's innovation zone](#)).

² NSF university rankings by R&D expenditure

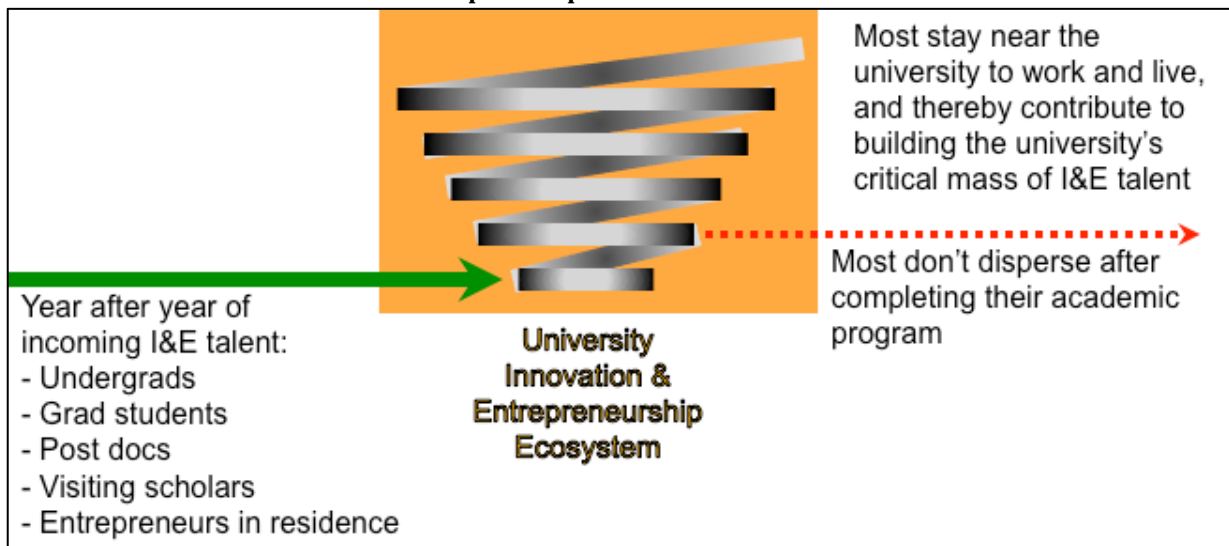
<https://ncesdata.nsf.gov/profiles/site?method=rankingBySource&ds=herd>

- The MRIE comprised of Stanford, Stanford Research Institute (SRI), NASA Ames Research Center, and the Silicon Valley cities particularly Palo Alto, Menlo Park, Mountain View, Sunnyvale, Santa Clara, San Mateo and San Jose.
- The life sciences MRIE comprised of UC San Francisco, several research institutes and the cities of the upper San Francisco peninsula especially San Francisco, South San Francisco, and Brisbane.
- The MRIE comprised of UC San Diego, Scripps Institute and the San Diego County cities.
- The New York City MRIE (especially in finance and media) comprised of Columbia, New York University and now the Cornell / Technion engineering graduate school.
- The emerging MRIE comprised of UC Berkeley, Lawrence Berkeley National Lab, and the (middle) East Bay cities particularly Berkeley, Emeryville and Oakland.

**Figure 1:
Waypoint Campus - Subcritical Mass of IE Talent**



**Figure 2:
Vortex Campus - Supercritical Mass of IE Talent**



**Figure 3:
Vortex Campus - World-Class IE Ecosystem**

