



Study on University-Business Cooperation in the US

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Executive Summary

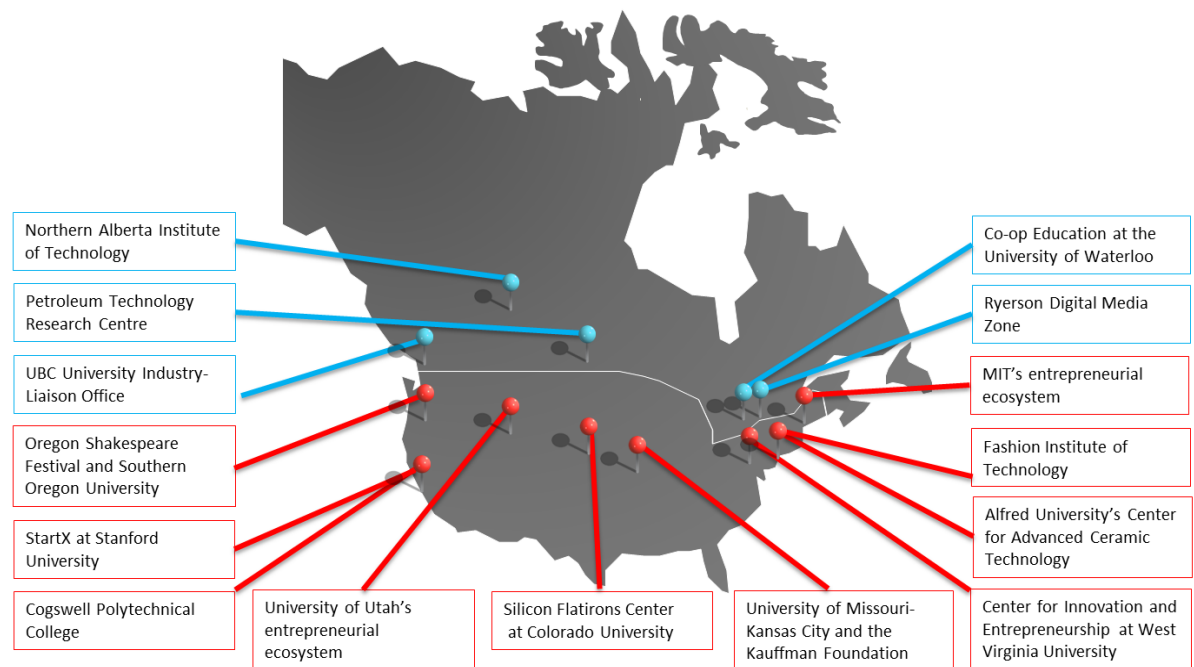
University-Business Cooperation is a relationship in flux, reflecting issues specific to the transition from an industrial to a knowledge society

1. **University-Business Cooperation (UBC) is a relationship in flux, reflecting issues specific to the transition from an industrial to a knowledge society.** UBC is undergoing a transformation from a dyadic university-business relationship, aimed at solving firm problems, sourcing new products or providing an outlet for academic research, to a triadic university-industry-government relationship that maintains these objectives, while incorporating new features, such as contribution to economic and social development at the national, regional and local levels, responsiveness to societal concerns and new forms of student involvement in entrepreneurial activities. The business side of UBC has broadened to include cultural, not-for-profit and civil society organizations, while the academic side is no longer confined to relatively small academic sectors, but has expanded from engineering and medicine to multi/interdisciplinary research sectors involving the social sciences and the arts. It also encompasses both undergraduate and postgraduate education, as well as lifelong learning. The interactions no longer take place across discrete boundaries, but the boundaries themselves have been transformed by the creation of new hybrid entities that operate on the basis of a new set of organizational dynamics.
2. **The theoretical framework used to explore UBC.** From the broad theoretical framework that can be used to explore UBC, we selected five streams of literature:
 - The National Innovation Systems model
 - Linear and non-linear (networked) innovation models
 - Elements of knowledge-based firm strategic management theories, such as the exploration-exploitation dichotomy, transaction cost economics, resource-based theory and the knowledge-based view

- The ‘academic capitalism’ theory; and
- The Triple Helix model

All these approaches acknowledge, in one way or another, the role of universities and business firms in the innovation process. However, a major difference lies in the size of the role granted to universities in the innovation process and the attention paid to university interaction with business and government. Our main focus was placed on the Triple Helix model, as it was thought to best capture these interactions. The Triple Helix model places the university in a leading role in innovation, on a par with industry and government, and contends that the hybridization of elements from the university, business and government spheres can generate innovation and economic development through new institutional and social formats for the production, transfer and application of knowledge.

3. The case studies: UBC is explored in this study by means of ten case studies from the US and five case studies from Canada, as illustrated in the map below:



The selection of case studies was based on several criteria:

- **Balanced geographical coverage:** in the US, we selected cases from the East Coast (MIT, New York State Center for Advanced Ceramic Technology, New York Fashion Institute of Technology, the Center for Innovation and Entrepreneurship at West Virginia University), central US (Silicon Flatirons Center at Colorado University, Technology Venture Development at University of Utah, Kauffman Foundation and the University of Missouri in Kansas City) and the West Coast (Stanford, Oregon State University, Cogswell Polytechnical College). In Canada, we selected cases in the

Western (University of Waterloo and Ryerson) as well as Eastern provinces (Northern Alberta, Petroleum Technology and UBC University-Industry liaison offices).

- **Public and private ownership of the higher education institutions involved:** in the US we selected both public institutions (Fashion Institute of Technology, Colorado University at Boulder, University of Utah, West Virginia University, University of Missouri-Kansas City, Oregon State University) and private ones (MIT, Alfred University, StartX at Stanford and Cogswell Polytechnical College). In Canada, all the selected universities are public. As education is a constitutional responsibility of provinces, most universities are publicly funded, but maintain institutional autonomy (private universities in Canada are relatively new and mainly exist at the undergraduate level) even if some of the oldest universities were originally privately endowed.
- **Different institutional types:** in the US, our selection focused primarily on the “Basic” and “Undergraduate instructional program” classifications under the Carnegie Classification framework of institutional diversity in U.S. higher education. In Canada, where the Carnegie classification does not apply, our case studies are equally reflective of diverse foci. They include research-intensive institutions, comprehensive institutions, and polytechnic universities.
- **Mix of various forms of UBC, performed in well-known and less known higher education institutions:** in the well-known category in the US we included cases like MIT, while most of the other cases are less known and exemplify various aspects of academic entrepreneurship that have been less explored (e.g. fashion and technology entrepreneurship at the New York Fashion and Technology Institute; law, technology and entrepreneurship at the Silicon Flatirons Center at Colorado University; entrepreneurship in digital media industry and the creative arts at Cogswell Polytechnical College). In Canada, selected case studies include some large-size institutions which are very well known, such as the University of British Columbia, as well as mid-size institutions, such as the University of Waterloo and the University of Regina.

4. **Origin of UBC.** Our case studies illustrate a variety of initial contexts for UBC. Although a sharp differentiation between them is difficult to make, as many cases share some degree of similarity, several distinct situations have been identified:

- **Long-standing UBC links in highly research-intensive universities with a strong entrepreneurial environment,** e.g. MIT, Tech Ventures at University of Utah, Silicon Flatirons Center at Colorado University, StartX at Stanford University (which, in spite of being a very recent initiative, emerged to fill a gap in the structure and functioning of

Stanford's strong and established entrepreneurial environment), the University-Industry Liaison Office of the University of British Columbia and the University of Waterloo.

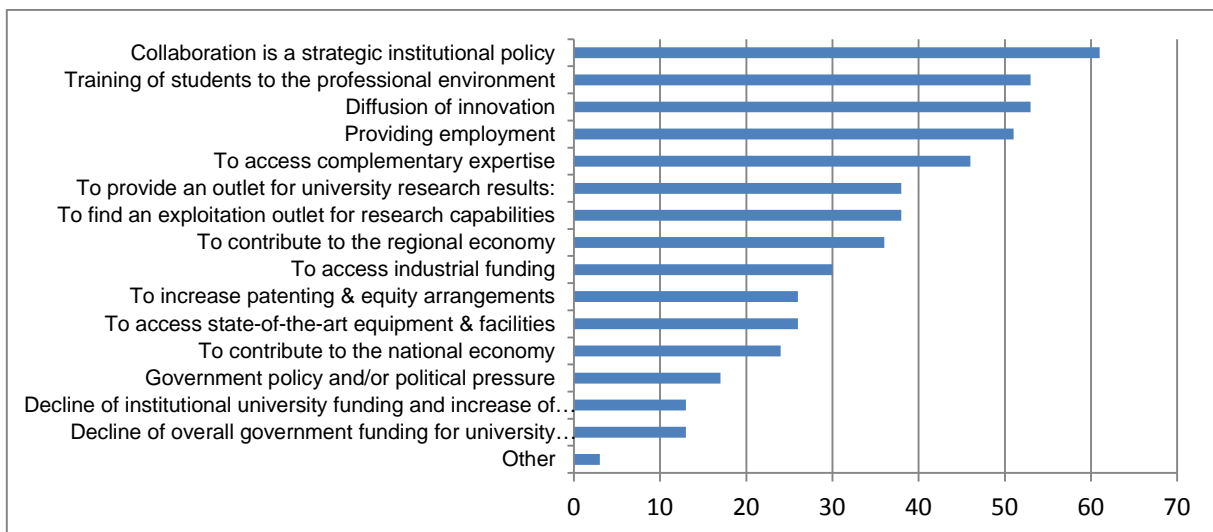
- **More recent UBC links in less research-intensive universities and less established entrepreneurial environments**, aimed to improve and update the university educational offer, improve student employability and attract new students, e.g. the Center for Innovation and Entrepreneurship (CIE) at West Virginia University's College of Business & Economics, and the cooperation between the University of Missouri-Kansas City and the Kauffman Foundation (UMKC-KF).
- **Long-standing UBC links in Master's colleges and universities**, aimed to strengthen the research capacity of the university and the professional-level education of students, e.g. at Alfred University's Center for Advanced Ceramic Technology (CACT) and the Fashion Institute of Technology (FIT);
- **Recent UBC links in undergraduate education colleges**, aimed to improve the overall quality and attractiveness of the institution, e.g. the Cogswell Polytechnical College of Sunnyvale, California, the Ryerson Digital Media Zone (DMZ) of the University of Ryerson and the NovaNAIT Center of the Northern Alberta Institute of Technology (NAIT);
- **A specific form of UBC spun-off from the university and grown into a world-famous art event with a strong social, economic and cultural impact on the local community**, e.g. the Oregon Shakespeare Festival and Southern Oregon University (OSF-SOU).
- **Recent UBC links aimed to develop the national economy**, such as the Petroleum Technology Research Center (PTRC).

5. Stakeholders of UBC. All the case studies have a broad and varied range of UBC stakeholders, as well as a significant depth of connections between them. Most of the case studies, particularly those established in highly research-intensive universities with strong entrepreneurial environments were part of complex innovative ecosystems comprising various academic departments and units, various organizations involved in technology commercialization, supporting academic administration units, faculty, students, student associations, etc. Business links have been often initiated informally by faculty, university managers, alumni, etc. and later formalized and managed through specialized university structures. On the business side, an important feature is the myriad of firms involved in collaboration with the respective universities, from high-tech firms to legal firms, venture capital firms, university start-ups, etc. Also noteworthy are the close links with the local entrepreneurs, who are involved in teaching and various forms of entrepreneurship education.

These wide-ranging connections between the stakeholders, regardless of their individual organizational designs, have significantly blurred the boundaries between universities and businesses' respective institutional spheres and increased the mobility of individuals across them, especially in terms of involving business people and entrepreneurs in academic educational activities. Therefore, most of the UBC forms we identified are no longer located on either side of the institutional spheres of university or business, but at the interface between them.

6. Financial resources for UBC include a variety of sources, such as the university itself, partner business firms, alumni, entrepreneurs and government agencies. While university, business sources, entrepreneurs and alumni are important sources that are present in all the cases (a further differentiation can be made here between the weights of each of these sources in the overall budget), government funding seems to be the most important differentiating factor, as some of the cases rely more heavily on government funding, while others rely on it only minimally or not at all.

7. Motivations of UBC that have emerged from the case studies and their relative importance are summarized in the graph below.



Overall, the most important UBC motivations appear to be collaboration as a strategic institutional policy, training of students for the professional environment, diffusion of innovation, and providing employment. The least important are the decline of institutional university funding and the increase of competitive funding, and the decline of overall government funding for university research caused by budget cuts. Government policy and/or political pressure appear to have a low to moderate importance. Also, the contribution to the national economy is ranked relatively low overall, much lower than the contribution to the regional economy. These motivations confirm the increasing adoption of collaboration as a

strategic institutional policy in higher education institutions, with a significant role in generating and diffusing innovation, rather than as a reaction to the decline of government or institutional funding, or a response to top-down government policies and pressures. Forging cooperative links with industry appears to be primarily a means to improve higher education institutions' research capabilities and education offer, and increase student employability. Also, the higher score given to the contribution to the regional economy than to the contribution to the national economy confirms the growing role of higher education institutions in regional economic development and the consolidation of their "third mission" (e.g. the Big 5 Entrepreneurship Initiative as a contribution of UMKC and the Kauffman Foundation to the development of Kansas City region, University of Regina and the co-op education programs of the University of Waterloo, which were established to develop the entrepreneurial spirit in the community). More specific UBC motivations can be drawn from each case study in correlation with their specific profiles, strengths and operation contexts, as these factors are also major determinants of their motivations.

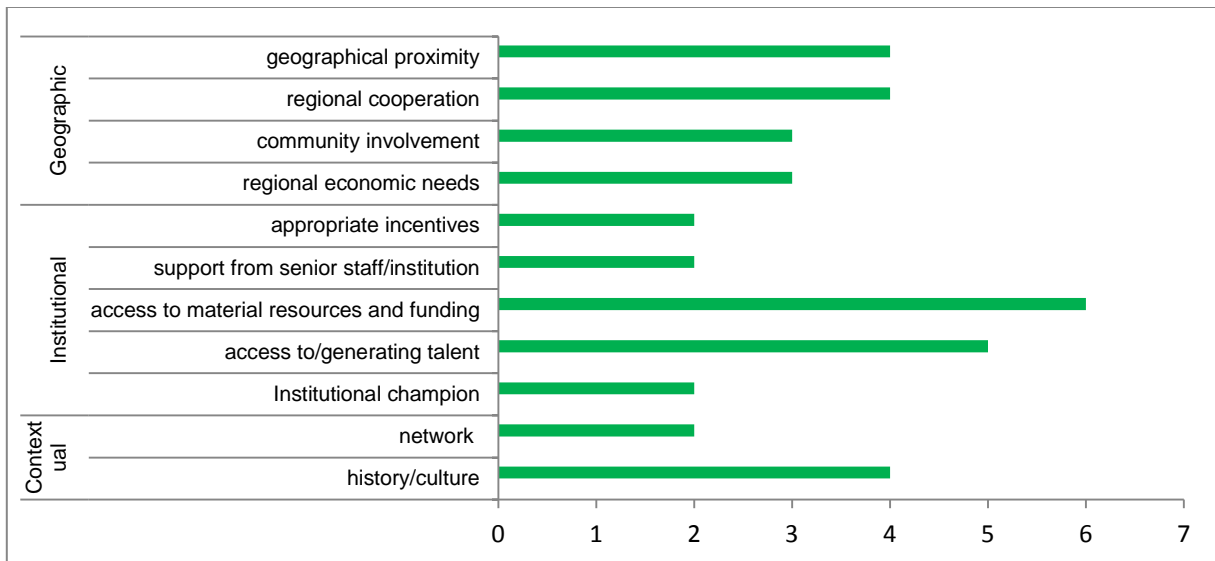
8. **Forms of UBC.** On an overall assessment, the most important forms of UBC in the US include knowledge sharing & transfer, and informal interactions. At some distance behind come applied innovation and involvement of academic staff and students in solving specific business problems, research partnerships, and entrepreneurship education and promotion. Other forms of cooperation specifically tailored to education, such as staff mobility, mobility/placement and internship of students, and cooperation in curricula have been scored with average importance overall, but they are highly ranked in some individual cases. UBC in Canada pertains mostly to research activities. Education developments in UBC emerged as a by-product of research cooperation in the majority of cases, with some examples of a strategic university decision in some other cases. In Canada, UBC forms are varied. The most widespread UBC form is applied innovation and cooperation in research, which subsequently leads to changes in curricula. Other forms of UBC include entrepreneurship education and promotion, knowledge sharing and transfer, with some examples of mobility placements for students and patenting and equity arrangements.
9. **Objectives of UBC.** Based on an overall assessment, UBC objectives can be divided into two broad categories: '**internal**' objectives focused on strengthening the research and education capacity of the university, while benefitting both students and faculty; and '**external**' objectives focused on strengthening the links with the local and regional community, including business firms, government agencies, professional associations, entrepreneurs, venture capitalists, etc. These local actors are not only potential employers for students and collaborators for the academic staff, but also an important source of knowledge

and expertise to tap for bringing real-world expertise to the classroom, for raising funds, solving specific problems of the community and for connecting the university to broad networks of partners.

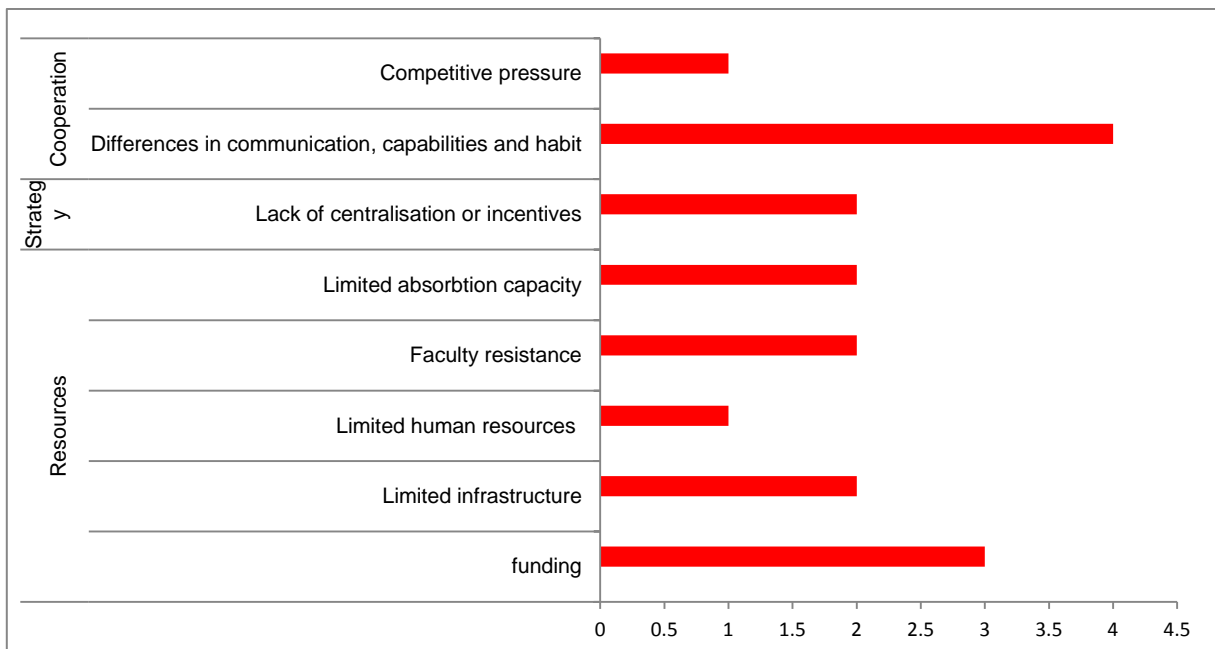
10. Benefits of UBC are manifold, and have been reported for all the stakeholders involved, from students and faculty to business partners and the local community. In most cases, the benefits apply to several stakeholders, e.g. university spin-offs or start-ups that may benefit the university, faculty and the local community, as well as the students.

- **Benefits for students** are multiple and vary from one case to another. Such benefits, that are presented in greater detail in the report, entail access to companies for internship programs, access to experiential and entrepreneurial education as well as first-hand exposure to 'real professional life exercises', such as firm formation projects.
- **Benefits for faculty** are also present in the case studies analysed. These range from access to industrial research fund (which are often tied to less restrictive administrative requirements than government-sponsored research programs) and cutting-edge technology and facilities to consulting opportunities. It emerges from the case studies that closer contact between faculty and industry may start a virtuous circle whereby faculty understands more and more industry's needs thus giving on hand more economic viability to academic projects and, on the other hand, attracting more and more industry research funds.
- **Benefits for business** include the opportunity to access complementary expertise that may be needed in the business but unavailable in-house, the possibility to hire skilled workers and establish links with them prior to graduation.
- **Benefits for the community** are also found in several instances where universities and businesses display close ties with their region, including the contribution to the economic development through events sponsored by the businesses, run jointly between universities and businesses or spun-off from a UBC. Job creation, a more thriving entrepreneurial local environment and increased tax revenues are also found to be important benefits to the community.

11. Drivers and barriers of UBC are examined in detail in the report. The figure below reports the drivers emerging from the case studies by order of frequency. As shown in the table below, the most recurring drivers of UBC identified in the case studies pertain to the institutional sphere, with access to material resources and funding as well as access to talent being the two main drivers.



The figure below reports the barriers that emerge from the case studies by order of frequency, differences in communication, capabilities and habits between universities and businesses appearing as the main barrier to UBC.



12. Impact of UBC: on an overall analysis of the impact of UBC reported in our case studies, two broad types of impact were identified:

- **An ‘internal’ impact on the university**, arising from the commercialization of university research and technologies and the revenues it generates to the university. This impact is particularly relevant for very high research-intensive universities,
- **An ‘external’ impact on the local and state economy**, measured by total revenue to the local and state economy brought by university spin-offs, jobs created for students and other employees by university spin-offs and start-ups, which sometimes are the largest local employer, and help to local entrepreneurs in launching businesses which then create jobs in the local area and boost tourism and the economic sectors which benefit from tourism (services, hotels, restaurants, etc.).

13. Conclusions and policy recommendations. The detailed exploration of the US and Canada case studies shows important differences in the UBC context not only between these two countries, but also in relation to the Europe. These differences pertain, on the one hand, to the institutional types of the higher education institutions concerned, their origin and time since inception, organizational formats, stakeholders of the UBC, funding sources and relationships with the government, objectives, drivers and barriers of UBC. On the other, we also distinguish differences that pertain to the broader social and economic environment where these institutions operate, the legal framework ruling their activities, including the IP regulations, their culture of collaboration, etc. These differences have an important influence on Europe’s performance in higher education, research and innovation, which lags behind that of the US and Canada in many respects. The “European paradox” (i.e. strong research capacity and results, but lower capacity to translate them into innovative products), although much reduced in recent years, could be further reduced by removing several gaps and obstacles at the university-business interface and beyond. Based on the findings from the 15 case studies carried out within this study, a set of policy recommendations aimed to improve Europe’s innovative performance are provided, that fully resonate with the recommendations made in the 2011 Communication of the European Commission on the modernization of higher education¹ (see details in section 5). The policy recommendations are targeted at different UBC and innovation stakeholders in order to capture developments and dynamics at different levels and maximize impact.

¹ European Commission (2011), Supporting growth and jobs – an agenda for the modernisations of Europe’s higher education systems, COM(2011) 567

Recommendations for higher education institutions

Develop the strategic, structural and institutional capacity for UBC

- Develop collaboration as a strategic institutional policy
- Develop a university-wide system for UBC
- Ensure institutional capacity development for UBC
- Diversify funding sources and adjust fundraising strategies accordingly

Facilitate the participation of business representatives in universities, as well as the participation of academics and students in business activities

- Encourage the participation of business representatives in university governance, in departments and centers through teaching entrepreneurship education, in compliance with the tradition and principles of academic autonomy.
- Provide career incentives for academics
- Provide more company placements and internships for students and encourage the recognition of students' work experience for qualifications and integration in curricula

Gain further understanding of the complexity of UBC

- Ensure management of conflict and expectations, supporting UBC according with the development stage of the cooperation

Recommendations for EU institutions

Disseminate information on the potential benefits of UBC

- Promote a greater social acceptance of the "entrepreneur" and the culture of entrepreneurship
- Encourage and fund more university-business fora or executive exchanges at the local, national and EU level expanding on the existing University-Business Forum

Develop a regulatory environment conducive to UBC

- Continue to support to universities' autonomy and links with the community
- Encourage the recognition of professional experience and work placement in the curriculum

Simplify administrative procedures and reduce administrative costs of participation in relevant EU initiatives

- Make co-funding rules less stringent and set-up a two-stage grant application process

Recommendations for governments

Develop a regulatory environment conducive to UBC

- Encourage UBC in a broader range of institutions and disciplines and acknowledge both education and research as development paths for achieving UBC
- Fund chairs to encourage movement of individuals across academia and industry

Recognize UBC as a tool for regional development

- Foster the relationship with the local community and the contribution of UBC to the regional economy

Recommendations for businesses

Create specialized departments for collaboration with higher education institutions and encourage the development of initiatives and programs focusing on specific knowledge needs of the company that can be addressed by higher education institutions

Introduction

University-Business Cooperation (UBC) is a relationship in flux, reflecting issues of transition from an industrial to a knowledge society. UBC is undergoing a transformation from a dyadic university-business relationship, aimed at solving firm problems or sourcing new products and providing an outlet for academic research, to a broader university-business-government relationship that incorporates new features, such as societal concerns for economic and social development at the national, regional and local levels, as well as greater responsiveness to firm and university needs². Moreover, in addition to the focus on research that UBC has privileged for the past few decades, evidenced by the creation of a plethora of technology transfer and collaborative research modalities, there is also a new focus on entrepreneurial education and on the role of students in UBC. Students are involved in new ways, beyond traditional internship schemes, at times creating ventures before graduation as part of entrepreneurial training and mentoring schemes.

UBC links are no longer confined to a relatively small academic sector, leaving most of the academy untouched, but have expanded from engineering and medicine to the social sciences and the arts, while the “business” side of UBC has broadened to include cultural, not for profit and civil society organizations³. Moreover, a broader strategic level has emerged, in the form of the creation of venues for discussion and development of regional innovation projects that provide a means to conceive and implement concepts that go beyond discrete sets of negotiations among the dyadic or triadic partners.

The cases treated in this report describe not only activities related to graduate and undergraduate education, research and involvement in regional development. They also highlight a shift from interactions across discrete boundaries between university and business, to transformation of boundaries themselves, with creation of hybrid entities that bring a new set of organizational dynamics. These new hybrid organizational models do not imply that older organizational formats or relationships precipitously disappear. Rather, they will be modified to accommodate different values and norms. The results presented here present instances of both, as well as the transition between these two formats. Thus, it is important to analyze the process of transition, rather than simply taking a snapshot at a single moment in time in order to best understand university-business relations, a field in flux. Boundaries, and their new dynamics as promoters of hybridization, are increasingly the source of creativity and innovation in the creation of new intellectual and organizational syntheses.

² Etzkowitz, H. and M. Ranga (2011), “Spaces”: A Triple Helix Governance Strategy for Regional Innovation’, In: Rickne A., Laestadius and H. Etzkowitz (eds), *Innovation Governance in an Open Economy: Shaping Regional Nodes in a Globalized World*, Routledge.

³ New York Times (2013), “New Cornell Technology School Tightly Bound to Business”, 21 January 2013.

This report is structured within five main sections. Section 1 sets out the theoretical framework for the analysis of UBC, placing a particular emphasis on the Triple Helix model. Section 2 discusses the main findings from the literature on the complex relationships between universities and businesses, while section 3 provides an overview of the relevant frameworks within which universities and businesses cooperate in the US and Canada. Section 4 provides an analysis of the 15 case studies that were undertaken within the project. Finally, section 5 provides the concluding remarks, stemming from the analysis of the case studies.

1 Theoretical framework for analyzing UBC

UBC has received increasing attention from government policy-makers, scientists and industrial managers over the last two decades, in the transition to the knowledge society. Growing intricacies have emerged in the structure and content of interactions between science and technology in the broader sense, often referred to as the “technicalization of science” and the simultaneous ‘scientification of technology’ (e.g. Böhme, 1978; Henrekson and Rosenberg, 2001). Consequently, the borderline between basic research, considered the stronghold of universities, and applied research/technology, seen as the realm of businesses, has become in many instances increasingly blurred. Both the university and business spheres have undergone significant transformations that have led to new forms of collaboration aimed at meeting the challenges of the new economic and technological landscape.

On the industry side, a new vision of business research and development (R&D) management emerged in the 1990s, centered on stronger integration of learning and R&D into corporate strategy, and content and process transformations for maintaining competitive advantages (Burgelman, 1990; Senge, 1990; Prahalad and Hamel, 1990; Porter, 1980, 1990; Debackere, 2000). An accelerated transition to knowledge markets was observed, in parallel with a search for external knowledge and formation of R&D alliances for increasing firm competitiveness and sharing increasing research risks and costs (Fusfeld, 1995). New forms of alliances (partnerships, co-operative programs, consortia with universities, government laboratories, other companies etc.) at the national and international level thus emerged in response to increasing efforts on the part of businesses to access external sources of technology and knowledge and to identify trained human resources, new partners and markets (Nelson and Rosenberg, 1994; Arundel et al. 1995; Santoro and Chakrabarti, 2002).

Openness to collaborative research was no longer considered a company weakness and became an important form of learning through R&D alliances. This was one of the most significant changes of corporate management in the 1990s compared to earlier years. R&D alliances started to be seen in a new light, as key instruments to facilitate knowledge transfer and enhance firms’ capabilities for learning and for dealing more effectively with technological and market uncertainty (Ciborra, 1991; Hagedoorn et al., 2000), or as avenues for internalizing new skills (Doz and Hamel, 1998). The increasing R&D internationalization is another notable change in business R&D, occurring against the background of trade and business globalization and having a major impact on economic development and public policies worldwide. This trend came from a shift in the R&D objectives of foreign subsidiaries, from supporting production and adaptation to local markets to a search for foreign

complementary skills and knowledge. This move marked a departure from the long accepted “internalization theory” (Rugman, 1981), which argues that subsidiaries perform only relatively little R&D, mostly directed at the adaptation of parent firms’ R&D outcomes to local markets. R&D internationalization also contributed to shifting the geographical division of labor, in response to the emergence of global networks of trade and production and the move towards integrated technological systems (Cantwell and Janne, 1999).

On the university side, one of the most significant changes has been their increasing involvement in socio-economic development and commercialization of research results, often referred to as the “third university mission”, next to education and research. Some see it as a consequence of the so-called “new funding rationale”, consisting of declining government funding for academic research, changes in funding flows (growing competitive funding, and declining institutional funding) and the introduction of indirect financial incentives to increase short-term efficiency, concentration and selectivity of research funds (Geuna, 1999a). Others see it as a consequence of the changing social division of labor between academic and business R&D in the context of globalization (Lee, 1996) or of the impact of post-modernism on contemporary academic work (Hill, 1995). Etzkowitz (1998) relates the internal changes within academia to government policies encouraging universities’ third mission. He ascribes them to a normative change in science equivalent to a “second academic revolution”, whereby “the conflicts are no longer about whether the university should pursue knowledge for profit, but over the shape that organizational innovations to accommodate industry connections will take” (p. 831).

In response to growing financial and organizational pressures, universities have witnessed complex institutional, managerial or attitudinal transformations in their collaboration with business partners. Institutionally, new structures and organizational forms have emerged at the university-business interface, including university research centers, technology transfer offices and industry liaison offices, science parks, etc. (Monck et al., 1988; Quintas et al., 1992; Massey et al., 1992; Jones-Evans et al., 1999; Howells et al., 1998; Jensen et al., 2003; Siegel et al., 2003a, 2003b, 2004; Chapple et al., 2005; Markman et al., 2005). Managerially, a noteworthy change was the shift in the academic research evaluation, from the *ex-ante* system specific to the post-WWII years based on academics’ evaluation of expected results of university research, to an *ex-post* evaluation (see Geuna, 1999). Attitudinally, literature shows a “natural”, evolutionary development in some cases, met with positive attitudes and no real cultural barriers, *a priori* preventing collaboration with industry and the development of formal and informal contacts (Dierdonck et al., 1990; Sanchez and Tejedor, 1995). In other cases, skepticism and “negative unintended consequences” were reported (e.g. Florida and Cohen, 1999), related to the university capacity to cope with the tensions and conflicts generated by this new functional workload.

The theoretical framework describing UBC encompasses several bodies of literature, which reflect the complexity of the topic and the various perspectives from which it can be addressed. For the purposes of our analysis, five streams of literature have been selected as most relevant in providing a theoretical framework:

- The National Innovation Systems model;
- The linear and non-linear (networked) innovation models;
- Elements of knowledge-based firm strategic management theories, such as the exploration-exploitation dichotomy, transaction cost economics, resource-based theory and the knowledge-based view;
- The “academic capitalism” theory;
- The Triple Helix model

All of these approaches acknowledge in one way or another the role of universities and business firms in the innovation process, but the major difference among of them lies in the size of the role granted to universities in the innovation process and the attention paid to the level of university interaction with business and government. The Triple Helix model is developed in further detail and presented in section 1.1, whilst the other four streams are presented in Annex 1.

1.1 The Triple Helix model

The Triple Helix thesis is that the potential for innovation and economic development in a knowledge society lies in a more prominent role for the university and in the hybridization of elements from university, industry and government to generate new institutional and social forms for the production, transfer and application of knowledge. This vision encompasses not only the creative destruction that appears as a natural innovation dynamic (Schumpeter, 1942), but also the creative renewal that arises within each of the three institutional spheres of university, industry and government, as well as at their intersections. The Triple Helix model thus introduces a three-dimensional perspective of innovation dynamics at the levels of industry, scientific institutions and governments, and emphasizes the interplay between differentiation and integration in the evolution of the complex system of industry-academia-government.

A central concept in the Triple Helix model is the “*entrepreneurial university*”, which is seen as a key driver in the move from the industrial to the knowledge society. The transition to an entrepreneurial university is the outcome of an “inner logic” of academic development and it can be viewed (made from both teaching and research universities) as an advance, rather than a distortion of academia. Academic entrepreneurship is an overlay on the teaching and research university missions, co-existing with them in a creative tension.

The transition to the entrepreneurial university is seen as the result of the interplay between:

- Exogenous factors, such as socio-economic, political or financial crises leading to loss of manufacturing industries, transformations in the technological foundations of economic growth, growth of science-based technologies, changes in intellectual property regimes, and failure to create alternative industries in a timely fashion
- Endogenous factors, such as internal transformations within the university, or other bottom-up organizational and management changes driven by commercial opportunities in research, a more aggressive commercial stance among universities, availability of public and private venture capital, emergence of entrepreneurial research groups that function as “quasi-firms” with many of the organizational characteristics of small firms without the profit motive, the “meandering stream” of basic research serendipitously producing useful results, collegiality, inter-disciplinarity, firm formation as a way of gaining independence from funding agencies, etc.

The combination of the endogenous and exogenous factors described above that leads to the rise of the entrepreneurial university can also be seen as an evolutionary process marked by two inter-related dynamics. The “*first academic revolution*” consisted of the inclusion of research into the university mission, in addition to teaching, the expansion of research in an increasing number of disciplines, from humanities to sciences, and the cementing of its role as an inextricable part of the teaching process. Practical implications were discerned in some of these research results and steps were taken to put them to use. The “*second academic revolution*”, triggered by the university’s involvement in socio-economic development as a “third mission” next to teaching and research, was to a large extent the effect of stronger government policies to strengthen the links between universities and the rest of society, especially business. It was also an effect of industry’s tendency to use universities’ research infrastructure for their R&D objectives, thus indirectly transferring part of their costs to the state that provides a large part of university funding (Slaughter and Leslie, 1997). Collaborative links with the other Triple Helix actors have enhanced the central presence of universities in the production of research over time (Godin and Gingras, 2000) disproving former views that increasing diversification of production loci would diminish the role of universities in the knowledge production process (Gibbons et al. 1994).

The expansion of university missions and the essential elements of the first and second academic revolutions are presented in Table 1 below.

Table 1 – Expansion of university missions

Teaching	Research	Entrepreneurial
Preservation and dissemination of knowledge	“First Academic Revolution”	“Second Academic Revolution”
One mission: teaching (12th century to the mid-19th century)	Two missions: teaching and research (mid-19th century – present) The new research mission generated conflict of interest controversies. Tensions largely solved by creating the conditions for the research university as a new academic mode.	Three missions: teaching, research, contribution to socio-economic development (various starting points in time, with the earliest forms at MIT and Stanford in the early 20th century) The new mission of contribution to socio-economic development also generates conflict of interest controversies. Tensions largely solved by creating specific rules and entities specific to the third mission, and legitimizing the entrepreneurial university as a new academic mode.

In comparison to the traditional “ivory tower” universities, the entrepreneurial university has several features that provide a significant competitive advantage:

- A continuous capacity to provide students, new ideas, entrepreneurial skills and talents that are a major asset in the Knowledge Society. Students are not only the new generation of professionals in various scientific disciplines, industry, culture etc., but they can also be trained and encouraged to become entrepreneurs and firm founders, contributing to economic growth and job creation in a society that needs such outcomes more than ever (see, for example the case study on StartX, Stanford’s student start-up accelerator, or the Team Academy – the Entrepreneurship Centre of Excellence of JAMK University of Applied Sciences in Jyväskylä, Finland, where students run their own cooperative businesses based on real-life projects⁴). Moreover, entrepreneurial universities are also extending their capabilities of educating individuals to educating organizations, through entrepreneurship and incubation programs and new training modules at venues such as inter-disciplinary centers, science parks, academic spin-offs, incubators (Etzkowitz, 2008; Almeida, Mello and Etzkowitz, 2012).
- The capacity to generate technology, moving thus from the position of a traditional source of human resources and knowledge to that of a new source of technology generation and transfer, with ever increasing internal organizational capabilities to produce and formally transfer technologies rather than relying solely on informal ties.

⁴ See details at <http://www.tiimiakatemia.fi/en/>

- The capacity to acknowledge the contribution of individual innovators through concepts like the “entrepreneurial scientist” and “innovation organizer”. The “entrepreneurial scientist” simultaneously attends to advancing the frontiers of knowledge and mining its practical and commercial results for industrial and financial returns. The underlying foundation of this development is the polyvalent nature of knowledge, which is at the same time theoretical and practical, publishable and patentable. Different academic entrepreneurial styles and degrees of the scientist’s involvement can be distinguished⁵, including: (i) a direct interest in the formation of a spin-off firm and in taking a leading role in this process; (ii) handing over these results to a technology transfer office for disposition; (iii) interest in playing a supporting role, typically as member of a Scientific Advisory Board; (iv) no interest in entrepreneurship, but in firm-formation as a useful source for developing technology needed to advance basic research goals. The “innovation organizer” defines a person that typically occupies a key institutional position, enunciates a vision for knowledge-based development and has sufficient respect to exercise convening power to bring the leadership of the institutional spheres together. The innovation organizer coordinates a mix of top-down and bottom-up processes that ensure agreement and build a platform where innovation stakeholders from different organizational backgrounds and perspectives can come together to generate and gain support for new ideas promoting economic and social development. The innovation organizer role can be extended from an individual to one or indeed more institutions, coming together in a consortium, as in the case of Birmingham University’s consortium of Triple Helix actors who projected the post-Rover, post-automotive future of the West Midlands, UK (Gibney, Copeland and Murie, 2009).

The Triple Helix model has been developed in a substantive body of literature that consists of two main complementary perspectives, a (neo) institutional perspective and a (neo) evolutionary perspective, which are presented in Annex 1.

⁵ It must be noted here the fact that the Triple Helix model also emphasises the collective nature of entrepreneurship, as only rarely does a single individual embody all of these required elements, especially in high-tech entrepreneurship, which is virtually always an “entrepreneurial circle” of complementary individuals. A new high-tech firm typically takes off after collaboration is secured between persons with business and technical expertise, backed by an experienced entrepreneur, especially if the initial collaborators are relatively inexperienced. Some important country differences can be distinguished here: in the US a strong ideology of individual entrepreneurship usually suppresses the contributions of collaborators and pushes a single individual to the forefront. For example, in the creation of the Apple origin myth, Steve Jobs moved to the foreground and Steve Wozniak, the technical collaborator, and Mark Makula, the experienced semiconductor executive, who gave the original duo credibility with suppliers and financiers, were elided (Freiberger and Swaine, 2000). In Sweden, by contrast, collective entrepreneurship is openly accepted, as individuals are culturally inhibited from attempting an entrepreneurial act unless backed up by a group.

In comparison with the other theoretical approaches identified above and discussed in Annex 1 (i.e. the NIS, linear innovation models, academic capitalism), the Triple Helix model presents several advantages:

- It provides a more fine-grained description of the specific nature of and relationships between innovation actors than the NIS model. It also accommodates both institutional and individual roles in innovation through the hybrid organizational formats created at the university-industry-government interface and concepts like the “innovation organizer” and “entrepreneurial scientist”. The Triple Helix model also goes beyond the system boundaries defined by national or regional borders, by industry structures or by technologies that typically cross both geographic and sectoral boundaries. Here, sectoral or technology boundaries are less important as long as regional and local resources are combined for realizing joint objectives and new institutional formats. Boundary permeability among the institutional spheres is an important source of organizational creativity, as individuals move among the spheres and engage in recombinations of elements to create new types of organizations.
- It moves away from the linear innovation model, describing the innovation process as an endless transition characterized by four dynamics: (i) internal transformation in each of the helices (e.g. companies forming strategic alliances); (ii) mutual influence among the helices (e.g. government promoting cooperation between industry and academia); (iii) organization of tri-lateral networks generating new knowledge (e.g. in the form of regional clusters); and (iv) entrepreneurial dynamic inspired by interactions within and among the Triple Helix actors (Etzkowitz, 2011).
- It goes beyond the negative consequences of the entrepreneurial turn in academia depicted in the “academic capitalism” theory, which presents a gloomy scenario fraught with irresolvable conflicts of interest and diversion from the traditional mission and freedom of the university, subordination of the university to business on the assumption that industry is inevitably the stronger partner, distortion of academic research direction and “commodification” of academic research. In contrast, the Triple Helix model focuses on the benefits of academic performance derived from enhancing entrepreneurial activities (i.e. a “more the more” hypothesis). It argues that increasing university-business links has a positive effect by introducing new sources of ideas into the academic research agenda, addressing scientific concerns as well as practical problems, increasing the university's financial independence through its own income-generating capacities, and contributing more directly to sustainable regional development and societal advancement.
- Combining academic and business interests has also become a strategy for business R&D units, seeking new sources of ideas and a neutral partner to sponsor collaboration and cost sharing with competitors on certain topics. The concern expressed of a “brain drain” of

academic scientists to industry has not been realized. Faculty members involved in entrepreneurial ventures usually maintain their university workplace or return to it after a leave of absence. They often bring back with them ideas for larger scale academic projects that may unite several centers into larger consortia, or proposals for more systematic technology transfer arrangements. The entrepreneurial scientist who is embedded in a dense network of interactions is displacing the isolated “ivory tower” individual researcher. The dominance of industry over university feared in the industrial society is superseded in the knowledge society, as knowledge embedded in intellectual property gives its holder significant bargaining power in setting the terms of its utilization. The question of who influences whom in UBC is always an empirical one, with the answer weighted towards the actor with the most highly valued good under varying societal conditions. A better understanding of an expanded role of the university in economic development can change fear into interest and lead to more support for academic enterprise, not only from the general public and traditional government funding agencies, but also from other sources such as regional development authorities, ministries of enterprise and industry, regional, national and multi-national funding agencies, etc.

2 Literature evidence on the complex nature of UBC

UBC is a complex phenomenon characterized by various features. We provide below a summary overview of the main aspects of UBC as highlighted in the academic literature and grouped according to key items emerging from the literature.

- **Purpose:** e.g. entrepreneurship education (teaching and research), staff and student mobility and internships, cooperative education⁶ (Bramwell and Wolfe, 2008), education targeted at managers and owners (Gordon and Jack, 2010), knowledge transfer activities such as collaboration on patents, teaching, publications, informal exchanges and contribution to spin-off formation (Landry et al., 2010), cooperation in curricula (Bramwell and Wolfe, 2008), research partnerships (Boardman and Ponomarev, 2009), informal interactions (Guerrero and Urbano, 2010) investment in infrastructure (Adams, 2009), involvement of business representatives in university board structures or vice versa etc. (Gibney, Copeland and Murie, 2009).
- **Institutional forms:** e.g. science parks, business incubators, spin-offs (sponsored or unsponsored)⁷ (Bathelt, Kogler and Munro (2010), innovation accelerators (Audretsch, Aldridge and Mark, 2011), high technology centers (Smilor, O'Donnell, Stein and Welborn, 2007) and technology transfer offices (Clarysse, Tartari and Salter, 2011), interdisciplinary centers and co-operation networks (Guerrero and Urbano, 2010).
- **Geographic spread:** e.g. can be concentrated in a unique physical location, as is the case with research parks, or can be spread over a larger area in the form of regional clusters (Breznitz et al, 2008). They can also take the form of virtual networks, as is the case with the Virtual Incubation Network launched by the Start-Up America initiative⁸.
- **Funding scale:** e.g. the University of Albany's College of Nanoscale Science and Engineering has a \$6bn investment from IBM, Tokyo Electron and SEMATECH, and a network of 250 industrial collaborators (Schultz, 2011).
- **Varying partnership strategy over time:** e.g. from a focus on managing knowledge and establishing strong links with well-established companies in the early years, to a focus on technology and infrastructure management, entrepreneurship and new start-ups, as the collaboration matures (Adams, 2009; Wonglimpiyarat, 2010).

⁶ Cooperative education is used to define programs where students complete a work term in industry as part of their curriculum (Bramwell and Wolfe, 2008: 1179). A case of cooperative education is presented in one of our case studies- the University of Waterloo.

⁷ A sponsored spin-off is the result of particular university research activities and they apply specific knowledge inputs to develop the initial technology core. Unsponsored spinoffs rely on decentralized idea development outside the university combined with generic knowledge in the development of innovative products.

⁸ National Association for Community College and Entrepreneurship, www.nacce.com/

- **Rationale:** such as regional development, which has been progressively integrated in the core mission of universities over the past decades (Goldstein, 2010), and for which universities have a variety of contributions, including commercializable knowledge and qualified research scientists, as well as generating and attracting talents and providing formal and informal technical support with local industry (Bramwell and Wolfe 2008).
- **Personal motivations for scientists.** This aspect refers particularly to the balance between a sense of intrinsic satisfaction and career rewards over financial rewards. UBC is encouraged by the ability to use alternative forms of currencies (like patents) as an alternative to publications to further an academic career given the growing influence of commercial science (Lam, 2010b).
- **Benefits,** such as:
 - Wealth creation for higher education institutions (HEIs) as well as for the wider economy. This is a major benefit, although it may have substantial variance by geographical location of the university and type of partner institutions. Higher wealth is generated in HEIs in more competitive regions, when institutions are “older”, and when university productivity is positively related to knowledge commercialization capabilities (Huggins and Johnston, 2009). Wealth creation for the wider economy takes the form of start-ups from graduates of entrepreneurship education (who are more likely to start businesses than faculty, according to Astebro, Bazzazian and Braguinsky, 2012), to graduate job creation in addition to job placements (Guerrero, Kirby and Urbano, 2011).
 - Social capital and social network creation: universities not only contribute to economic development by being a source of knowledge for companies, but they may also generate social capital and social networks through educational programs targeted at owners and managers (Gordon and Jack 2010).
 - Personal benefits for academics: the changing nature of the relationship between academia and industry leads to entrepreneurial academics to acquiring a pre-dominant position vis-à-vis traditional academics (Lam 2010).
 - Broadening students’ experience through entrepreneurship education, which allows students to “test the waters”, following the venture creation approach. Students explore real-life situations and entrepreneurial behaviors when creating new ventures, as is the case with the Chalmers School of Entrepreneurship (Ollila and Williams-Middleton, 2011). Going further, academic capitalism is not exclusively driven by profit-making considerations; conversely social entrepreneurship may underpin business-oriented students’ initiatives (Mars and Rhodes 2012).
- **Impact assessment** of UBC is usually measured in terms of the number of spin-offs, start-up businesses created (as well as their survival rate), patents and licenses obtained by

faculty, students, or staff. New ventures within institutions (intrapreneurship) may also be a measure of success (Guerrero, Kirby, David and Urbano, 2011).

- **Drivers and barriers for collaboration** – the literature presents an extensive list of drivers and barriers summarized in Tables 2 and 3 below.

Table 2 – Drivers of UBC

Author and date	Driver
Smilor et al., 2007	<ul style="list-style-type: none"> • Proactive approach to development (Research Park Triangle North Carolina); • Major event which mobilizes business, government and academia to work together (University of Texas Austin); • Research excellence and promotion of spinout companies and entrepreneurial start-ups (University of California San Diego); • Presence of a catalyst research university, organization and/or role model; • Visible, visionary and passionate leadership; • Active role of corporations; • A culture of innovation, as is developed in the Canadian Ryerson Digital Media Zone; • An increasing financial base; • Proactive policies and procedures; • Recognition of the time that development takes.
Guerrero and Urbano, 2010	<ul style="list-style-type: none"> • Formal environmental factors: an entrepreneurial and flexible organization and governance structure, support measures for entrepreneurship such as a Technology Transfer Office (which needs not only to be embedded in the university but also have various connections outside of the university organization), entrepreneurship education; • Formal internal factors: human, financial, physical and commercial resources, social relationships with institutions also positively influencing likelihood to set up businesses; • Informal factors: status, networks, location, attitude of the university community towards entrepreneurship;
Guerrero, Kirby and Urbano, 2011	<ul style="list-style-type: none"> • Strategically aligned rewards, clear rules for intellectual property ownership, minimal regulation of new venture creation, seed funding and science parks.
Schultz, 2011	<ul style="list-style-type: none"> • Academics with industrial experience.
Mars and Rhodes, 2012	<ul style="list-style-type: none"> • Existence of student entrepreneurship programs; • Formalized agreement with the Technology Transfer Office; • External funding, e.g. from granting bodies such as the Kaufman Foundation;
Clarysse, Tartari and Salter, 2011	<ul style="list-style-type: none"> • Individual level attributes, e.g. experience and opportunity recognition skills; • Entrepreneurial teaching methodologies, having role models and reward systems.
Huffman et al., 2002	<ul style="list-style-type: none"> • Location of the academic institutions relative to the agglomeration of scientific firms (e.g. the San Francisco Bay Area with Stanford University and UC Berkeley) because graduates are likely to settle close to their university of graduation due to their networks; • Ability to set out a long-term shared strategy between business and government.

Younghwan et al., 2012	<ul style="list-style-type: none"> • Synergy between university, government R&D and industrial R&D; • Positive role of tax incentives in low entrepreneurial regions; • Important role of funding from industrial sources, but university and government R&D expenditure also significant.
Adams, 2009	<ul style="list-style-type: none"> • Availability of funding. Limited funding may trigger an entrepreneurial attitude (e.g. the case of Stanford developing its entrepreneurial attitude during the 1940s and 1950s); • Type of funding is influenced by the public or private nature of universities: private universities are more likely to look for money from businesses.
Metcalfe, 2010	<ul style="list-style-type: none"> • Availability of public funding; e.g. Canada's shift from a system of block public subsidy to a system where public funds were used to strategically position Canadian institutions on the path toward increased revenue generation. (STEPS in Canada and the applied sciences and engineering campuses in New York City).
Breznitz et al., 2008	<ul style="list-style-type: none"> • Level of support and selectivity of the policies. High support and selective policies are more efficient in entrepreneurially underdeveloped environments (MIT Deshpande Center).
Philpott et al., 2011	<ul style="list-style-type: none"> • Nature of the scientific discipline: science & technology-based disciplines being a fruitful ground for UBC.
Boardman and Ponomarev, 2009	<ul style="list-style-type: none"> • Certain characteristics of traditional academic life: receiving industry grants or government grants, being affiliated to a university research center, having a high number of collaborators and students supported through grants, having tenure, and a diverse working environment.
Landri et al., 2010	<ul style="list-style-type: none"> • Certain academic activities, including contribution to spin-off formation, patenting and consulting are complementary between each other as well as between publishing and teaching.

Table 3 – Barriers to UBC

Author and date	Barrier
Guerrero, Kirby, and Urbano, 2011.	<ul style="list-style-type: none"> • Organizational structure and university governance; • Lack of funding and resources; • Too much reliance on state funding;
Phillpott, Dooley, O'Reilly and Lupton, 2011.	<ul style="list-style-type: none"> • Lack of entrepreneurial role model within the university; • Academic progression processes adversely affecting academics' entrepreneurial efforts; • Absence of a unified entrepreneurial culture across the institution; • Procedural barriers and institutional structures; • The unequal relevance of academic disciplines for UBC leading to disharmony in the university, rather than the unified spirit necessary for UBC; • A bottom-up governance style to implement UBC may reduce the potential of the academic community to take part in such cooperation. •
Rasmussen and Borch, 2010).	<ul style="list-style-type: none"> • Resources required to foster hard forms of UBC, such as academic spin-offs, require significant resources, hence business university cooperation may be limited to a few major universities.

Turk-Bicakci and Brint, 2005.	<ul style="list-style-type: none"> Costs of UBC may take five to ten years to be recovered for universities. Production of licensing output more costly to generate than research grants and contracts;
Goldstein, 2010.	<ul style="list-style-type: none"> Faculty's potential ambivalence towards a full-fledged entrepreneurial model of universities. Researchers have a stronger commitment to the norms of "open science" and "knowledge as a public good" than an emphasis on commercialization.

3 An overview of UBC in the US and Canada

Both in Canada and – particularly – in the US, the framework for UBC is a complex web of initiatives that span from the public to the private sector and from the federal to the state level, mediated by different organizations such as federal funding agencies, professional associations, and private foundations. This section provides an overview of the main initiatives that are currently implemented in the US and Canada at the federal level, while Annexes 5 and 6 provide an overview of key initiatives being developed at the state level.

3.1 US initiatives at the federal level

The basic framework for UBC in the US was provided in 1980 by the **Bayh-Dole Act**, which created a single framework for small businesses and non-for-profit organizations to retain rights over inventions made under federally-funded research programs. According to the Association of University Technology Managers (AUTM), six major provisions in the Act enabled a major change in the way universities interact with businesses and approach research commercialization. These are the provisions that (i) non-profits, including universities, and small businesses may elect to retain title to innovations developed under federally-funded research programs; (ii) universities are encouraged to collaborate with commercial concerns to promote the utilization of inventions arising from federal funding; (iii) universities are expected to file patents on inventions they elect to own; (iv) universities are expected to give licensing preference to small businesses; (v) the government retains a non-exclusive license to practice the patent throughout the world; and (vi) the government retains march-in rights⁹.

Since 1980 a number of initiatives led by the government and/or by private-sector organizations (including foundations and professional organizations) have created a very rich and diverse framework within which US universities and businesses interact. The remainder of this section provides an overview of the main initiatives at the federal level.

3.1.1 Recent government-led initiatives¹⁰

The **America Invents Act**, signed in 2011 by President Obama, is a strategy aimed to “help American entrepreneurs and businesses bring their inventions to market sooner, creating new businesses and

⁹ Association of University Technology Masters. http://www.autm.net/Bayh_Dole_Act1.htm. Last accessed 07/01/2013

¹⁰ For background on a wide range of older federal programs see Etzkowitz, Gulbrandsen and Levitt *Public Venture Capital* New York Harcourt, 2000 (2nd edition, 2001)

new jobs¹¹. A major breakthrough introduced by the Act is the provision of a reformed framework for patenting including: (i) a streamlining of the patenting process; (ii) a reduction of the patents backlog; (iii) a reduction of patent litigation; (iv) an improvement of patent quality; and (v) an increased ability for US inventors to protect their property rights abroad. The Act represents the cornerstone of a broader framework of initiatives aimed to “move ideas from lab to market¹²” that was launched in conjunction with the Act and that involves the private sector as well. Two initiatives are of particular relevance: (i) the commitment of over 100 universities to increase their entrepreneurial potential by establishing closer links with industry, in coordination with the Association of American Universities and the Association of Public and Land-grant Universities; and (ii) a prize competition to identify and promote best practices in the field of research commercialization supported by the Wallace H. Coulter Foundation, the National Science Foundation and the American Association for the Advancement of Science (AAAS).

Start-up America is a government-led initiative aimed to provide an umbrella under which innovators from academia and industry can work in a coordinated fashion with the government. Start-up America has five main objectives: (i) expanding access to capital for high-growth start-ups throughout the country; (ii) expanding entrepreneurship education and mentorship programs that empower more Americans to get and create jobs; (iii) strengthening commercialization of research outputs funded by federal R&D funds; (iv) identifying and remove unnecessary barriers to high-growth startups; and (v) expanding collaborations between large companies and startups¹³. The US Small Business Administration (SBA) is particularly involved in the initiative through financial contributions, including the \$1 billion Impact Investment Fund and the \$1 billion Early-Stage Innovation Fund.

The **Trade Adjustment Assistance Community College and Career Training (TAACCCT)** program was authorized in 2009 as part of the American Recovery and Reinvestment Act and funded in the amount of \$2 billion in 2010 under the Health Care and Education Reconciliation Act. TAACCCT aims to create a bridge between community colleges and the labor market by ensuring that the education and career training provided by community colleges matches the needs of employers. In this respect, it encourages – through grants – the establishment of partnerships between community colleges and local employers.

¹¹ The White House (Sept 16, 2011) “President Obama Signs America Invents Act, Overhauling the Patent System to Stimulate Economic Growth, and Announces New Steps to Help Entrepreneurs Create Jobs” <http://www.whitehouse.gov/the-press-office/2011/09/16/president-obama-signs-america-invents-act-overhauling-patent-system-stim>. Last accessed 09/01/2013

¹² The White House (Sept 16, 2011) “President Obama Signs America Invents Act, Overhauling the Patent System to Stimulate Economic Growth, and Announces New Steps to Help Entrepreneurs Create Jobs” <http://www.whitehouse.gov/the-press-office/2011/09/16/president-obama-signs-america-invents-act-overhauling-patent-system-stim>. Last accessed 09/01/2013

¹³ US Small Business Administration. “Start Up America: Empowering America’s Entrepreneurs” <http://www.sba.gov/startupamerica>. Last accessed 09/01/2013

Similar to the TAACCCT in its objectives, **Skills for America's Future** is a government-led effort to build "partnerships with industry, labor unions, community colleges and other training providers in all 50 states"¹⁴ with a view to developing the country's workforce through education. Skills for America's Future is being developed at an operational level with the commitment of leading private sector companies as diverse as Accenture, McDonald's, United Technologies, and PG&E to improve the skills of the workforce through various means, ranging from McDonald's commitment to expand the literacy of their employees to Accenture's collaboration with Universities and Community Colleges to increase students' participation in e-round tables (so-called "JobSTART101") that provide students with the basic toolkit of skills needed as they first enter the labor market.

The **Community College to Career Fund** also operates with the objective of creating successful transitions from education to work with heavy involvement from community colleges and businesses. This \$8 billion fund has four priorities: (i) developing community college partnerships to train skilled workers for available jobs, including support for training in sectors that are demanded by the employers and funding for internships for students; (ii) instituting "Pay for Performance" in job training, that is providing a financial reward to institutions that run programs with a proven ability to place students in quality jobs in the short-term following completion of the program; (iii) bringing jobs back to America, by providing grants that encourage companies to locate in the US; and (iv) training the next generation of entrepreneurs, including the development of online entrepreneurial education courses¹⁵.

The **Strategy for American Innovation**, launched under the Obama administration and building on the Recovery Act, is an overarching strategy aimed at fostering the country's innovation potential. It identifies three areas where government's involvement is deemed crucial to this end. These are: (i) investing in the building blocks of American innovation, e.g. R&D, human, physical, and technological capital; (ii) promoting competitive markets that spur productive entrepreneurship, by creating a national environment conducive to entrepreneurship; and (iii) catalyzing breakthroughs for national priorities, i.e. developing alternative energy sources, reducing costs and improving lives with health, IT and manufacturing advanced vehicles. In these industries where markets may fail on their own, government can be part of the solution¹⁶.

The **National Science Foundation** (NSF) is a federal agency operating since 1950 that promotes the advancement of research in most fields of science and engineering. NSF was funded with over \$7

¹⁴ The White House (October 4 2010), "President Obama to Announce Launch of Skills for America's Future" <http://www.whitehouse.gov/the-press-office/2010/10/04/president-obama-announce-launch-skills-america-s-future>. Last accessed 09/01/2013

¹⁵ The White House (February 13 2012), "FACT SHEET: A Blueprint to Train Two Million Workers for High-Demand Industries through a Community College to Career Fund" <http://www.whitehouse.gov/the-press-office/2012/02/13/fact-sheet-blueprint-train-two-million-workers-high-demand-industries-th>. Last accessed 09/01/2013

¹⁶ The White House, National Economic Council. (September 2009) "A Strategy for American Innovation: Driving Towards Sustainable Growth and Quality Jobs" <http://www.whitehouse.gov/administration/eop/nec/StrategyforAmericanInnovation>. Last accessed 09/01/2013

billion in the financial year 2012 and disbursed grants and cooperative agreements to over 2,000 institutions, including colleges, businesses, universities and other research organizations. NSF places a particular emphasis on promoting collaborative research ventures to ensure that academia, industry and government work together to exchange ideas and personnel across the three spheres.

3.1.2 Non-governmental initiatives

The **Startup America Partnership** runs in parallel to the government-led Startup America (described above). The Startup America Partnership is an independent, private-sector coalition of major corporations, advisors, funders, service providers and mentors working to dramatically increase the prevalence and success of American entrepreneurs. The Startup America Partnership is focused on bringing the private sector together to maximize the success of American entrepreneurs and the competitiveness of the United States in an increasingly global world. Through resources provided by its partners, the Startup America Partnership plans to help startups grow their organizations, expanding from dozens of employees to hundreds and someday thousands to become high-growth firms (called 'speed-ups'). While the Startup America Partnership is national in scope, it also recognizes that building up regional entrepreneurial ecosystems will help spur the creation of more startups and speedups. The Startup America Partnership attempts to highlight best practices, and convene leaders in different regions and sectors, with the goal of creating hyper-growth ecosystems around the nation.

The **National Association for Community College Entrepreneurship (NACCE)** fosters economic development by acting as a forum for the dissemination and integration of knowledge and successful practices regarding entrepreneurship education and student business incubation. NACCE aims to nurture economic vitality at the local and national level by supporting and advancing entrepreneurship education and entrepreneurial leadership at the community college level. NACCE provides membership to community colleges across the United States, through which it helps them link their traditional role of workforce development with entrepreneurial development; it organizes annual conference, symposiums and a quarterly journal, among other services, to allow members to share information about entrepreneurship education. The NACCE is also involved in wider UBC frameworks, such as the Startup America and the Startup America Partnership. Within the Startup America Partnership, NACCE is involved through the **Virtual Incubation Network**, which is a pilot program aimed to foster new business creation through a network of virtual incubators that will be established at community colleges in 11 states.

The **Council on Competitiveness** is a non-governmental organization that brings together CEOs, university presidents, and labor leaders to meet the challenges of competitiveness posed by

globalization. Several specific initiatives are promoted by the Council on Competitiveness in the field of UBC. These include:

- The Technology Leadership and Strategy Initiative (TLSI) brings together a network of chief technology officers from industry, academia and government in an effort to contribute to the development of American innovation discourse and strengthen American technological leadership. TLSI forms a collaborative environment that tries to understand and contribute to changes, challenges and opportunities facing the technology sector of the United States. It engages with these issues by defining investment drivers and strategy at the core of innovation capacity, establishing cooperation between public and private stakeholders to optimize investments and identifying critical policy direction to sustain long-term innovation.
- The Global Innovation Initiative (GII) strengthens global collaboration with critical U.S. partners to build business environments that support innovation at home and abroad, with the main goal of understanding, analyzing and benchmarking the new dynamics of competitiveness in the global economy. The GII acts to encourage mutually beneficial investments in new ideas, inventions and services that generate higher returns for workers, companies and economies, as well as working to facilitate dialogue, summits and partnerships with key trading partners, such as Brazil, China, Mexico, Japan and the European Union, to focus on collaborative paths to build competitiveness.
- The National Innovation Initiative (NII) is an effort to engage leaders across the United States with the goal of optimizing society for a future in which innovation will be a salient factor in shaping prosperity. The NII organizes working group sessions, roundtables and regional summits to shape a private-sector driven innovation agenda.
- The Regional Innovation Initiative (RII) aims to create new knowledge through applied research across U.S. regions, while communicating this new model to leaders across various sectors and assisting regions in implementing economic and workforce development strategies. Through its activities, the RII hopes to promote awareness across federal, state and local stakeholders of the necessary conditions for innovation, encourage policy-makers to support regional development and provide regions with the tools and techniques to develop their innovation capacity. The effects of its efforts can be seen in its foundational innovation project, the Clusters of Innovation Initiative, which encouraged federal, state and local governments to enact pro-innovation policies and private-sector leaders to implement innovation-based economic development strategies.

The **Business Higher Education Forum** (BHEF) is an organization of senior business and higher education executives that are working to advance innovative solutions to US education and workforce challenges. It is composed of CEOs, college and university presidents, and other leaders, and it aims to address issues fundamental to global competitiveness. One of BHEF's main initiatives to foster UBC

is the **College Readiness, Access, and Success Initiative** (CRI) which brings business and higher education together to promote college readiness, access and degree completion, as well as successful entry into the workforce. In response to the inter-relation of these challenges, CRI takes a comprehensive, systemic approach to addressing them in the elementary-through-graduate school education pipeline. CRI harnesses the influence and resources of BHEF and its membership to: (i) address critical issues in the elementary-through-graduate school education pipeline, especially for underserved populations; (ii) identify practical solutions and strategies that support systemic change; (iii) increase the alignment of higher education with high-demand jobs; (iv) ensure that graduates possess the necessary competencies to meet workforce needs; and (v) create a platform for local/state member-led partnerships to develop strategic approaches, implement them, and disseminate lessons learned.

The **Association of University Technology Managers** (AUTM) aims to support and advance academic technology transfer globally. It serves primarily as a forum for dialogue and exchange of best practices and it offers several tools in this respect, such as educational opportunities, meetings and networking. Specific activities run by AUTM include: (i) Special Interest Groups (SIG) which is a network with members sharing a common area of interest within the technology transfer field; (ii) the AUTM Technology Transfer Practice Manual which is a free access four-volume of successful practices with sample policies and agreements; (iii) the Global Technology Portal where available technologies, success stories are made public; (iv) the Better World Report, where members can submit their technology transfer success stories for the chance to be featured on the Better World Project website; (v) finally, AUTM provides access to more than 20 years of statistical data with AUTM's web-based research tool Statistics Analysis for Technology Transfer (STATT).

100Kin10 is an educational initiative launched in 2001 under President Clinton administration which identifies in the developing excellence in the fields of science, technology, engineering and math (STEM) a main driver for a vibrant economy. To this end, 100Kin10 has the objective to hire, develop and retain 100,000 teachers in STEM between 2011 and 2021. Funded through the financial commitments of several foundations, the initiative brings together "corporations, school districts, museums, institutes of higher education, foundations, federal agencies, professional associations, states, and nonprofit organizations"¹⁷ that all have a commitment to contributing to the improvement of the US's STEM performance.

The **National Business Incubation Association** (NBIA) aims to promote business incubation and entrepreneurship by providing information sessions, education and networking services to professionals who are in the early-stage development of their companies. It is governed by an elected

¹⁷ 100Kin10. <http://www.100kin10.org/page/aboutus>. Last accessed 07/01/2013

board of business incubators and while being based in the US, the association has an international outreach with over 60 countries represented across its 1,900 members. The specific services offered by the NBIA include: (i) organizing conferences and specialized training; (ii) conducting research and compiling statistics on the incubation industry; (iii) producing publications that describe practical approaches to business incubation; and (iv) consulting governments and corporations on incubator development¹⁸.

The Government-University-Industry Research Roundtable (GUIRR) was established in 1984 following the National Commission Research call for a forum where representatives from government, industry and academia could discuss issues of mutual interest. GUIRR promotes three plenary meetings per year but member working groups carry out their activities throughout the year. GUIRR also sponsors other initiatives aimed at enhancing dialogue and cooperation across the institutional spheres of university and industry. An example of a GUIRR-sponsored initiative is the **University-Industry Demonstration Partnership (UIDP)**, an organization that includes companies and universities that come together to discuss issues of mutual interests, such as “operational and strategic issues such as contracting, intellectual property, and compliance matters”¹⁹. UIDP provides a forum for leaders from the two spheres and organizes a series of events – e.g. webinars – in cooperation with other organizations that share similar objectives, such as the **National Council of Entrepreneurial Tech Transfer (NCET2)**.

The **Kauffman Foundation** is a leading private institution promoting the entrepreneurial potential of the US. A closer look at the activities of the Foundation is provided through two case studies: primarily through the case study analyzing the relationship between the University of Missouri-Kansas City and the Kauffman Foundation and, secondarily, through the case study StartX at Stanford. Please refer to section 4 of the report and to the relevant annexes containing the full case studies.

In addition to these federal initiatives, a large proportion of UBC occurs at the state-level, as education is a state responsibility. Annex 5 provides an overview of the main initiatives undertaken in each of the US states.

3.2 Canadian initiatives at the federal level

At the federal level, several initiatives have been undertaken in Canada to enhance UBC. As noted in Bramwell et al. (2012), Canadian granting councils have developed a series of programs particularly targeted at increasing cooperation between academia and industry. These programs focus mainly on

¹⁸ National Business Incubation Association (NBIA) http://www.nbia.org/about_nbia/. Last accessed 07/01/2013

¹⁹ <http://sites.nationalacademies.org/pqa/uidp/index.htm>. Last accessed 08/01/2013

collaborative research, enabled through grants to form research partnerships or to allow the temporary exchange of personnel between industry and academia.

3.2.1 Government-led initiatives

The **National Science and Engineering Council (NSERC)** has been active since 1978 as a departmental corporation of the Government of Canada. NSERC's overarching objective is "to make investments in people, discovery and innovation to increase Canada's scientific and technological capabilities for the benefit of all Canadians"²⁰ and it has invested "over \$7 billion in basic research, projects involving partnerships between postsecondary institutions and industry, and the training of Canada's next generation of scientists and engineers"²¹. The NSERC disburses \$310 million annually, which covers the training of 10,000 students and a portfolio of 2,000 projects between industry and academia, including scholarships, grants, Industrial Chairs and network funding. NSERC attracts \$140 million in cash and in-kind contributions from industry. Specific programs and initiatives to foster UBC include:

- Strategy for Partnerships and Innovation (SPI): the SPI was the product of a consultation with government, industry and post-secondary institutions, and was "...designed to realize more value from the government's investment in postsecondary research by increasing the impact, scale and scope of NSERC's activities targeted at developing and supporting industry-academic partnerships"²². In particular, the Strategy highlights the need to break down cultural barriers between academia and industry by increasing knowledge of each other's motivations, and seconds the need to provide opportunities for new university-industry research partnerships. The SPI's first recommendations were that NSERC create opportunities for researchers and higher education institutions to demonstrate their capabilities to companies, on the one hand, and to increase awareness in industry about the benefits of collaborating with academia on the other. A third approach was to create fora for both types of organizations to meet and identify research challenges. The SPI also makes recommendations for actions which lie beyond the scope of NSERC's activities – principally, for other government agencies.
- Industrial Research Chairs (IRCs): the NSERC offers three types of IRCs: Senior IRCs (for senior researchers), Associate IRCs (for early-stage researchers) and Executive IRCs for R&D professionals. The IRC grant provides Chair holder salaries, as well as research tools and instruments and general expenses for the Chair's program of research, on a five-year basis. They are jointly funded by NSERC and industry, with a requirement that the industrial

²⁰ Natural Sciences and Engineering Research Council for Canada. "NSERC's Vision" http://www.nserc-crsng.gc.ca/NSERC-CRSNG/vision-vision_eng.asp Last accessed 10/12/2012

²¹ Natural Sciences and Engineering Research Council for Canada. "NSERC's Vision" http://www.nserc-crsng.gc.ca/NSERC-CRSNG/vision-vision_eng.asp Last accessed 10/12/2012

²² Natural Sciences and Engineering Research Council for Canada. (2009) *Strategy for Partnerships in Innovation* http://www.nsercpartnerships.ca/docs/SPI_e.pdf Last accessed 10/12/2012

cash commitment is at least equal to NSERC's commitment during the same period. Where small businesses are participating, or where an industrial sector is emerging, the NSERC may leverage "cash equivalent" in-kind contributions. The support must be deemed essential to the project. Universities are required to establish tenured, tenure-track or non-tenured term appointments along with laboratory and office space with administrative support. Financial contributions from the university are not necessary, though they strengthen requests for support. IRCs are intended to: (i) assist universities in building on existing strengths to achieve the critical mass required for major research endeavors in science and engineering that are of interest to industry; (ii) and/or assist in the development of research efforts in fields that have not yet been developed in Canadian universities but for which there is an important industrial need; (iii) and provide an enhanced training environment for graduate students and, where appropriate, postdoctoral fellows by exposing them to research challenges unique to industry and the opportunity for significant on-going interactions with the industrial partner(s).²³ As the IRC is based in a university, this policy is aimed primarily at universities. However, the industry participants must demonstrate the ability to collaborate with university researchers that "would provide industrially relevant training opportunities for the students and that would lead to the exploitation of research results in Canada"²⁴.

- Industrial Postgraduate Scholarships: the Industrial Postgraduate Scholarships are aimed at highly qualified engineering and science graduates. The intention is that recipients gain research experience in industry while undertaking advanced studies in Canada. There are a range of different modes of support, varying in duration and requirements. The amount is \$15,000 per year for up to three years plus a minimum contribution from the sponsoring organization of \$6,000 per year.

The **Social Sciences and Humanities Research Council (SSHRC)**, established in 1977, is a federal agency which "promotes and supports postsecondary-based research and training in the humanities and social sciences". The research they support is intended to enhance "our understanding of modern social, cultural, technological, environmental, economic and wellness issues". In the UBC domain, SSHRC runs the program "Partnerships for success". This program offers three types of grants:

- Partnership Development Grants: from \$75,000 - \$200,000 over one to three years for new partnerships. Businesses provide cash or in-kind contributions;
- Partnership Grants: from \$500,000 to \$2.5 million over four to seven years. Business and other partners support these with cash or in-kind contributions. The Canada Foundation for Innovation may also support the project by financing infrastructure costs. These grants are

²³ Natural Sciences and Engineering Research Council for Canada. "Professors" http://www.nserc-crsng.gc.ca/Professors-Professeurs/CFS-PCP/IRC-PCI_eng.asp. Last accessed 08/01/2013

²⁴ Natural Sciences and Engineering Research Council for Canada. "Professors" http://www.nserc-crsng.gc.ca/Professors-Professeurs/CFS-PCP/IRC-PCI_eng.asp. Last accessed 08/01/2013.

similar in many respects: both can be used to fund either existing or new research, and neither have restrictions on whether leadership for the partnership must come from the research community, or public/private/Not-for-Profit sectors. Given the larger scale of the Partnership Grant, more activities are encouraged (not stipulated), including the establishment of partnered research centers and partnered research training initiatives;

- Connection Grants: from \$7,000 to \$50,000 to support events, and disseminate research findings. The Partnerships for Success initiative is aimed at businesses, with a view to assisting them in finding researchers using the SSHRC's awards search engine. The Partnerships for Success initiative is one of three streams of SSHRC-funded partnerships. "Community Partners" provides funding to encourage collaboration between not-for-profit organizations and researchers. "Joint Initiatives" is a resource pooling mechanism for collaboration between research, and related activities with, among others, government departments²⁵.

The **Canadian Institutes of Health Research (CIHR)** is the Government of Canada's health research investment agency. The overarching mission of the CIHR is to "create new scientific knowledge and to enable its translation into improved health, more effective health services and products, and a strengthened Canadian health care system." The CIHR is made up of 13 institutes, and has provided support for 14,100 health researchers and trainees across Canada. In the field of UBC, CIHR also promotes grants that can be used for collaborative research, such as the **Industry-Partnered Collaborative Research Operating Grant (IPCR)**. The IPCR is designed to fund collaborative research projects involving academics and Canadian industry partners. The maximum amount for a grant is \$250,000 per year for up to five years. The logic behind the grant is that there is much unused intellectual property, developed by academics, which may never be commercialized, unless further research and development activities occur – funding for which may traditionally be unavailable. The grant is designed to fill part of this funding gap. The academic researcher in a partnership is responsible for applying for the grant. Candidates for research projects must incorporate an "integrated knowledge translation" (KT) approach to their grant proposals. "Integrated KT describes a different way of doing research with researchers and knowledge users working together to shape the research process".

The **Canada Foundation for Innovation (CFI)** was established in 1997 by the Government of Canada with the overall objective to "build Canada's capacity to undertake world-class research and technology development to benefit Canadians". CFI funds research infrastructure on the basis that 'state-of-the-art infrastructure allows researchers to push the boundaries of knowledge, explore the

²⁵ Social Sciences and Humanities Research Council for Canada. "Partnerships" http://www.sshrc-crsh.gc.ca/about-au_sujet/partnerships-partenariats/index-eng.aspx. Last accessed 08/01/2013

unknown and generate exciting outcomes that benefit humankind". The **College-Industry Innovation Fund** is the flagship initiative promoted by CFI. It is a fund primarily directed at enhancing the capacity of colleges to perform large scale, technical collaborative projects with private partners. The fund's total size is \$25 million, divided into two streams: \$20 million for Research infrastructure grants and \$5 million for "research infrastructure associated with a Five-Year College and Community Innovation (CCI) Innovation Enhancement (IE) grants". The latter is provided in partnership with NSERC (above). CFI covers the cost of 40 per cent of a project. Private sector partners are expected by CFI to be "actively engaged throughout the life of the research infrastructure project, including the application stage." CFI encourages proposals which 'stimulate competitive college-industry applied research and technology development partnerships that lead to business innovation'. The priority is enhancing the college's capacity, building on existing applied research capacity within the college. An additional goal is to develop the networks of researchers, to encourage more collaborative projects with the private sector.

3.2.2 Cross-agency collaboration to facilitate research-driven innovation

The **Network of Centers of Excellence (NCE)** is a joint initiative of the NSERC, the SSHRC and the CIHR, and in partnership with Industry Canada and Health Canada, running two UBC programs:

- **Centers of Excellence for Commercialization and Research (CECR):** "A CECR is a not-for-profit corporation created by a university, college, not-for-profit research organization, firm or other interested non-government party that matches clusters of research expertise with the business community". These corporations must have an established Board of Directors in order to be eligible. The objective is to see new technologies being brought to market faster, with new commercialization activities that "would likely have never taken place without the CECR program", and further to "create internationally recognized centers of excellence in research and commercialization in the areas of priority for the Government of Canada to deliver economic, social, health and environmental benefits to Canadians." The program invests \$30 million/year, to cover costs which are not eligible for funding from other federal research funds. There is a matching requirement, which can include funds from foreign direct investment and venture capital.
- **Business-Led Networks of Centers of Excellence (BL-NCE):** the program is designed to support academic and private-sector partners equitably, and unlike many such programs allow research to be conducted in private sector organizations' facilities. Networks must partner as not-for-profit organizations. Priority research areas: (i) environmental science and technology; (ii) natural resources and energy; (iii) health and life sciences and technology; (iv) information and communications technologies; and (v) management, business or finance. The funds cover up to 75% of the networking, commercialization, administration and

outreach expenses, and up to 50% of the eligible direct costs of research activities (salaries, intellectual property protection, equipment, travel and equipment).

The **College and Community Innovation Program** is a NSERC-funded program developed in cooperation with CIHR and SSHRC. The objective of this program is to “increase innovation at the community and/or regional level by enabling Canadian colleges to increase their capacity to work with local companies, particularly small and medium-sized enterprises (SMEs). It supports applied research and collaborations that facilitate commercialization, as well as technology transfer, adaptation and adoption of new technologies.” Under the program there are different types of grants aimed at advancing research in five priority areas, namely: (i) environmental science and technologies; (ii) natural resources and energy; (iii) health and related life sciences and technologies; (iv) information and communications technologies; and (v) other areas of research that will advance the principles and goals of the Government of Canada's science and technology (S&T) strategy, *Mobilizing Science and Technology to Canada's Advantage*. As the grant program focuses first and foremost on colleges, the college is responsible for hosting the activities, providing administrative support and reporting. The program makes stipulations about the sharing of intellectual property, in order that eventual benefits are shared, and colleges are able to use research for future teaching and research.

Automotive Partnership Canada (APC) will disburse \$145 million in research funds over five years, as a partnership between five federal research and granting agencies: Natural Sciences and Engineering Research Council of Canada (NSERC); National Research Council (NRC); Canada Foundation for Innovation (CFI); Social Sciences and Humanities Research Council of Canada (SSHRC); Canada Excellence Research Chairs (CERC). The duration of funded projects ranges from six months to five years, with no stipulations for minimum or maximum financial contributions. Industrial partners must promise to be “transformational”, fulfilling at least one of three conditions: (i) research results must be used by “people who can turn these results into commercial products and services”; (ii) industrial partners “must include more than one member within the automotive supply chain”; (iii) the research must have “a profound and disruptive impact” on the industrial partner's business and the automotive industry in Canada (as judged by the industrial partner). While the majority of the research priority areas relate to technical aspects of automotive and their production, new streams have been added relating to social sciences and humanities, provided the proposed research maintains and enhances the competitiveness of the automotive sector.

The **Industrial Research Assistance Program** (IRAP), part of the National Research Council of Canada, offers a range of services designed to help firms develop and commercialize technologies. These include: (i) technical and business advisory services; (ii) financial assistance; (iii) networking and linkage services; and (iv) youth employment program. Of particular relevance are (iii) and (iv). The

Networking and Linkage Services is a network for use by small and medium sized enterprises to connect with local sources of financing, research and development institutions, technology brokers and technology transfer centers. The IRAP network includes universities and colleges (in addition to regional development agencies and other government departments, potential financing groups, service providers and industry associations). The IRAP provides “industrial technology advisors”, based in various communities, with a toll-free number. The Youth Employment Strategy is designed to assist employers in hiring young (aged 15-30) Canadians, by providing financial assistance to innovative small and medium-sized enterprises. The funds are used to hire post-secondary school science, engineering, technology, business and liberal arts graduates, with a view to them working on innovative projects, participating in research and contributing to the commercialization of technologies.

3.2.3 Non-governmental initiatives

The **Canadian Council for Small Business & Entrepreneurship** (CCSBE) is the only Canadian organization “whose goals are to promote and advance the development of small business and entrepreneurship through research, education and training, networking and dissemination of scholarly & policy-oriented information²⁶. The organization brings together leaders from the industry and the academia, runs activities such as conferences, and deploys a variety of knowledge sharing tools in the field of entrepreneurship, such as newsletters and “knowledge links”.

4 Analysis of case studies

This section provides an analytical assessment of the 15 case studies that were undertaken during the project. The main patterns and trends that emerge from the case studies are discerned and assessed. It is upon this analysis that we ground our conclusions and policy recommendations that follow at in section 5. The case studies have been selected with the explicit aim to capture a variety of interactions between universities and businesses in terms of size and scope of the cooperation, type of cooperation, as well as type of institution within which the cooperation takes place.

The analysis of such a diverse landscape returned a very rich and challenging picture. The information has been systematized along two main dimensions:

1. A **geographical dimension** looks at the case studies according to their location, i.e. US and Canada.
2. A **thematic dimension** categorizes the findings according to six main headings, as follows:

²⁶ Canadian Council for Small Business and Entrepreneurship. <http://www.ccsbe.org/index.asp>. Last accessed 10/01/2013

- The **nature** of UBC, including its historical origins, the stakeholders involved and the financial resources backing the cooperation;
- The **motivations** for UBC, outlining the strategic choices and rationale for establishing the cooperation;
- The **forms** that UBC takes;
- The **objectives** that UBC pursues and the **benefits** derived from it;
- The **drivers** and **barriers** that have stimulated or hindered the cooperation;
- And finally, the **impact** of the cooperation.

4.1 Introduction of the case studies and rationale for their selection

Our analysis of UBC in the US and Canada is based on ten US and five Canada case studies, which are briefly presented in Boxes 1 and 2 below, respectively.

Box 1 - An overview of US case studies

MIT's entrepreneurial ecosystem

MIT's entrepreneurial system is exemplified by six programs and centers. Three of them, the Martin Trust Center for MIT Entrepreneurship, the Deshpande Center for Technological Innovation and the MIT Technology Licensing Office, are discussed in this study, while the other three, the Legatum Center, the Lemelson-MIT and the Venture Mentoring Service are only briefly mentioned. The mission of the Martin Trust Center for MIT Entrepreneurship is to foster, develop and coordinate MIT's entrepreneurial activities and interests and develop future entrepreneurs through education and research and strategic business and technology partnerships. The Center also works to create a network that unifies academic, government, and industry leaders around the vision of entrepreneurial success. The Deshpande Center's mission is to move technology and inventions from the labs at MIT to the marketplace, by promoting the earliest stages of technology development with grant funding, connecting MIT's inventors with the business community (particularly in New England) and tying MIT's technological research into market needs. The MIT Technology Licensing Office's mission is to foster commercial investment in the development of inventions and discoveries flowing from the research at the MIT and Lincoln Laboratory (a federally funded research and development center that applies advanced technology to problems of national security), through licensing of the intellectual property resulting from the research.

Center for Advanced Ceramic Technology (CACT) at Alfred University

This is one of New York State's 15 Centers for Advanced Technology (CATs), which facilitates collaboration between industry and academia with the goal of creating economic impact for the CACT's industrial partners. In particular, it promotes the internationally recognized expertise of Alfred University's faculty in advanced technical ceramics and glass, for application in energy, the environment, health care, defense, etc. The CACT is highly flexible and works with companies of all sizes, from one person start-ups to multi-national corporations, on a variety of projects ranging from short-term analytical testing to multi-year sponsored research contracts. It leverages funding that it receives annually from New York State and funding that it receives from its industrial partners to equip its laboratories with state-of-the-art equipment and to further its faculty members' research agendas. Over the last five years, on an investment of \$5 million, CACT and its partners have returned around \$458 million in economic impact numbers.

Fashion Institute of Technology's School of Graduate Studies and the Jay & Patty Baker School of Business and Technology

The Fashion Institute of Technology (FIT) prepares students for professional careers in design, fashion, and business. The School of Graduate Studies is a vital and growing part of FIT's rich educational mix and provides advanced professional education in disciplines closely tied to the college's mission, promoting excellence in the post baccalaureate study of business, art, and design. It advances research in the creative industries and fosters collaboration between leading professionals, faculty and students. The Jay and Patty Baker School of Business and Technology serves nearly 4,000 students in 10 different majors with a focus on business in fashion and related professions. Both FIT *School for Graduate Studies* and the *Jay and Patty Baker School of Business and Technology* participate in virtually every type of university-business partnership included in the list of typologies developed for this study. The Schools integrate entrepreneurship education into all of their programs and courses, and involve industry executives as professors, mentors and advisors. FIT faculty members conduct joint research with industry and carry out consultancies. Many students are working while studying and bring knowledge back and forth between the industrial and educational sectors, other students in both the *School for Graduate Studies* and the *School of Business and Technology* make use of the vast internship possibilities offered by the New York fashion industry and arts community and others have the opportunity to meet with industry professionals in their course work and/or in seminars held around the world.

Center for Innovation and Entrepreneurship at West Virginia University

Located in the College of Business and Economics of West Virginia University (WVU), the Center for Innovation and Entrepreneurship was founded by the joint efforts of the WVU College of Business & Economics, Davis College of Agriculture, Forestry and Consumer Sciences, WVU Extension Service, and the Office of the Vice President for Research & Economic Development. The Center carries out activities mainly in the areas of entrepreneurship education and promotion, mobility/placements of students, staff mobility, knowledge sharing and transfer and applied innovation. It has developed an 18-credit entrepreneurship minor for students in other degree programs and university colleges outside of the College of Business & Economics, to give them a strong grounding in business without getting a business degree. It also developed an internship program, and a statewide student business plan competition; it conducts research, sponsors the Entrepreneurship Club, and hosts events for National Entrepreneurship Week.

University of Missouri-Kansas City and the Kauffman Foundation (UMKC-KF)

The Kauffman Foundation, established in the mid-1960s by the late entrepreneur and philanthropist Ewing Marion Kauffman with an endowment of approximately \$2 billion, is based in Kansas City,

Missouri and is the largest American foundation to focus on entrepreneurship. Its mission is to help individuals attain economic independence by advancing educational achievement and entrepreneurial success by providing grants to external groups and by operating an in-house research and policy analysis unit to promote its vision of entrepreneurship and technology transfer. The Foundation views its main remit as national, but also views itself as a good citizen of Kansas City and approaches the Kansas City region “as a program incubator where feasible, in which new approaches can be tried and tested before being disseminated nationally” and to “partner with others to leverage our resources and capabilities while avoiding the creation of dependency”²⁷. UMKC is a regional public university that has been part of the University of Missouri System since 1963. Before joining the University of Missouri System, the school was originally the University of Kansas City, a private institution, which was chartered in 1929 and began classes in 1933, but fell into financial difficulties and had to be rescued through inclusion in the state university system. The collaboration between Kauffman Foundation and the University of Missouri-Kansas City (UMKC) shows how a non-elite university can take advantage of a local center of excellence to build an education and research program and thereby achieve distinction. UMKC has gained considerable resources from the Foundation and built up programs that have made it credible in the academic entrepreneurship space. The Foundation is a bridge for UMKC to engage with the commercial world and it helps stimulate intellectual exchanges between businesses and UMKC.

University of Utah’s entrepreneurial ecosystem

University of Utah (UU) ranked no. 1 in the US in starting companies based on university research for three consecutive years – 2009, 2010 and 2011, according to the annual surveys of the Association of University Technology Managers (AUTM). This designation places the UU ahead of technology powerhouses like MIT, Columbia, CalTech and Johns Hopkins. Since the 1970 launch of its first start-up, more than 200 research-based start-ups were founded at the UU, 125 in the past seven years. The main UU actors in technology commercialization, partnerships with the community, student innovation and entrepreneurship education are the Technology Venture Development Office (“Tech Ventures”) and its departments, the Technology Commercialization Office, which manages the university’s intellectual property, and the Pierre Lassonde Entrepreneur Center, which provides business and entrepreneurship education to students and young entrepreneurs. Other actors are the David Eccles School of Business, which provides a complete range of business education with a strong emphasis on technology, innovation, commercialization and entrepreneurship, and some of the Schools’ Knowledge Centers, like the Bureau for Economic and Business Research and the Sorensen Center for Discovery and Innovation. Tech Ventures also works with the School’s University Venture Fund and its affiliate, the University Impact Fund. The primary focus is on Tech Ventures and its departments,

²⁷ Ewing Marion Kauffman Foundation, “Vision, Mission & Approach” <http://www.kauffman.org/about-foundation/vision-mission-and-approach.aspx>. Last accessed 09/01/2013

but some activities performed in the other organizations mentioned above are also presented, in order to highlight the breadth of UU's overall entrepreneurial ecosystem.

Silicon Flatirons Center for Law, Technology and Entrepreneurship at Colorado University Law School (SFC)

Silicon Flatirons Center for Law, Technology and Entrepreneurship is an interdisciplinary research center focused on analyzing the changing dynamics in the telecommunications industry and regulatory environment, and preparing students for leadership and entrepreneurial careers. SFC has earned national prominence for its research, publications and leading conferences that debate legal and policy issues, foster practical solutions and innovative ideas, facilitate networking and produce scholarship. SFC serves as a source for new ideas, a forum for discussions and research, as well as a valuable campus platform for the technology community. SFC is one of Colorado University (CU)'s "confederated centers of entrepreneurship" that work in synergy to realize the university policy goal of turning the CU into a leading entrepreneurial university: the Deming Center for Entrepreneurship, the Management and Entrepreneurship Division and the Center for Education on Social Responsibility (CESR) in the Leeds Business School, the Entrepreneurship Center for Music, the campus-wide Alliance for Technology, Learning and Society (ATLAS), the College of Engineering and Applied Sciences with its Engineering Entrepreneurship Program (E-ship), the CU Technology Transfer Office and the Center for Space Entrepreneurship (eSpace).

StartX at Stanford University

StartX is a non-profit student-led organization whose mission is to accelerate the development of Stanford's top entrepreneurs through experiential education and collective intelligence. As a partner of many Stanford programs and the Stanford student government, StartX represents and aims to support all Stanford founders from undergrads to PhDs, postdocs and professors in any discipline. The start-up accelerator run by StartX provides access to an organized community of the best Stanford founders, serial entrepreneur mentors, real time and individualized education, and resources that start-up founders need to accelerate the growth of their companies. In less than two years since inception, StartX has received applications from over 2,000 Stanford founders comprising 900+ companies, of which 170 founders and 60 companies went through the program. The Kauffman Foundation gave StartX an \$800,000 grant in August 2012 to support the operation of the program, to provide resources to document and to develop StartX's curriculum, in addition to helping identify a model for replication. StartX benefits from a range of partners, from Google to Microsoft and AOL. Filling a gap in a support structure for spin-off activity in an already highly productive innovation system produced a significant increase in firm-formation at Stanford University. The StartX phenomenon demonstrates that the world's leading entrepreneurial university located in the world's most productive innovation region has been operating below its potential and is amenable to improvement. The broader significance of this

case is that it is a targeted intervention, based on research into strengths and weaknesses of an academic innovation system and its context.

Cogswell Polytechnical College

Located in Sunnyvale, California in the heart of the Silicon Valley, Cogswell Polytechnical College is an accredited four-year private not-for-profit higher education institution with a curriculum that fuses art, engineering and entrepreneurship. It is one of the Bay Area's premier colleges, which integrates teaching and collaboration with industry in a novel academic approach. Teaching and learning are collaborative and project-based, using multidisciplinary teams to take projects from concept through delivery, emulating the collaborative, cross-discipline industry environment and bringing together talented teams of artists, audio engineers and programmers to create finished games and animated short features. Cogswell offers a BA degree in Digital Arts & Animation or Entrepreneurship & Innovation, a BS degree in Digital Arts Engineering, Digital Audio Technology, Computer Engineering or Software Engineering, and an MA degree in Entrepreneurship & Innovation (since October 2012). This combination of digital arts, engineering, technology and entrepreneurship along with a broad general education provides a solid foundation for Cogswell's students to move quickly into global digital media industries, as well as into other related professions (over 90% student employability in the last 10 years). The College is a very small higher education institution, with a large majority of local students.

Oregon Shakespeare Festival (OSF) and Southern Oregon University (SOU)

The Oregon Shakespeare Festival (OSF) is a theatre festival, emanating as a spinoff from the teaching mission of a local institution of higher education that combines public entertainment with dissemination of scholarship on the Elizabethan era. Started in 1935 by Angus Bowmer, an instructor at Southern Oregon Normal School, now Southern Oregon University (SOU), OSF has transformed its town, Ashland, from a small town based on resource extraction to an arts, theatre and tourism destination that is the core of an arts and humanities cluster. Beyond its social and economic impact, OSF has also spurred the academic development of SOU, allowing a relatively small school to "punch above its weight" in the theatre studies academic arena.

Box 2 - An overview of Canada case studies

University of Waterloo and Co-op Education

The University of Waterloo is a research university located in Waterloo, Ontario, founded in the mid-1950s. It has a particular focus on mathematics, engineering and computer sciences, and is well-known in Canada for its adoption of co-operative (co-op) education, where students alternate between spells in the classroom and time spent working in industry. The choice of this particular design led the University of Waterloo, originally an affiliate of the University of Western Ontario, to become an

independent, degree-granting institution in 1957. Co-op programs at the University of Waterloo include 17,000 of its 28,000 students, and 4500 businesses cooperate in 120 co-op programs. The programs typically spread over five years and include eight semesters of academic work and six work terms. Work terms are arranged through the office of co-operative education (OCE), which has 140 employees.

University of British Columbia University-Industry Liaison Office

The University of British Columbia (UBC) is a major research university located in Vancouver, Canada. Founded in 1906, it has always been considered the main university of the British Columbia province (until the mid-1960s, the University of British Columbia was the province's only university). The University of British Columbia was among the earliest Canadian adopters of the American post-Bayh-Dole model of tech transfer, establishing the Industrial Liaison Office (UILO) in 1984. The UILO concentrates on patenting/licensing and spin-offs, and also offers internships, co-op education, student educational projects, support to 'affiliated companies' started by students, and support to the creation of start-up through seed funding. The recent creation of federally funded Centers of Excellence and Commercialization in Research (CECR) has increased research commercialization in Canada and helped UILO's objectives.

Ryerson Digital Media Zone (DMZ)

The Ryerson Digital Media Zone (DMZ) is a business incubator/accelerator space with a very specific focus on digital media. Its objective is to create a successful digital media incubator capable of launching new and innovative companies created by Ryerson students and alumni. DMZ is funded by the University of Ryerson. DMZ hosted 50 companies and 220 people in 2012. Current students run 9 of the 31 existing businesses in the space, and make up 31% of the Zone's population, while alumni predominate in the DMZ. Peer-to-peer sessions and mandatory check-ins give the DMZ a specific educational flavor. DMZ provides a cluster of small-to-medium tech firms in the downtown Toronto area that contribute to the university both in financial terms (through donations) and provide the university with an ongoing stream of ideas and opportunities with which their own faculty, students, and alumni can interact and thrive. DMZ led to a number of companies, including Teamsave, which now employs around 50 people.

Petroleum Technology Research Center (PTRC)

The PTRC is a case of an intermediary body being set up to link university research to businesses. It is a joint venture between the University of Regina, the Saskatchewan Research Council, the Government of Saskatchewan and the Government of Canada, which emerged in the late 1980s. In 2008, PTRC was recognized by the federal government as a "business-led centre of excellence in research" and received a four-year \$10 mil grant to continue its research. PTRC provides subsidies to

encourage private sector oil companies to engage in research at public institutions. It develops its research agenda with private-sector participation, contracts the research to university partners, and manages the research process.

North Alberta Institute of Technology

The Northern Alberta Institute of Technology (NAIT) is a polytechnic located in Edmonton Alberta, with a little under 9,000 full-time students and about 14,000 part-time students and/or apprentices. Founded in 1961, the institution has for much of its existence been focused on providing technical training (either a full technical program, or apprenticeship training²⁸) for the province's oil and gas industry, much of which is in the city's environs or just north of it. The North Alberta Institute of Technology Technology's applied research office, called NovaNAIT, was created in 2006. The office has two major foci: a business incubator, and the arranging of applied research agreements with local business. Students are involved in applied research, in business cooperation through curricula and can benefit from the resources of the incubator (including an entrepreneur in residence).

The selection of US and Canadian case studies was based on several criteria, such as:

- **A balanced geographical coverage:** in the US, we selected several cases from the East Coast (MIT, New York State Center for Advanced Ceramic Technology, New York Fashion Institute of Technology, the Center for Innovation and Entrepreneurship at West Virginia University), central US (Silicon Flatirons Center at Colorado University, Technology Venture Development at University of Utah, Kauffman Foundation and the University of Missouri in Kansas City) and the West Coast (Stanford, Oregon State University, Cogswell Polytechnical College) – see Fig. 3 below. In Canada, we selected cases in the Western (University of Waterloo and Ryerson) as well as Eastern Provinces (Northern Alberta, Petroleum Technology and UBC University-Industry liaison offices).
- **Public and private ownership of the higher education institutions involved:** in the US we selected both public institutions (Fashion Institute of Technology, Colorado University at Boulder, University of Utah, West Virginia University, University of Missouri-Kansas City, Oregon State University) and private ones (MIT, Alfred University, StartX at Stanford and Cogswell Polytechnical College). In Canada, as education is a constitutional responsibility of provinces, most universities are publicly funded, but maintain institutional autonomy (private universities in Canada are relatively new and mainly exist at the undergraduate level) even if some of the oldest universities were originally privately endowed.

²⁸ Apprenticeship training in Canada is alternance-based, with long spells in the workforce followed by periods of 8-12 weeks (depending on the trade) in technical training which is usually delivered through publicly-funded community colleges and technical institutes.

- **Different institutional types:** in the US, our selection focused primarily on the “Basic” and “Undergraduate instructional program” classifications under the Carnegie Classification framework of institutional diversity in U.S. higher education:

“Basic” classifications:

- Research Universities (very high research activity: RU/VH): MIT, University of Colorado at Boulder, University of Utah, Oregon State University, Stanford University.
- Research universities (high research activity: RU/H): University of Missouri-Kansas City, West Virginia University
- Master’s L: Master’s Colleges and Universities (larger programs): Alfred University
- Master’s S: Master’s Colleges and Universities (smaller programs): Fashion Institute of Technology

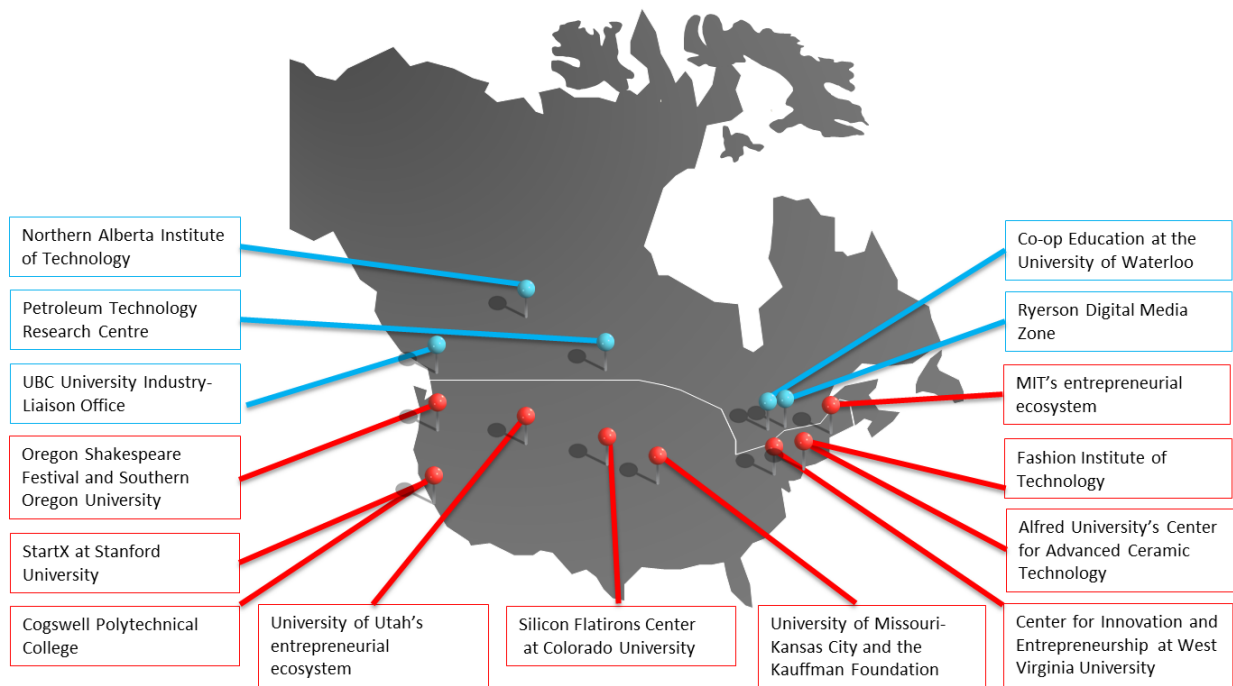
“Undergraduate Instructional Program”:

- Professions focus, no graduate coexistence (Prof-F/NGC): Cogswell Polytechnical College.

In Canada, where the Carnegie classification does not apply, our case studies are equally reflective of diverse foci. They include *research-intensive institutions*, such as the University of Waterloo, *comprehensive institutions*, which by definition have a strong research element, such as the University of Regina, and *polytechnic universities*, such as the University of North Alberta and the University of Ryerson. Polytechnic institutions usually concentrate on vocational training.

- **Mix of various forms of UBC**, performed in well-known and less known higher education institutions: in the well-known category in the US we included cases like MIT, while most of the other cases are less known and exemplify various aspects of academic entrepreneurship that have been less explored (e.g. fashion and technology entrepreneurship at the New York Fashion and Technology Institute; law, technology and entrepreneurship at the Silicon Flatirons Center at Colorado University; entrepreneurship in digital media industry and the creative arts at Cogswell Polytechnical College). In Canada, selected case studies include some major size institutions which are very well known, such as the University of British Columbia, as well as mid-size institutions, such as the University of Waterloo and the University of Regina.

Figure 2 – Geographical coverage of the US and Canada case studies



4.2. Nature of UBC

The broad nature of UBC is examined in terms of origins, stakeholders and financial resources involved.

4.2.1 Origin of UBC

Our **US case studies** illustrate a variety of initial contexts for UBC. Although a sharp differentiation between them is difficult to make, as many cases share some degree of similarity, five distinct situations can be identified:

- **Long-standing UBC links in highly research-intensive universities with a strong entrepreneurial environment**, e.g. MIT, Technology Ventures Development at University of Utah, Silicon Flatirons Center at Colorado University. We also include here the case of StartX at Stanford University, in spite of it being a very recent initiative, because it emerged to fill a gap in the structure and functioning of Stanford's strong and established entrepreneurial environment.

At **MIT**, the Technology Licensing Office started in the 1960s and was reorganized in 1985, continuing a practice of patenting inventions and licensing agreements initiated in the 1930s. MIT had its first class in entrepreneurship in the 1960s and has long been a pioneer in the

teaching, research and practice of entrepreneurship. In the 1990s, the increasing spread of entrepreneurial activities across the campus the need to create an Entrepreneurship Center, later renamed the Martin Trust Center for MIT Entrepreneurship, with co-sponsorship from MIT Sloan faculty across multiple disciplines, to serve not just the Sloan School of Management, but all of MIT, in order to increase and provide central coordination for the Institute's entrepreneurship classes and student activities. Following the MIT tradition of "Mens et Manus" (mind and hand), the Center connects theoretical knowledge underlying entrepreneurial success with practice, by linking entrepreneurial researchers with successful entrepreneurs and venture capitalists. MIT's Deshpande Center, established in the School of Engineering in 2002, is a more recent initiative that reflects the need to bridge what its staff refer to as the "innovation gap" between technological concepts and commercial reality caused by fear of risk, reduced government spending on basic and applied research, the limited financial ability of small businesses to identify and promote untested technology and the disconnect between academia and the marketplace.

University of Utah (UU)'s commitment to its entrepreneurial mission is long standing. Some UBC activities have been going on here since the 1950s, in the form of industry sponsorships for research. UU created its Technology Commercialization Office in 1967 to manage its technology transfer and intellectual property, and establish commercial partnerships to develop products based on technologies developed by university faculty, staff and students²⁹. One year later, in 1968, the Research Park came to existence, and was one of the first 10 in the country³⁰. During the 1980s, the then-president of the UU, Chase Peterson, coined the term "academic capitalism" and rose to prominence as one of the nation's leading advocates of commercializing academic research and technology. A variety of practices and policies were introduced in a more formal and programmatic way at institutional and unit levels in order to realize this goal. For example, the *Utah Innovation Center* supported by the National Science Foundation during the early 1980s was an early technology transfer experimental precursor to the technology business incubators that are now a common occurrence in many universities. The state-sponsored *Centers of Excellence Program (COEP)*, established in 1986, while not focused exclusively on the UU, has been a major programmatic asset for the creation of start-ups based on university-developed technologies. It funded later stage research in order to mature innovative technologies that might be commercialized via new products and new companies by university faculty, with substantive

²⁹ Crispin, J. E. (2011), *The Economic Impact of Start-up Companies and Invention Licensees Originating from Research at the University of Utah*, Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, March 2011. http://www.techventures.utah.edu/Documents/BEBR_report_March2011.pdf.

³⁰ Charland, W. (1989), 'The Downside of Capitalism on Campus', *The Christian Science Monitor*, <http://www.csmonitor.com/1989/0705/echar.html>, July 5 1989.

and financial participation by private sector partners³¹. UU's strengths in establishing industry partnerships are also largely related to its state-centered strategy focused on links with new or small local technology companies, many of which were the university's own spin-offs. In January 2005, the UU reorganized the commercialization of industry-sponsored research, aiming to perform this activity more systematically across the campus and to meet the needs of the entrepreneurial faculty who were asking for better support from the university in initiating or advancing their start-up activities. The newly created Technology Venture Development (Tech Ventures) took responsibility for a suite of existing and new centers and programs, such as the Technology Commercialization Office, the Utah Entrepreneur Center (renamed in 2006 as the Pierre Lassonde Entrepreneur Center) and the Bureau of Business and Economic Research.

The Silicon Flatirons Center (SFC) at Colorado University Law School was founded in 2000 as a national center of excellence in telecommunications and technology with an ambitious three-fold mission³²: to debate key technology policy issues by providing a forum for entrepreneurs, lawyers, industry professionals and policy-makers to discuss changing technologies, new business models and relevant legal issues associated with them, and to examine legal and regulatory reforms for technological change; to support and enable entrepreneurship in the technology community of the region; and to inspire, prepare and place students in Technology and Entrepreneurial Law. Even if this initiative is more recent than the previous cases, it is embedded in a wide cross-campus system of "confederated entrepreneurship centers" at Colorado University (several other entrepreneurial centers and academic departments with longer entrepreneurial experience) and operates in synergy with them.

Stanford University's StartX is a very recent initiative, founded in 2009 and launched in 2010, originating from Stanford Student Enterprises (SSE), a branch of the Associated Students of Stanford University (ASSU), the university's independent student government. The project is led by a recent graduate, Cameron Teitelman, who had attempted to organize a firm as an undergraduate, but found the entrepreneurial courses and assistance available on campus useful, yet insufficient to help him achieve his objective. StartX began from this premise of filling gaps in the university's innovation system and has developed from relatively modest beginnings as a student "lab" into a complex entrepreneurial support structure for students, which has attracted significant resources, both human and financial. Filling a gap in a support structure for spin-off activity in an already highly productive innovation system

³¹ Tornatzky, L. G., P. G. Waugaman and D. O. Gray (2002), *Innovation U.: New University Roles in a Knowledge Economy*, Southern Growth Policies Board.

³² Silicon Flatirons Center. <http://www.siliconflatirons.com/aboutUs.php> and SFC 2011 Annual Report.

produced a significant increase in firm-formation at Stanford University. The StartX phenomenon demonstrates that the world's leading entrepreneurial university, located in the world's most productive innovation region, had been operating below its potential and is amenable to improvement. The broader significance of this case is that it is a targeted intervention, based on research into strengths and weaknesses of an academic innovation system and its context. StartX is a prescription to fill gap(s) and connect the dots between existing resources, a bottom-up process in this instance.

- **More recent UBC links in less research-intensive universities and less established entrepreneurial environments**, aimed to improve and update the university educational offer, improve student employability and attract new students, e.g. the Center for Innovation and Entrepreneurship (CIE) at West Virginia University's College of Business & Economics, and the cooperation between the University of Missouri-Kansas City and the Kauffman Foundation (UMKC-KF):

The Center for Innovation and Entrepreneurship (CIE) created in 2002 at West Virginia University's College of Business & Economics has introduced a number of relatively recent initiatives that aim to broaden the Center's scope of work to include more experiential learning opportunities for students and additional opportunities for businesses to avail of faculty and student problem-solving. Such changes were estimated necessary in order to adapt to a business environment that is far different from what it was ten years before, when the Center was created. The Center also illustrates the need for universities involved in collaboration with business to periodically review and update their objectives and activities according to changes in the needs of students and businesses. The Center's original aim of offering an entrepreneurship minor to students in other degree programs and university colleges outside the College of Business & Economics so they could get a strong grounding in business without getting a business degree, was maintained, but other activities have been added, such as a business plan competition and research on entrepreneurship, the integration of more experiential learning components into individual courses in which faculty and students work together to solve real business problems and plans to scale these up to full programs in the Center.

The UMKC-KF cooperation started as a top-down initiative driven by Professor Carl Schramm, the head of the Foundation, between 2002 and 2011, and Martha Gilliland, Chancellor of UMKC, between 2000 and 2005. The cooperation started therefore as a consequence of, on one hand, the interest of KF to see what it could do to improve the reputation of UMKC, as the two organizations were physically located in close proximity, and

on the other hand, the commitment of UMKC to improve its entrepreneurial potential. Through the collaboration between the two institutions, UMKC has been able to benefit from the KF's resources such as funding, facilities, ideas and network. UMKC built up programs that made it credible in the academic entrepreneurship space, such as entrepreneurship education and promotion, staff mobility, lifelong learning, knowledge sharing and transfer, as well as the involvement of academic staff and students in solving specific business problems. The KF support expanded and speeded a transformational process that has been under way in business schools, from preparing people to work in existing large organizations, to participation in the founding of new ventures. While part of a broader phenomenon, UMKC's rapid expansion of entrepreneurship education is a direct effect of the interest that the KF took in its neighbor. The "additionality" that occurred cannot be measured precisely as the business school would have developed entrepreneurship programs following broader trends even in the absence of KF's interest in the school. Nevertheless, specific effects can be identified in the level of recruitment that took place and in programmatic developments that spilled over into other schools. The hybridization of entrepreneurship training, with its group emphasis, and traditional individualistic training programs with their competitive emphasis, stood out at UMKC.

- **Long-standing UBC links in Master's colleges and universities**, aimed to strengthen the research capacity of the university and the professional-level education of students, e.g. Alfred University's Center for Advanced Ceramic Technology (CACT) and the Fashion Institute of Technology (FIT):

Alfred University's Center for Advanced Ceramic Technology (CACT) is one of the most recent forms of the university's long collaboration with industrial companies initiated in the late 1980s. Applying to become one of New York State Foundation for Science, Technology and Innovation³³ (NYSTAR)'s Centers for Advanced Technology (CAT) program was seen as a way to amplify what the university was already doing. The NYSTAR CAT program was created in 1983 to support university-industry collaborative research and technology transfer in commercially relevant technologies, stimulate technology-based applied research and economic development in New York, promote workforce development, better leverage state funds with investments from the federal government, industry, foundations, and not-for-profit economic development organizations, and increase the competitiveness of New York State companies. Alfred University was selected through a competitive process to be one of its first

³³ NYSTAR subsequently became the Division of Science, Technology and Innovation within the Empire State Development Agency, though still referred to as NYSTAR.

CATs in the area of materials and materials processing technology in 1987, and was last re-designated in 2008, as the CAT designation is for 10 years at a time.

The Fashion Institute of Technology (FIT) has been known as a place where education meets industry since it was established in 1944 as part of an effort to revitalize the fashion and apparel industry following the war. Seven years later it became the second community college in the State University of New York System. In 1975, an amendment to the Education Law of New York State permitted FIT to offer BS and BFA programs; another in 1979 authorized Master's programs. *The FIT School of Graduate Studies* introduced its first Master of Arts programs in 1985, while the first Master of Professional Studies degree, in Cosmetics and Fragrance Marketing and Management, was added in 2000 and the second, in Global Fashion Management, in 2004. At present the School offers four MA Programs in Art Market, one Master of Fine Art Program in Illustration, and two Master of Professional Studies Programs, Cosmetics and Fragrance Marketing and Management and Global Fashion Management. *The Jay and Patty Baker School* now has ten programs leading to Associate's and Bachelor's degrees and is the largest of FIT's Schools. FIT's professional programs were developed with industry collaboration to respond to the growing demand for professional-level education to support an increasingly complex and globalized workplace. Many of the programs remain the only ones of their kind in the world and draw students from around the globe.

- **Recent university-industry links in undergraduate education colleges**, aimed to improve the overall quality and attractiveness of the institution, e.g. the Cogswell Polytechnical College of Sunnyvale, California, an undergraduate higher education institution with a long history of technical education, which recently introduced entrepreneurship and innovation degrees in the digital media industry to improve its curriculum, attract new students and serve an important niche market in California and beyond.

Cogswell Polytechnical College's long history of technical education goes back to its inception by Dr. Henry Daniel Cogswell, who founded the college in March 1887 as a non-profit charitable trust and a high school with well-equipped departments of technical education for boys and business education for girls³⁴. The college opened in August 1888 and was the first technical training institution in the West³⁵. It operated in this capacity until 1930, when its status was changed to that of a technical college offering a two-year program.

³⁴ Cogswell Polytechnical College "The History of Cogswell College" <http://blog.cogswell.edu/2010/04/the-history-of-cogswell-college/> Last Accessed 13/02/2013

³⁵ California Legislature, *Journal: Appendix. Reports, Volume 5, 1888, p. 247*

In 1971 Cogswell began offering four-year Bachelor degrees³⁶. In 1992-93, the College started to establish more formal relations with digital media, computer graphics, computer animation and film companies in the Bay Area, Los Angeles, New York (for animation and film industry), Chicago and Seattle (for game industry). These relations had been initiated more informally by Cogswell's faculty and administrative staff, and have been maintained and strengthened over time through alumni connections, faculty members' strong industry experience and connections, award-winning student films of professional quality or student hiring by professional companies that cemented the relations. The core of entrepreneurial education offered by the College is in its Entrepreneurship and Innovation program, which offers BA degrees in Entrepreneurship and Innovation and in Entrepreneurship and Innovation for Digital Media, and, since October 2012, a MA in Entrepreneurship and Innovation in five areas of specialization: Technology, Animation, Audio, Games, and Interactive Marketing.

- **A specific form of UBC spun-off from the university and grown into a world-famous art event with strong social,** economic and cultural impact on the local community, e.g. the Oregon Shakespeare Festival and Southern Oregon University.

The Oregon Shakespeare Festival (OSF) was started in 1935 by Angus Bowmer, an instructor at Southern Oregon Normal School, now Southern Oregon University (SOU), who used the meager resources available to him to pursue his vocation in a depression-era college. Bowmer spun off the Festival from the teaching and dissemination missions of academia by recruiting members of the college, such as fellow faculty members, willing to act and by aggregating financial resources in the community through a vision of public entertainment generated from communal activity. Over time, the Festival grew into a world-famous art event with a wide-ranging impact on its town's economic and social development, as well as on the academic development of SOU. The collaboration between OSF and SOU also involved the broader community which led to an indirect change in the town's culture and economy. In the beginning there was no grand vision of collaboration between a theatre festival and a university, or the effect such a festival would have on Ashland. Today, the collaboration between OSF and SOU involves internships for SOU students at OSF, lifelong learning through education programs for senior citizens, a Master's program for high school and community college teachers, and knowledge sharing between the two organizations. From an idea by a university instructor to put on plays at a civic event, OSF has indirectly led to a change in the town's culture and economy to a focus on theatre. Visitors come from all

³⁶ Cogswell Polytechnical College "The History of Cogswell College" <http://blog.cogswell.edu/2010/04/the-history-of-cogswell-college/> Last accessed 13/02/2013

over the United States, and even abroad, as a result of OSF and other theatres which make Ashland unique relative to other towns.

Our **Canadian case studies** follow three of the same classifications, allowing us to identify three key patterns:

- **Long-standing UBC links in highly research-intensive universities with a strong entrepreneurial environment**, e.g. the University-Industry Liaison Office of the University of British Columbia and the University of Waterloo:

The University-Industry Liaison Office of the University of British Columbia was established in the 1980s. The University of British Columbia (UBC) is a major research university located in Vancouver, Canada, founded in 1906, and which became a major research institution in the early 1980s. The University-Industry Liaison office was originally created to support the patenting and licensing of university research findings. It expanded through the mid-1990s to include spin-off companies and in 2006 to include several types of relationship networks with local business. The University-Industry Liaison office encourages entrepreneurship (through an inter-faculty initiative called entrepreneurship@UBC) and provides support to companies started by students in addition to its traditional patenting and licensing activities.

The University of Waterloo is known in Canada for its co-operative education, which was set up in the mid-1950s. The creation of co-op education in Waterloo corresponded to a shift to high-tech at the engineering faculty (where the program originated). The co-op education program was also the catalyst for Waterloo's decision to become an independent, degree-granting institution in 1957, taking distance from the University of Western Ontario from which it was affiliated until then. Student demand led to the expansion of co-op education from Engineering to several other departments, including Mathematics (1964), Environmental Science (1967) and the Faculty of Arts (1975).

- **Recent university-industry links in undergraduate education colleges**, aimed to improve the overall quality and attractiveness of the institution, e.g. the Digital Media Zone of the University of Ryerson and the NovaNAIT Center of the Northern Alberta Institute of Technology (NAIT).

The Digital Media Zone of the University of Ryerson is a business incubator/accelerator space in digital media. It started as an extension of a computer science class where students had to develop a student-initiated project. Participants get free desks, phones, and internet access (for four months), along with mentorship, business development and counseling

services, and opportunities for networking and promotion. Students, alumni, and people from outside the Ryerson community can apply on a rolling basis and must submit a pitch to the selection committee. The DMZ has increased the reputation of Ryerson University, the graduate programs of which are less than 20 years old. DMZ is largely funded by the University of Ryerson, although companies using the space can incur fees for long stays (after the early months of the accelerator phase). The Ryerson Digital Media Zone fills a gap by providing students a space to develop their business ideas and for outside companies to come and meet new talents.

The NovaNAIT Center of the Northern Alberta Institute of Technology (NAIT) focuses on applied research projects. NAIT itself is a polytechnic institution with a little under 9,000 full-time students and about 14,000 part-time students and/or apprentices. It is located in Edmonton Alberta. Founded in 1961, the institution has focused on providing technical training (either full technical program, or apprenticeship training³⁷) for the province's oil and gas industry, much of which is in the city's environs or just north of it. NAIT was among the institutions in the forefront of the use of applied research. NAIT diffused applied research activities through an office known as NovaNAIT in 2006 following a visit of NAIT's president in Europe (until then, individual professors – mainly those in the faculty of engineering – would create arrangements on their own without centralized institutional effort). NAIT emphasizes the applied research curricular benefits. The first Bachelor's degree program (B.Tech in Technology Management) was introduced in the mid-2000s. These degrees require students to complete an eight-month capstone project in their final year; as a result, there was suddenly a much larger demand from within the institution for applied research projects, a gap that NovaNAIT fulfills.

- **More recent UBC links aimed to develop the national economy**, e.g. the Petroleum Technology Research Center (PTRC)

The Petroleum Technology Research Center (PTRC), a joint venture between the University of Regina, the Saskatchewan Research Council, the Government of Saskatchewan and the Government of Canada was a way for the Government of Saskatchewan to encourage private investment in petroleum technology research (through subsidies). Set up in 1998, the PTRC's official mission was to “develop world-leading technologies and processes to ensure that the recovery of Canadian hydrocarbon resources is environmentally and economically sustainable for the benefit of stakeholders”. PTRC is a

³⁷ Apprenticeship training in Canada is alternance-based, with long spells in the workforce followed by periods of 8-12 weeks (depending on the trade) in technical training which is usually delivered through publicly-funded community colleges and technical institutes.

mediator and an aggregator: an intermediary body which develops a research agenda with private-sector participation, contracts the research to university partners, and manages the research process (PTRC does not conduct research itself). Businesses pay a membership fees so that they can have a say in the research agenda, approve projects and gain access to research findings. PTRC follows from the creation by the Government of Canada of Business-Network Centers of Excellence (BL_NCE) in 2007. The BL-NCEs were an attempt to copy the successful Networks of Centers of Excellence (NCE) model and make it more commercially-oriented by putting businesses in charge of the networks' agenda and involving them in the design and execution of the projects.

4.2.2 Stakeholders of UBC

A common feature of all the US case studies examined is the broad range of stakeholders involved in the UBC, as well as the variety and depth of connections between them. Most of the case studies we analyzed, particularly those established in highly-research intensive universities with a strong entrepreneurial environment (e.g. MIT, Technology Venture Development at the University of Utah, Silicon Flatirons Center at Colorado University) were part of complex innovative ecosystems, comprising various academic departments and units, various organizations involved in technology commercialization, supporting academic administration units, faculty, students, student associations, etc. Business links were often initiated informally by faculty, university managers, alumni, etc. and later formalized and managed through specialized university structures. On the business side, an important feature is the myriad of firms involved in collaborations with the respective universities, from high-tech firms to legal firms, venture capital firms, university start-ups, etc. Also noteworthy are the close links with the local entrepreneurs (e.g. Silicon Flatirons Center, Cogswell Polytechnic College, etc.) who are involved in teaching and various forms of entrepreneurship education.

These wide-ranging connections between the stakeholders, regardless of their individual organizational designs, have significantly blurred the boundaries between the university and business institutional spheres and increased the mobility of individuals across them, especially in terms of involving business people and entrepreneurs in academic educational activities. Therefore, most of the UBC forms we identified are no longer located on either side of the institutional spheres of university or business, but at the actual interface between them.

The stakeholders identified in our US case studies are summarized in Table 4 and briefly discussed below.

Table 4 – Partners and Stakeholders in the US case studies

Institutions	Partners and stakeholders
MIT	<p>Technology Licensing Office MIT, MIT faculty inventors, investors, companies</p> <p>Martin Trust Center MIT, MIT students and faculty, entrepreneurs</p> <p>Deshpande Center MIT, MIT faculty and students, venture companies, other companies, industry people</p>
CACT	Alfred University and the NYSTAR program within the Empire State Development group, New York state companies, engineering faculty members involved as Principal Investigators and researchers in the joint projects, engineering students involved as researchers, New York State Governor and legislators, industry associations with a professional interest in the research that is being undertaken.
FIT	FIT faculty, students and staff, the State University of New York system, business/companies, industry professionals, the community (NYC galleries, museums, etc.).
TVD	TVD with its Entrepreneurial Faculty Scholars (EFS) and EFS Executive Committee, and its departments – the Technology Commercialization Office and the Pierre Lassonde Entrepreneur Centre, David Eccles School of Business and its Bureau of Economic and Business Research (BEER), Sorensen Center for Discovery and Innovation, University Venture Fund (UVF), University Impact Fund (UIF), the Research Park, University of Utah start-ups, local business community (chambers of commerce, Utah Technology Council, Economic Development Corporation of Utah), many local economic development agencies, business firms, banks, etc.
SFC	<i>“Confederated centers of entrepreneurship”</i> : Leeds Business School with its Deming Center for Entrepreneurship, the Management and Entrepreneurship Division and the Center for Education on Social Responsibility (CESR), the Entrepreneurship Center for Music, the Alliance for Technology, Learning and Society (ATLAS), the College of Engineering and Applied Science and its Engineering Entrepreneurship Program (E-ship), the university Technology Transfer Office, the Center for Space Entrepreneurship (eSpace), the cross-campus club for entrepreneurship StartupCU, SFC’s supporters (business firms, law firms and individuals), SFC’s partners (communications technology professionals, the Federal Communications Bar Association (FCBA), CU Interdisciplinary Telecom Program (ITP), CU Law School, etc. Government agencies only episodically involved in collaboration with SFC.

CIE -WVU	WVU College of Business & Economics, Davis College of Agriculture, Forestry and Consumer Sciences, WVU Extension Service, and the Office of the Vice President for Research & Economic Development, the WVU Central Administration, other WVU university colleges, faculty, students, businesses and local and state government.
UMKC-KF	Kauffman Foundation, UMKC faculty, students, business companies.
CPC	Alumni, partner companies in the digital media, film, games and animation companies.
StartX	Entrepreneurially-minded undergraduate students and recent graduates, professors various partners such as Kauffman Foundation, Microsoft and AOL (signature partners), Greylock Partners, Founders Fund (Venture Capital Partners), several legal partners and resource partners.
OSF-SOU	SOU faculty members willing to act, local businessmen and professionals interested in community service, people within the local government, college, civic-minded business people in Ashland, federal economic development funds.

Note:

MIT: Massachusetts Institute of Technology

CACT: Center for Advanced Ceramic Technology at Alfred University

FIT: Fashion Institute of Technology's School of Graduate Studies and the Jay & Patty Baker School of Business and Technology

TVD: Technology Venture Development at University of Utah

SFC: Silicon Flatirons Center for Law, Technology and Entrepreneurship at Colorado University Law School

CIE-WVU: Center for Innovation and Entrepreneurship at West Virginia University

UMKC-KF: University of Missouri-Kansas City and the Kauffman Foundation

CPC: Cogswell Polytechnical College

StartX: StartX at Stanford University

OSF-SOU: Oregon Shakespeare Festival and Southern Oregon University

At **MIT**, Technology Licensing Office employees work with inventors on patents and licensing agreements, and maintain relationships with a range of businesses and venture capital companies that can be matched with MIT inventors. The Martin Trust Center coordinates a large number of different programs targeted to students and designates industry mentors ("entrepreneurs in residence") to work with students. The Deshpande Center is organized around its grant requests for proposals from faculty-led research teams and the selection process. It also involves carefully chosen "catalysts" from industry to help guide grantees, and carries out networking activities with businesses to give MIT researchers access to venture capital companies. The collaborations run by these offices / the program are beneficial to the entire MIT community, both in terms of the services offered and in the prestige that they have added to the institution. Similarly, the local community is impacted by the large number of businesses and employment opportunities that become available when MIT technology is commercialized.

At **CACT**, the range of stakeholders expanded over time as part of its mandate, from Alfred University and the NYSTAR program within the Empire State Development Group as the only stakeholders at its

inception, to a multitude of New York state companies with whom it collaborates³⁸, Engineering faculty involved as Principal Investigators and researchers in the joint projects, Engineering students involved as researchers, and industry associations who have a professional interest in the research that is being undertaken. As the financial allocations for all of the CATs in New York State must be included in the state budget each year, the Governor and legislators are also seen as partners in the collaborations.

FIT and its Schools had as formal partners and stakeholders at inception FIT faculty and staff, the State University of New York system and business/companies. At present, the range of partners and stakeholders of both Schools was extended to include faculty members and staff, students, industry professionals, the community (galleries, museums, etc. in NYC) and businesses/companies. Each type of collaboration is managed in a distinct manner. Entrepreneurship education and opportunities for contacts with industry experts are integrated into the curricula of all classes and programs when they are designed and revised by faculty and staff together with industry advisors. The Internship Center assigns, structures, and monitors internships to provide the most appropriate and valuable experience for each student. For some students, internships are an integral part of their required course of study, while for others internships are taken on a supplemental-credit basis. Internships are run as two-pronged academic programs that include both on-site professional/work experience supervised by an organization executive and classroom instruction. Research is conducted by individual faculty members on a consulting basis, but new joint research initiatives are coordinated by the Creative Hub.

University of Utah's Technology Venture Development (Tech Ventures), with its Entrepreneurial Faculty Scholars (EFS) and EFS Executive Committee, and its departments – the Technology Commercialization Office and the Pierre Lassonde Entrepreneur Centre, is at the center of a complex institutional system of entrepreneurial organizations. The most important stakeholders include: the David Eccles School of Business, which offers a complete range of business education with a strong emphasis on technology, innovation, commercialization and entrepreneurship, and its Bureau of Economic and Business Research (BEBR), Sorensen Center for Discovery and Innovation, University Venture Fund (UVF), and its recent affiliate, the University Impact Fund (UIF). Another stakeholder is the Research Park that ensures the economic development mission of the university, by attracting and promoting industrial technology, stimulating the interaction of the university and industrial communities to foster the economic growth and development of Utah. University of Utah start-ups are also notable stakeholders. Launched in an impressive number of over 220 since 1970³⁹, they emerged at a rate nearly 20 times higher in the last seven years since the Tech Ventures inception in 2005 (144 start-ups

³⁸ The companies do not have to be headquartered in NYS, but they must have offices there. While CACT is not in the business of bringing businesses into the state, when they are able to it is considered to be a bonus.

³⁹ See a full overview of the University of Utah start-ups since 1970 in the 2012 Annual Report, pp. 8-9. <http://content.yudu.com/Library/A1y3um/2012AnnualReport/resources/index.htm?referrerUrl=http%3A%2F%2Fwww.techventures.utah.edu%2Fabout.php>. Last accessed 13/02/2013

during 2006-2012, average 20.8 per year) than in the 1970-2005 period (79 start-ups, average 2.2 per year)⁴⁰. A record number of 22 start-ups were created in 2009, five times the national average of 4 start-up companies created by U.S. research universities⁴¹. Last, but not least, the local business community includes other important stakeholders (chambers of commerce, the Utah Technology Council, the Economic Development Corporation of Utah), many local economic development agencies, business firms, banks, etc.

Silicon Flatirons Center at Colorado University Law School is embedded in a model of “*confederated centers of entrepreneurship*” that comprises several institutions across campus that work in synergy to realize the university policy goal to become a leading entrepreneurial university in the world. These centers include: the Leeds Business School with its Deming Center for Entrepreneurship, the Management and Entrepreneurship Division and the Center for Education on Social Responsibility (CESR), the Entrepreneurship Center for Music, which is one of the earliest and most developed music entrepreneurship programs in the country and a national leader in professional development for musicians, the Alliance for Technology, Learning and Society (ATLAS), which is an innovative campus-wide initiative in education, research, creative work and outreach having ICT as the enabling force, the College of Engineering and Applied Science and its Engineering Entrepreneurship Program (E-ship), the university Technology Transfer Office, the Center for Space Entrepreneurship (eSpace) and the cross-campus club for entrepreneurship StartupCU. A key role in this entrepreneurial ecosystem is played by the SFC’s supporters, who are community members (business firms, law firms and individuals) interested in law, technology and entrepreneurship, and who participate in the debate around technology policy issues, facilitate networking and inspire student interest in technology law. Among the supporters, individuals account for a large share, which is explained by the nature of these individuals. They are alumni or successful entrepreneurs, venture capitalists, business angels, many relocated from elsewhere, being attracted by Boulder’s small, but vibrant community with a flourishing entrepreneurial spirit, a world-class university and a supportive start-up scene (Boulder was named “*America’s Best Town for Startups in 2010*” by Bloomberg Business Week⁴² and a “*highly networked city inhabited by active life-styled, serial entrepreneurs*” by Fast Company⁴³). Business companies are predominant among the SFC’s Hatfield Program supporters (e.g. AT&T, Comcast Corporation, Google, T-Mobile USA, Walt Disney Company, Time Warner Cable, Cisco Systems, Verizon, Microsoft, Ericsson, National Cable and Telecommunications Association (NCTA), DISH Network,

⁴⁰ Jack Brittain (2012), ‘Papers, Patents and...Products’ Presentation at the Triple Helix Workshop ‘Building the Entrepreneurial University’, Stanford University, 12 November 2012. <http://triplehelix.stanford.edu/node/51> Last accessed 13/02/2013

⁴¹ Crispin, J. E. (2011), *The Economic Impact of Start-up Companies and Invention Licensees Originating from Research at the University of Utah*, Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, March 2011, p. 1.

⁴² Wadhwa, V. (2012), ‘Why Boulder Is America’s Best Town for Startups’, Bloomberg Business Week, April 22, 2012. <http://www.businessweek.com/stories/2010-04-22/why-boulder-is-americas-best-town-for-startupsbusinessweek-business-news-stock-market-and-financial-advice> Last accessed 13/02/2013

⁴³ Rich, L. (2010), ‘Why You Should Start a Company in... Boulder’, FastCompany, January 12, 2010. <http://www.fastcompany.com/1446569/why-you-should-start-company-boulder> Last accessed 13/02/2013

CableLabs etc.), while law firms comprise the majority of the SFC's Energy Initiative sponsors. Supporters' involvement takes place primarily through sponsorships and participation in the SFC's Advisory Boards:

- Silicon Flatirons Board (includes successful venture capitalists, top executives at publicly traded corporations, and partners at large law firms);
- IT & IP Advisory Board (includes leaders in the educational, entrepreneurial and legal communities); and
- Entrepreneurship Advisory Board (includes law and business schools students and professors, venture capitalists, successful entrepreneurs, top executives at established companies and attorneys).

In addition, SFC's partners within the CU system, in the local community and nationally allow for greater cross-fertilization of ideas and facilitates networking across programmatic and geographical boundaries. Partners include: communications technology professionals, the Federal Communications Bar Association (FCBA), CU Interdisciplinary Telecom Program (ITP), CU Law School, etc. Government agencies are only episodically involved in collaboration with SFC, in connection with specific projects, e.g. a roundtable discussion hosted jointly with the Mayor's Office in Denver to convene local leaders.

The **Center for Innovation and Entrepreneurship at West Virginia University** counted among the formal partners and stakeholders involved in its inception the WVU College of Business & Economics (which provides funding to the center), Davis College of Agriculture, Forestry and Consumer Sciences, WVU Extension Service, and the Office of the Vice President for Research & Economic Development. The creation of the Center was encouraged by the Central Administration at the time. Other stakeholders and partners are WVU university colleges that have the multidisciplinary major, whose students do an entrepreneurship minor, students (who take the entrepreneurship minor, participate in the business plan or apps competitions or are involved in other Center activities including experiential learning activities), businesses and local and state government (who provide opportunities for students to gain experience in real businesses and government offices), and faculty (who teach entrepreneurship classes and undertake research).

The **UMKC-KF cooperation** has as its main stakeholders the Kauffman Foundation and UMKC, but also the university faculty and students and the business companies that the Foundation helps to forge links with the university.

Cogswell Polytechnical College's most important stakeholders are its alumni and partner companies in the digital media, film, games and animation companies. Cogswell alumni span many generations

and various careers, from particle accelerators to movies⁴⁴, and their credentials include the world's best-selling video games and blockbuster films⁴⁵. Cogswell partners have included many types of companies over the years. The two most recent partners are Apple Computer and DigiDesign, two local leaders in technology that relates specifically to the Digital Arts, who provide professional training in the areas of audio and video production that lead to industry-recognized certifications.

StartX stakeholders are primarily the entrepreneurially-minded undergraduate students and recent graduates, who organized StartX as an experiential educational coaching and mentoring project, working through Stanford's student government to assist their fellow students' entrepreneurial ventures. They were joined by professors who share a common experience founding a company that creates an atmosphere of trust and information sharing amongst the program's participants. StartX developed from relatively modest beginnings as a student "lab" into a complex entrepreneurial support structure that has attracted significant resources, both human and financial. Among them is the Kauffman Foundation, who announced on August 23, 2012 a \$800,000 grant to StartX to support the operation of the program, to provide resources to document and to develop StartX's curriculum, in addition to helping identify a model for replication⁴⁶. In addition to the Kauffman Foundation, StartX receives support from various firms, such as: Microsoft and AOL (signature partners), Greylock Partners, Founders Fund (Venture Capital Partners), Cooley LLP, Fenwick & West LLP, Goodwin Procter LLP, Orrick, Herrington & Sutcliffe LLP, Wilmer Cutler Pickering Hale and Dorr LLP (legal partners), Amazon Web Services, Rackspace Hosting, Fog Creek Software, GitHub, Early Growth Financial Services, Mohler, Nixon & Williams, First Republic Bank, Wells Fargo, Square 1 Bank, Paychex, Survey Monkey, LucidChart, ZenPayroll, Google and oDesk (resource partners)⁴⁷.

In the case of **OSF-SOU**, the initial partners and stakeholders were SOU faculty members willing to act, as Angus Bowmer spun off the Festival from the teaching and dissemination missions of academia by recruiting some of his fellows and by aggregating financial resources in the community through a vision of public entertainment generated from communal activity. Bowmer's first play in Ashland was thus cast from the Southern Oregon Normal School's faculty. Later on, Bowmer's passion for theatre led to him proposing to a group of businessmen and professionals interested in community service, and which was a group he was part of, to include The First Annual Shakespeare Festival as part of the revival of Ashland's Fourth of July "Independence Day" festivities. Bowmer used his connections to build a broad base of stakeholders. Due to his role in both organizations, OSF's origins involved members of the university and the local business and professional community, coming together in a

⁴⁴ Cogswell Polytechnical College. "Where our Alumni have worked" http://www.cogswell.edu/alumni-partners/alumni_where_alumni_work.php Last accessed 13/02/2013

⁴⁵ Cogswell Polytechnical College. "Cogswell College Announces Workshop for Entrepreneurs and Their Creative Ventures at SIGGRAPH Conference" <http://www.cogswell.edu/news/news073112.php> Last accessed 13/02/2013

⁴⁶ Lee and Pruitt, "Kauffman Foundation Announces Grant to StartX" <http://www.kauffman.org/newsroom/kauffman-foundation-announces-grant-to-startx.aspx> Last accessed 13/02/2013

⁴⁷ StartX, "StartX Partners". <http://startx.stanford.edu/partners> Last accessed 13/02/2013

large coalition of people within the college as well as civic-minded business people in Ashland. For the educational mission of the university, Bowmer brought aboard Professor Margery Bailey, an English Professor at Stanford University, to become the Academic Advisor for the Festival in 1948 and the Festival's education mission began in 1949⁴⁸.

In the Canadian cases, a number of partners and stakeholders were also identified, as summarized in the table below.

Table 5 – Partners and stakeholders in Canadian case studies

Institution	Partners and stakeholders
University of Waterloo	Local business community, students, faculty in Engineering, Mathematics, Environmental Science and the Arts, office of co-operative education (OCE).
Nova NAIT	Local businesses, faculty, staff and students (originally mostly from the School of Trades and the School of Information, Communication and Engineering Technology).
PTRC	University of Regina (originally particularly in Petroleum Systems Engineering Department, the Saskatchewan Research Council, the Government of Saskatchewan and the Government of Canada, Saskatchewan Research Council's Petroleum Analysis Laboratory, mid-size companies involved in heavy oil, staff.
University of British Columbia UILO	Faculty of life sciences, engineering and medicine, Centers of Excellence in Commercialization of Research (CECRs), businesses, students and staff.
Ryerson DMZ	StartMeUp (coaching center), students, alumni, entrepreneurs, services of the university (HR etc.) and local community.

NOTES

Waterloo University

NovaNAIT Northern Alberta Institute of Technology's office (NovaNAIT)

PTRC = Petroleum Technology Research Center of the University of Regina

UBC UILO = University of British Columbia University-Industry Liaison Office

Ryerson DMZ = University of Ryerson Digital Media Zone.

The Office of Co-operative Education (OCE) at Waterloo University, which employs 140 people, mostly organizes work terms and therefore liaises with students and businesses. Students can also directly organize their work placement, which is increasingly done as some seek employment opportunities in a geographically more distant region. Many businesses in the region co-operate, and Waterloo has attracted some companies with an international profile such as Microsoft and Google.

⁴⁸ Griffith, E-mail October 18, 2012.

The local community and big businesses in southern Ontario, many of whose US parent corporations had experienced the benefits of co-operative education at participating US institutions, have supported co-op education from its creation in the mid-1950s. The faculty is responsible for organizing the curriculum around co-op education. The faculty is hired on the expectation that it will comply with the very systematic process of curriculum planning in which business feedback is intensely sought.

NovaNAIT currently liaises with projects commissioned by industry partners or companies for its applied research activities, as well as start-up companies for its incubator activities. Roughly three-quarters of these are created when a company comes to the school with a specific project, while the remainder are the result of the school (or more likely an individual instructor) approaching an industry partner. NAIT provides new companies with desks, meeting space, internet and telephones for one to five people in exchange for a monthly fee of \$250 Canadian. The incubator also has an entrepreneur-in-residence. NAIT only admits companies with a need for applied research in an area which forms one of NAIT's academic pillars (oil & gas, health informatics, nanotechnology, Boreal reclamation, electronics/robotics and digital media). The projects initially concentrated on the School of Trades and the School of Information, Communication and Engineering Technology. From 2008, NAIT has included other areas, such as business and health.

The DMZ accepts applications from students, alumni, and people from outside the Ryerson community on a rolling basis. All applicants must provide a written and oral "pitch" of their ideas to the DMZ steering committee, which is mostly comprised of industry experts; however, student businesses get some prior coaching through StartMeUp, the university's entrepreneurship support center. Currently, alumni predominate in the DMZ; current students run 9 of the 31 businesses in the space, and make up 31% of the Zone's population. Companies have access to a variety of business service provided by the university (HR, legal, accounting, finance, etc) as well as mentoring from entrepreneurs. Prof. Rahnama is the original creator of the DMZ. He operated a computer science class from 2006-2010, which required students to develop some kind of digital application in their projects. In 2009, the university President Sheldon Levy supported the creation of a small incubator space known as the Digital Media Zone (DMZ), which operates on the side of the applied research projects.

PTRC, as an intermediary body which develops a research agenda with private-sector participation, liaises with fee-paying representatives from the private sector who have paid membership fees, and university partners (to whom it contracts the research). The PTRC research agenda is set periodically by its Board of Directors on the advice of staff who consult widely with industry partners. PTRC tends to attract are mid-size, upstream oil companies such as Husky Oil, Cenovus Energy, and Canadian Natural Resources. There is also a tendency for participating companies to be more involved in heavy

oil (where extraction technologies are still fairly experimental) than in light oil (which is a more mature industry, technologically speaking).

UBC UILO traditionally liaised with relatively large companies interested in partnerships or sponsored research and licensing. More recently, it has diversified the profile of companies involved given a parallel diversification of activities (including for example co-op education). UBC UILO also liaises with government regarding infrastructure and research grants, and entrepreneurs through its spin-off companies. The creation of Centers of Excellence in Commercialization of Research (CECRs), government funded non-profit agencies, aiming to improve universities' commercialization efforts by bridging the gap from inkling to proof-of-concept, changed the operating environment of UBC UILO, which sees CECRs as beneficial partners rather than competitors. For example, UBC UILO gets a percentage of future success through patents and licensing agreements it signs with CECR.

4.2.3 Financial resources of UBC

The financial resources for UBC in our US case studies come from a variety of sources, such as the university itself, partner business firms, alumni, entrepreneurs and government agencies. While university, business sources and alumni are important sources that are present in all the cases (a further differentiation can be made here between the weights of each of these funding sources in the overall budget), the level of government funding seems to be the most important differentiating factor, as some of the cases rely more heavily on government funding, while others rely only minimally or not at all on this funding source. Therefore, we divided our cases into two categories determined by the presence or absence of government funding, as briefly discussed below:

- **Cooperation financed by university, business, alumni, entrepreneurs and government sources**, e.g. MIT, CACT, the Fashion Institute of Technology, Technology Venture Development, the Center for Innovation and Entrepreneurship at WVU.

MIT's research is funded by the Federal government to about 70%, while state, local and foreign governments contribute about 6%. The activities of the Martin Trust Center and the Deshpande Center, while quite different from one another, given their different objectives, responsibilities and roles and target groups, are similar in that neither directly involves the government. The TLO office has ongoing contact with government agencies in its patenting activities. MIT's Technology Licensing Office is mainly funded by MIT, though it does collect some royalties, patent reimbursement, and equity cash-ins. The Martin Trust Center is also funded mainly by MIT, though it also raises some money from corporate sponsors and alumni. The Deshpande Center was founded with an initial donation of \$20 million by Desh Deshpande, the co-founder and chairman of Sycamore Networks Inc. and his wife Jaishree.

It depends on the financial and professional support of alumni, entrepreneurs, and investors to provide a sustainable source of funding for its operating costs. In addition, because all patents developed using MIT resources belong to MIT, after cost recovery, about one-sixth of the revenue is allocated to the Center (about \$40,000/year), most of which is used for maintenance fees on licenses. The Center also requests that spin-outs donate some equity, but this is not mandatory. While these sources provide some funds, they are not sufficient to fund the entire Center.

CACT's main funding sources include the NYSTAR grant and payments from partner companies. Although CACT has a 10-year contract with NYSTAR (it is presently halfway through this contract), its allocation has to be put in the New York State budget each year and some years CACT staff have had to lobby for it to be awarded in full. To receive the allocation, CACT reports to NYSTAR each year using a performance matrix⁴⁹ that is a crucial tool for the continuation of the funding. Over the last five years, on an investment of around \$5 million, CACT and its partners have returned around \$458 million in economic impact numbers. Return on investment is very high, although not all of CACT research has worked and in some cases, it has had zero return. CACT is also starting to pursue a new funding strategy – state grants, in response to the significant tightening of company budgets in the last several years as a result of the financial crisis. CACT partners with companies on New York State's Strategic Partnership for Industrial Resurgence (SPIR) and New York State Energy Research and Development (NYSERDA) grant applications. Once awarded, the companies cover some of the grant costs, but also receive federal funding dollars. Because CACT is considered a sub-contractor on these projects, it can count the money that it receives as matching business dollars. CACT also has other funding sources within the School of Engineering. One third of the Director's salary is paid by Alfred University. Faculty members still go out and seek other grants and funding with support from CACT.

At FIT and its schools, the primary funding sources for the collaboration with business are FIT itself (from funds that it receives from New York State, the City of New York's Department of Education, the New York Counties and the federal government and from tuition fees paid by students or their employers) and businesses (e.g. the 2012 Capstone project for Master's students in the cosmetics and fragrance marketing and management

⁴⁹ The performance matrix includes: jobs created or retained; increased sales; capital expenditures; cost savings and other funding sources (such as the National Institutes of Health or Department of Defense) to back up their productivity, and partner companies who assert that the CACT is a unique resource in NY State that allows them to access the expertise that they need within the state. The performance matrix is an important tool to use when putting CACT's budget before the New York State legislature. CACT can expect that its funding will continue as long as it retains its performance numbers. To date, this matrix has always backed up the Center's productivity. CACT's partner companies complete matrices for their collaboration and give them to CACT who rolls them up into a single report for NYSTAR. In addition, the regional development council for Western New York has identified CACT as an asset to the region.

program was supported by L'Oreal USA). Special grant funding has also been used for individual activities. Some of the funding for the recent symposium on diversity and globalization in the beauty industry, for example, was covered by a grant from the FIT Diversity Council. The balance over time between these sources has remained relatively constant, though New York State funding to FIT declined by about \$1.3 million in 2012 compared to 2011. While future cuts are not anticipated, it may take some time before funding reaches its previous levels (FIT 2012).

For the *Technology Venture Development office at University of Utah*, the most important funding source (far ahead of the others) is business, in the form of industry-sponsored research overheads and commercial sponsorships, royalties from licenses and patents, and endowment returns. Revenues from both commercial research and licensing have increased over the last years, with a more significant growth of the latter. In 2011, Tech Ventures raised seed funding of over \$100 million for investments in the university start-ups. Venture funding over the last five years accounted for nearly \$300 million, plus nearly \$430 million in commercialization grant funding from the government. Most of this funding came from outside the state and was a direct investment in the state's future economic development⁵⁰. More government funding is present in the form of the *Utah Science, Technology and Research Initiative (USTAR)*, a long-term investment in Utah's economic future based on strengthening the University's research skills and the commercialization of its research-based technologies for job creation throughout the state. The USTAR Initiative is funded through SB (Senate Bill) 75. This was passed with overwhelming support by the Utah Legislature in 2006, as a result of the lobby made by Utah's business community in 2005-06 (chambers of commerce, the Utah Technology Council, the Economic Development Corporation of Utah, and many local economic development agencies). SB 75 allocated \$179 million to the USTAR Initiative, as well as \$15 million in ongoing annual funding to support research teams at the University of Utah and Utah State University, \$4 million to support economic outreach programs around the State, and \$160 million toward the construction of \$200 million in new research facilities at the University of Utah and Utah State University, which contributed matching funds toward the research buildings (\$10 million each)⁵¹. USTAR provides annual funding to the University of Utah to recruit world-class researchers to Utah and to support start-up packages for faculty with proven track records of research and commercialization in 12 key areas (research clusters)⁵². The main new funding source estimated to grow in the future is equity in its own start-ups, which is now starting to

⁵⁰ Tech Ventures 2011 Annual Report, p. 5. <http://content.yudu.com/Library/A1tbz4/2011AnnualReportTech/resources/index.htm?referrerUrl=http%3A%2F%2Fwww.techventures.utah.edu%2Fnews%2F2011%2F08%2F2011-annual-report-released%2F> Last accessed 13/02/2013

⁵¹ University of Utah. "About USTAR at the University of Utah" <http://www.ustar.utah.edu/about-ustar> Last accessed 13/02/2013

⁵² University of Utah. "Research Clusters" <http://www.ustar.utah.edu/research-clusters> Last accessed 13/02/2013

accumulate. Also, revenues from current endowments are envisaged to be used for scholarships.

The Center for Innovation and Entrepreneurship at West Virginia University benefits from state appropriations that are funneled through the College of Business and Economics. It has close ties with government and public/private agencies that aim to bring together business, government and universities to develop strategies for regional economic development. Among these agencies at the community, state and national level are WV Vision Shared, Morgantown Entrepreneurs Forum, West Virginia Entrepreneurship Initiative, WV Venture, DreamQuest, WV Department of Education, Young Entrepreneurs, Global Consortium of Entrepreneurship Centers (formerly NCEC), and WV Higher Education Entrepreneurship Roundtable. The Center supports their efforts and gets ideas from them. For example, the Center is studying the crowd funding initiative that is being developed by Vision Shared for new entrepreneurs to see if it can be adapted for WVU students. The Center gets its primary funding from the College. It also gets some small grants, though they are not a significant source of funding. Funding has remained fairly constant over time. The Center's objective is to become self-sustaining within three or four years through its own activities. Even without cuts, West Virginia is a small state and WVU has a large operating budget, so the state only covers a portion (less than half) of it. There are threats that state funding to WVU will be cut by 7.5 % in the 2013 state budget.

- **Cooperation financed by university, business, alumni, entrepreneurs (without government).** e.g. Silicon Flatirons Center at Colorado University, University of Missouri Kansas City and Kauffman Foundation (UMKC-KF), StartX, Cogswell Polytechnic College

For the *Silicon Flatirons Center*, the sponsorships of its supporters are the primary funding source, accounting for over 90% of SFC's budget. The sponsorships are granted mainly in support to the overall mission of the SFC, rather than for specific projects. A secondary funding source is Colorado University, which only accounts for a very little share of the SFC budget (less than 3%)⁵³. The main financial focus remains on the supporters' sponsorships, but grants from foundations, such as the Kauffman Foundation, are also envisaged as a possible new funding source to be better exploited in the future.

⁵³ Interview with Phil Weiser, 19 October 2012.

The UMKC-KF collaboration is supported financially by the Kauffman Foundation, which provided annual grants to UMKC since 2005, ranging from approx. \$100,000 (in 2009) to \$2 million (in 2010)⁵⁴.

StartX receives funding from a various firms and more recently, in August 2012, from the Kauffman Foundation, which provided a \$800,000 grant to support the operation of the program, provide resources to document and to develop StartX's curriculum, in addition to helping identify a model for replication.⁵⁵

Cogswell Polytechnical College's financial resources come primarily from its annual tuition and fees, which amounted in the academic year 2011-2012 to \$19,668 (without housing) and \$25,668 (with housing).

A special case is the OSF-SOU cooperation, which is not focused on financial resources. For the first Festival, the costs were charged to the Fourth of July Committee⁵⁶, as the Festival was part of Ashland's Fourth of July festivities. While in the second year when the Festival used the Southern Oregon Normal School's credit, today, while OSF helps SOU attract students and, while SOU purchases tickets to OSF, the main collaboration is not centered on financial reasons.

The patterns of financing UBC in the Canadian cases are analyzed below:

- **Cooperation financed by university, business, alumni, entrepreneurs and government sources** (the federal Government provided substantial funds in the case of the University of British Columbia and the University of Regina):

PTRC of the University of Regina is funded by company subscriptions to access the program. The federal government also provided PTRC with a four-year, \$10 million Canadian grant to continue its research in 2008 conditional on matching funding being found (which came via the provincial government). The fees for these vary depending on the type of oil extraction results are required for (light oil = \$70K/year, heavy oil extraction = 120K/year, or both = \$150K/year). Companies can provide in-kind contributions, e.g. making their own facilities available for field-testing of processes and technologies developed through PTRC projects. Fees allow companies to participate in meetings which set the research agenda, approve individual projects, and gain access to the research findings. PTRC manages research for various departments, but most funding is allocated to the Saskatchewan's

⁵⁴ Flores, T. "UMKC 5-year payment history". E-mail December 3, 2012.

⁵⁵ Lee and Pruitt, "Kauffman Foundation Announces Grant to StartX" <http://www.kauffman.org/newsroom/kauffman-foundation-announces-grant-to-startx.aspx> Last accessed 13/02/2013

⁵⁶ Angus L. Bowmer, As I remember, Adam, p. 94.

Research Council's Petroleum Analysis Laboratory and the University of Regina's Petroleum System Engineering Department⁵⁷ (PTRC funding accounts for 50.8% and 92.1% of these two institutions' funding, respectively). The government has significantly improved the rate of return for PTRC member companies by increasing the leveraging effect of their membership funds.

The University of British Columbia's research infrastructure gets a large part of its funds through federal funds allocated through the Canada Foundation for Innovation Industry-University Liaison office. Out of a total of \$519 million Canadian in 2011/12, 43.1 million in 2011/12 (8.3%) came from industry-sponsored projects and 383.8 million from governments and other grants. The University of British Columbia diversified its sources of funding (which until then came from the government) from the mid-2000s' downturn in biotech industries, which concurred with local venture capital firms becoming more difficult to access. Since then, UBC has diversified its sources of funding through a diversification of its activities, for example including co-op education. Alumni and the BC Innovation Council also contribute to university initiatives, such as Entrepreneurship@UBC (see description under forms of cooperation) which benefited from a \$10 million venture fund, capitalized by donations.

- **Cooperation financed by university, business, alumni, entrepreneurs:**

At the University of Waterloo, the co-op programs are funded by the University itself and student fees. The University of Waterloo does not receive any extra government funding as a result of this. The office which manages co-op education is self-supporting through extra fees paid by students in the program (currently set at \$623 Canadian/term). Each co-op student costs roughly 18% more to teach than a non-co-op student.

Ryerson's DMZ is supported by the University, which sees the program as an experiment. Ryerson only charges fees to companies with long stays (beyond the early months of the incubation or acceleration phases), but these fees are more likely to be paid through "community work", supporting other groups in the center. The University rarely asks for an equity position in start-up in return for long stays. It has avoided seeking funds from the government, although a regional development grant program has provided project-based funding (in a program called the Applied Research and Commercialization Initiative in which higher education institutions partner with small business on commercialization efforts). The funding model of Ryerson's DMZ may be limited by a potential fall in public funding, as well

⁵⁷ Because of federal funding rules, SRC, being a provincial body rather than an independent university, is not eligible for funding under the BL-NCE

as growing estate costs and the fact that Ryerson provides services beyond those available at most incubators. The University has invested to create a cluster of small-to-medium tech firms in the downtown Toronto area that can contribute to the university both in financial terms (through donations) and by providing the university with an ongoing stream of ideas and opportunities with which their own faculty, students, and alumni can interact with.

NovaNAIT has a budget of about \$1 million for 12 staff that the University invested in. For its incubator activities, NovaNAIT charges a fee of \$250 Canadian per seat per month, to provide the company with a desk, phone, internet and meeting spaces, as well as an entrepreneur-in-residence. NAIT does not take an equity stake in companies that use the facilities. NAIT also receives fees from industry partners for applied research services.

4.3 Motivations for UBC

Table 6, which summarizes the motivations for UBC and the relative importance attached to them (1: least important; 5: most important) shows that on an overall assessment, the most important motivations appear to be: collaboration as a strategic institutional policy, diffusion of innovation, training students for the professional environment, and providing employment. The least important are: the decline of overall government funding for university research caused by budget cuts, as well as the decline of institutional university funding and increase of competitive funding. Government policy and/or political pressure appear to have a low importance in most cases, and a moderate one in the rest. Also, the contribution to the national economy is ranked low overall, much lower than the contribution to the regional economy.

It is important to note the top importance of adopting collaboration as a strategic institutional policy. Forging cooperative links with industry appears to be primarily a means to improve higher education institutions' research capabilities and education offer, and increase student employability, rather than a reaction to the decline of government or institutional funding, or a response to top-down government policies and pressures. Also, the higher score given to the contribution to the regional economy than to the contribution to the national economy confirms the growing role of higher education institutions in regional economic development and the consolidation of their "third mission" (e.g. the Big 5 Entrepreneurship Initiative as a contribution of UMKC and the Kauffman Foundation to the Kansas City region, whereby the two organizations are part of a partnership in Kansas City to create an entrepreneurial environment to develop the regional economy).

Table 6 - Motivations for UBC in the US case studies

Motivations	MIT TLO	MIT MTC	MIT Deshp.	CACT	FIT GS	FIT B&T	TVD	SFC	UMKC-KF	CIE-WVU	CPC	StartX	OSF-SOU	Total
Decline of overall government funding for university research, caused by budget cuts				3	1		3	2		3		1		13
Decline of institutional university funding and increase of competitive funding				1	3		3	2		3		1		13
To access industrial funding				5	4		4	1	5	5		5	1	30
Collaboration is a strategic institutional policy	5	5	5	3	5	5	5	4	5	4	5	5	5	61
To find an exploitation outlet for research capabilities		5		1	5	5	3	3	5	5		1	5	38
To access complementary expertise		5			5	5	4	4	4	5	4	5	5	46
To provide an outlet for university research results:	5	5	5		2	4	5	3	4	4		1		38
To access state-of-the-art equipment & facilities				5	5		4	1	2	1	4	4		26
To contribute to the regional economy	5	5		5	5		2	4	5	4			1	36
To contribute to the national economy	5	5		2	3		2	3	2	1			1	24

Government policy and/or political pressure		3		2	3		4	1	1	1		1	1	17
To increase patenting & equity arrangements	5		5	3	2	3	5	1		1		1		26
Diffusion of innovation	5	5	5	4	3		5	5	5	4	2	5	5	53
Training of students to the professional environment		5		5	5	5	3	5	5	5	5	5	5	53
Providing employment		4		5	5	5	2	5	5	5	5	5	5	51
Other							3 (special state funding)							3

Note: 1- least important; 5- most important.

Blue highlights the most important motivations; Yellow highlights the least important motivations

MIT TLO/MTC/Desh: MIT Technology Licensing Office/Martin Trust Center/Deshpande Center

CACT: Center for Advanced Ceramic Technology at Alfred University

FIT GS/B&T: Fashion Institute of Technology's School of Graduate Studies/Jay & Patty Baker School of Business and Technology

TVD: Technology Venture Development at University of Utah

SFC: Silicon Flatirons Center for Law, Technology and Entrepreneurship at Colorado University Law School

UMKC-KF: University of Missouri-Kansas City and the Kauffman Foundation

CIE-WVU: Center for Innovation and Entrepreneurship at West Virginia University

CPC: Cogswell Polytechnical College

StartX: StartX at Stanford University

OSF-SOU: Oregon Shakespeare Festival and Southern Oregon University

Going beyond these general observations, more specific insights about the motivations for UBC emerge from the specific profiles, strengths and contexts of the institutions examined, as these factors are also major determinants of their motivations. Two categories can thus be identified:

- **Institutions with stronger research capabilities and capacity to generate high technologies with commercial potential have also scored high motivations pertaining to the commercialization of these technologies**, e.g. finding an exploitation outlet for university research capabilities and results, accessing state-of-the-art equipment and facilities, accessing industrial funding and increasing patenting & equity arrangements. This was the case for all the three MIT centers, which appeared to be motivated by the need to provide outlets for university research results and to diffuse MIT innovations. On a more fine grained comparison between the three MIT centers, we could see that, while TLO and the Deshpande Center have put particular emphasis on moving technological inventions from the MIT research lab into the marketplace and increasing their patenting and equity arrangements, the Martin Trust Center, given its primary focus on students, was additionally motivated by the need to train students to the professional environment and provide employment for its graduates. Similar high scores have been given by CACT to accessing industrial funding, and state-of-the-art equipment and facilities, FIT to finding an exploitation outlet for research capabilities, accessing state-of-the-art equipment and facilities, accessing industrial funding, providing an outlet for university research results, and increasing patenting & equity arrangements, Technology Venture Development to provision of an outlet for university research, and CIE to finding exploitation outlets for research capabilities, accessing industrial funding and complementary expertise.
- **Institutions with a stronger focus on the educational mission scored high motivations pertaining to the strengthening of their educational mission**, such as training of students for the professional environment, providing employment, accessing complementary expertise and diffusion of innovation. This was the case for the Cogswell Polytechnical College, OSF-SOU, StartX, and the Silicon Flatirons Center.

The **Canadian case studies** suggest that institutions with strong research capabilities, such as the University of British Columbia, are motivated by strengthening their research capacities, providing an outlet for research results or accessing industrial funding. Contributing or engaging in the regional community also appears to be a strong motivation for the PTRC and for universities well-known for their educational offers, such as the University of Waterloo, which also established co-op education in order to develop entrepreneurial spirit in the community. Increasing institutional reputation was also mentioned in the case of the University of Ryerson.

4.4 Forms of UBC

Table 7 below, which summarizes the forms of UBC identified in the US case studies and the relative importance attached to them (1: least important; 5: most important), shows that on an overall assessment, the most important forms of UBC include knowledge sharing & transfer, and informal interactions. At some distance behind come applied innovation and involvement of academic staff and students in solving specific business problems, research partnerships, and entrepreneurship education and promotion. Other forms of cooperation specifically tailored to education, such as staff mobility, mobility/placement, and internship of students, and cooperation in curricula have been scored with average importance overall, but they are highly ranked in some individual cases.

Table 7 - Forms of UBC in the US case studies

Forms	MIT TLO	MIT MTC	MIT Desh	CACT	FIT	TVD	SFC	UMKC-KF	CIE-WVU	CPC	StartX	OSF-SOU	Total
Cooperation in curricula		3		1	3	3	4	4		5	1	3	27
Research partnerships		3	5	5	3	5	4	4			1	2	32
Investment in infrastructure		3		3	3	3	3	1		3	1	1	21
Patenting & equity arrangements	5	3	5	1		2	2	1			1	1	21
Involvement of business representatives in university board structures		3		4	3	2	5			5			22
Involvement of university representatives in company board structures				3						5			8
Informal interactions	5	4	5	5	3	5	5	5		5	5	5	52
Entrepreneurship education and promotion	2	4			3	4	5	5	3	5	1		32
Mobility/placements and internship of students		4		3	3	3	5	2	3	4			27
Staff mobility		4		3		2	2	5	3	4	1	4	28
Knowledge sharing and transfer	5	4	5	5		5	5	5	3	4	5	5	51
Applied innovation and involvement of academic staff and students in solving specific business problems		5		5	3	4	4	5	3	2	5		36
Continuing education (lifelong learning)				4		2	4	3			1	4	18

Other				5		5							10
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Note: 1- least important; 5- most important.

Blue highlights the most frequent forms of UBC; Yellow highlights the least frequent forms of UBC

MIT TLO/MTC/Desh: MIT Technology Licensing Office / Martin Trust Center / Deshpande Center

CACT: Center for Advanced Ceramic Technology at Alfred University

FIT: Fashion Institute of Technology's School of Graduate Studies and Jay & Patty Baker School of Business and Technology

TVD: Technology Venture Development at University of Utah

SFC: Silicon Flatirons Center for Law, Technology and Entrepreneurship at Colorado University Law School

UMKC-KF: University of Missouri-Kansas City and the Kauffman Foundation

CIE-WVU: Center for Innovation and Entrepreneurship at West Virginia University

CPC: Cogswell Polytechnical College

StartX: StartX at Stanford University

OSF-SOU: Oregon Shakespeare Festival and Southern Oregon University

Beyond this schematic representation of the forms that UBC takes, we provide below further insights into specific forms of UBC, such as entrepreneurship education and promotion, mobility placements and internships, staff mobility, lifelong learning, governance, knowledge sharing and transfer, engagement of academic staff in solving specific business problems.

4.4.1 Entrepreneurship education and promotion in the US

MIT Deshpande Center offers grant programs that help bring faculty ideas and research closer to development and commercialization, e.g. the *Ignition Grants* that provide up to \$50,000 for exploratory experiments and proof of concept, and the *Innovation Grants* that help researchers advance from the invention stage to the point where venture capitalists or companies might invest in the technology. The Center also has an annual call for proposals for faculty members (along with their post-docs and graduate students) funded by the MIT Office of Sponsored Programs for grant administration and works with each researcher to reduce the technology and market risks so investors will be more interested in funding a spin out company. The grantees are provided with technical support by the *Center's Catalysts*, a highly vetted group of individuals from the business community with experience in commercializing early stage technologies and/or mentoring researchers and entrepreneurs and industry expertise. While some catalysts are also mentors in the Venture Mentoring Service, they are more often technologically involved in specific projects, while mentors generally provide all around business advice. The Center hosts *networking events* with significant participation from area venture capital companies and entrepreneurs, e.g. the *IdeaStream Symposia*, which showcase new MIT technology featuring poster sessions by professors and post-docs and facilitate connections between venture capitalists and MIT innovators. The Center also runs the *Innovation Teams (i-Teams)*, in collaboration with the Martin Trust Center, a course in which student teams evaluate selected scientific and engineering breakthroughs for commercial feasibility and then develop go-to-market strategies for the innovations.

MIT's Martin Trust Center is the most involved in entrepreneurship education and promotion among all the three MIT centers analyzed. It runs an *Entrepreneurship and Innovation Track* in the Sloan MBA program, leading to a MIT Sloan Certificate in Entrepreneurship & Innovation in addition to the MBA degree. It also offers an *Executive Education program* in a number of areas for senior executives from corporations and government agencies and the *Innovation Teams (I-Teams) course* (offered together with the Deshpande Center). Moreover, it hosts an *"Entrepreneur in residence" program* and a series of three contests (the Elevator pitch contest, the Accelerate contest and the Launch contest) under the umbrella of the MIT \$100K Entrepreneurship Competition, funded by a number of different foundations and businesses. The MTC also coordinates the *MIT Founder Skills Accelerator project* (created by MTC together with all five MIT schools) and the *MIT Regional Entrepreneurship Acceleration Program*

(REAP) that hold international workshops bringing together regional task forces who want to learn from MIT's experience in catalyzing regional action and who are interested in intra-regional collaboration.

At ***FIT School of Graduate Studies***, entrepreneurship education is woven into the graduate curriculum with strategic leadership and decision making, financial management and product innovation courses. Like the concepts of globalization and sustainability, entrepreneurship is considered to be part of the School's DNA. Both professional Master's programs have international seminars to gain experience and contacts with industry executives in other countries and expose students to the global marketplace. The two-year Cosmetics and Fragrance program organizes two two-week seminars in Europe and Asia. The three-semester Global Fashion program organizes a two-week seminar each semester with their partner institutions, Institut Français de la Mode and Hong Kong Polytechnic University, in one of their home cities. Chief executive officers of major apparel companies and industry leaders such as KPMG are invited to give presentations and spend time with the students. These leaders are interested in what is happening in the educational arena and are committed to helping and having a dialogue with tomorrow's leaders. The *Executive Mentor Program* matches graduate students with senior executives to guide them in assessing and developing leadership styles and skill sets. The program is a formal part of the curriculum worth three credits for the Master's in Professional Studies students. Students in these programs work with their Executive Mentors, selected in collaboration with the program Chairperson and, in the case of the Cosmetics and Fragrance marketing and management program, corporate sponsors, over the two-year program to assess their professional skills and use this assessment to develop an individual development plan that is reviewed by the program director.

At ***FIT School of Business and Technology***, entrepreneurship education is offered in a new program, Entrepreneurship in the Fashion and Design Industry. The school also partners with other schools and industry to organize conferences on such topics as "Retail in a Global Multicultural World" (June 2012) and organizes regular forums bringing industry people, many of them alumni, in to talk about their experiences. Fashion companies such as the Warnaco Group sponsor students' participation in large worldwide conferences.

The Center for Innovation and Entrepreneurship at West Virginia University provides different entrepreneurship education and promotion activities ranging from its entrepreneurship minor to its Business Plan Competition and the recently created App Challenge contest. *The 18 credit (6 courses) entrepreneurship minor* is offered by the Center to multi-disciplinary students from other WVU colleges (e.g. the Center has just concluded an agreement with the School of Journalism to provide their students with entrepreneurship courses). The Center runs two major competitions, the *Business Plan Competition* and the *App Challenge*. The Center has managed the business plan competition program

for the past 10 years. Until 2006 the competition was open only to WVU students, but subsequently, it was opened up to for full-time students throughout WVU (21 colleges and universities – 80,000 students). Two winning teams are chosen each year, and each team receives \$10,000 plus start-up accounting, legal, media and advertising services and space in the WVU Business Incubator for one year. The Center's *App Challenge*, in its second year, offers the opportunity for students to develop and propose a new app for smart phones. Private industry leaders are brought in to present and serve as judges. Two prizes are given, a \$1,500 first prize and a \$1,000 second prize. The student keeps all property rights to their idea.

The Technology Venture Development Office at the University of Utah runs various forms of entrepreneurship education and promotion, both within its own departments and in conjunction with the David Eccles School of Business. TVD's own initiatives include: the Entrepreneurial Faculty Scholars (EFS), the Innovation Scholar, the Bench to Bedside Competition, the Commercialization Interchange (jointly with the Technology Commercialization Office) and the Distinguished Innovation and Impact Award (DIIA), awarded by EFS in partnership with the Academic Affairs office. *The Technology Commercialization Office (TCO)* coordinates the TCO Accelerator, the Software Development Center and the Start-up Center for Students, as well as the TCO Student Program. *The Pierre Lassonde Entrepreneur Center* coordinates the New Venture Development Center, the Utah Entrepreneur Series (including the techTITANS, Opportunity Quest and the Utah Entrepreneurship Challenge), a Student Entrepreneurship Conference and The Foundry (run jointly with the David Eccles School of Business. *The David Eccles School of Business* offers a broad range of business education courses with strong emphasis on technology, innovation, commercialization and entrepreneurship. In addition it collaborates with the University Venture Fund (UVF), which is the largest student-run private equity fund in the US, managing an \$18.5 million independent venture fund and operating as an investment firm for graduate and undergraduate students, and with its recent affiliate, the University Impact Fund (UIF).

The Silicon Flatirons Center of Law, Technology and Entrepreneurship has a very broad range of entrepreneurship education initiatives under its *Entrepreneurship Initiative*: New Technology Meet-Ups, Entrepreneurs Unplugged, Crash Course Series for Entrepreneurs, Roundtable Series on Entrepreneurship, Innovation and Public Policy, CU New Venture Challenge, the Entrepreneurship Law Clinic and the Samuelson-Glushko Technology Law & Policy Clinic, the Entrepreneurship Week and the Entrepreneurship Certificate. The SFC also works closely with other entrepreneurship centers across the campus that have their own offer of entrepreneurship education. For example:

- The Deming Center for Entrepreneurship in the Leeds Business School prepares undergraduate, MBA and PhD students for entrepreneurial, business and social innovation careers and offers a Cross-Campus Entrepreneurship Education & Certificate. The Center

coordinates the Innovation Lab and a Sustainable Entrepreneurship program in clean technologies (solar, wind, smart grid, etc.), natural and organic products, and green jobs, corporate sustainability and social entrepreneurship. It also connects students to industry leaders via the Deming Network – an active group of over 2,000 world-class entrepreneurs and innovators, and helps students to access opportunities in technology transfer and engineering, law, bio-frontiers, and environmental science programs). Students affiliated with the Center can practice class concepts during internships, mentorships and collaborations with the business community.

- The Management and Entrepreneurship Division of Leeds Business School prepares students on three tracks: Human Resource Management, Information Management, and Operations Management.
- The Center for Education on Social Responsibility (CESR) at the Leeds School of Business provides graduate and undergraduate students with courses in social entrepreneurship and gives them the opportunity to give business advice to social entrepreneurs and social ventures around the world. CESR is the campus sponsor for the social venture track of the New Venture Challenge case competition and also supports student clubs focused on socially responsible business and social entrepreneurship, including the Net Impact Club, Leeds Social Impact Consultants (founded by MBA students) and the cross-campus Student Center for Social Entrepreneurship.
- The Entrepreneurship Center for Music (ECM) is one of the earliest and most developed music entrepreneurship programs in the country and a national leader in professional development for musicians. It is itself an entrepreneurial endeavor, developing new paradigms for education, leadership and advocacy in the emerging field of arts entrepreneurship. The center organizes courses for credit, a weekly seminar series, workshops, special guest residencies, individual mentoring and partnering with local practitioners and other entrepreneurship units on campus to create venues for entrepreneurial activity, internships with arts organizations in both the for-profit and non-profit sectors, and one-on-one career mentoring. The curriculum includes a Certificate in Music Entrepreneurship.
- The Alliance for Technology, Learning and Society (ATLAS) is an innovative campus-wide initiative in education, research, creative work and outreach in which ICT is the enabling force. ATLAS programs bring together students, educators, artists, writers, scholars and leaders from the academy, industry, non-profits and government to create a multidisciplinary environment that contributes to the understanding of the interaction of ICT and human society.
- The College of Engineering and Applied Sciences offers an Engineering Entrepreneurship Program (E-ship), which was launched in fall 2008 and teaches fundamental entrepreneurial

skills through core courses in business management and leadership, high-technology marketing and finance. After completion of these preparatory classes, students enroll in the Deming Center for Entrepreneurship's capstone course in business plan development, where engineering and business students work together to create business plans for the top ideas generated in the class.

- CU Law School offers a Master of Laws (L.L.M) in Entrepreneurial Law and a Master of Laws (L.L.M) in Information Technology & Intellectual property, as well as a dual degree and Certificate Programs integrating the study of law with other disciplines.

At the **UMKC**, entrepreneurship stands out as achieving distinction well above UMKC's overall ranking. The Henry W. Bloch School of Management (School of Management), founded in 1953, offers undergraduate and graduate entrepreneurship programs, an MBA with an entrepreneurship emphasis, and also houses the Regnier Institute for Entrepreneurship and Innovation (IEI). The Princeton Review ranked IEI's undergraduate entrepreneurship program number 12 in the US, while the graduate entrepreneurship program was ranked 19th in the US for 2012.⁵⁸ IEI also received the National Model Graduate Entrepreneurship Program award from the United States Association for Small Business and Entrepreneurship (USASBE) in 2012.⁵⁹ IEI houses the E-Scholars, a certificate program open to UMKC students and members of the community, where students pass by creating a venture which a panel deems can earn \$50,000 in revenue in the first year and \$1,000,000 in annual revenue within the first five years. Unlike a standard university course which is more of an academic exercise, the program is applied and specifically intended to help students create and develop an actual business. In addition to learning from UMKC faculty, the course offers mentorship from business people from the community so students are able to receive assistance from members of the Kansas City business community. While the Kauffman Foundation does not directly fund the E-Scholars program, it does fund the IEI, provides speakers for the E-Scholars program and hosted last year's E-Scholars end of program celebration.

The Kauffman Foundation hosts the weekly One Million Cups workshop, which is attended by entrepreneurs, investors and local community leaders who meet people, pitch their business, and raise awareness for their venture. While the One Million Cups program under the Foundation has no formal relationship with UMKC, all the E-Scholars interviewed for this case study have attended One Million Cups at least once. This shows the interconnectedness of the Foundation and UMKC and the overlap between the two communities since there are many in the UMKC community involved with Foundation programs also.

⁵⁸ The Princeton Review, "Top Entrepreneurship Programs Press Release" <http://www.princetonreview.com/top-entrepreneurial-press-release.aspx> Last accessed 13/02/2013.

⁵⁹ UMKC Institute for Entrepreneurship and Innovation, "Awards & Achievements".

At Cogswell Polytechnical College, the Entrepreneurship and Innovation program is immersive and practice-based, integrating real-world experience through internships or practicums, student ventures and contacts with successful entrepreneurs from Silicon Valley. The Program has two undergraduate and one graduate degree programs: an *Undergraduate Degree (BA) in Entrepreneurship and Innovation* and an *Undergraduate Degree (BA) in Entrepreneurship and Innovation for Digital Media*, and a *Graduate Degree (MA) in Entrepreneurship and Innovation*, which is a one-year, comprehensive program for students to learn how to create or grow creative ventures within start-ups as well as larger organizations. The MA is intensive and experiential, combining coursework with learning from creative entrepreneurs and their companies. This degree program started in October 2012, and is taught in eight-week intensive semesters by creative entrepreneurs who are in their large majority serial entrepreneurs who have launched and successfully managed their own creative ventures. They not only teach students the basics of operating a business, but they also use students' own projects as teaching opportunities, helping them fast-track their business idea or company project through implementation. The program also takes advantage of Cogswell College's location in the heart of Silicon Valley, which allows students' access to professional resources and the entrepreneurial ecosystem that has nurtured some of the world's most influential companies. The MA offers five areas of specialization: *Technology, Animation, Audio, Games and Interactive Marketing*. The program culminates in an intensive practicum that requires students to create or grow a venture by addressing business growth challenges, researching new opportunities, moving the venture to a new level or market, or otherwise developing some aspect of their venture. As a precursor to the new MA in Entrepreneurship & Innovation, Cogswell College organized in September and again in October 2012 the *Black Collar Immersion Program™*, which prepares people to be "Black Collar" entrepreneurs who combine artistry and creativity together with technology know-how and business expertise. The Black Collar Immersion Program engages participants with their peers in an intensive, hands-on and highly interactive workshop environment.

StartX offers entrepreneurship education and can be thought of as being part of the Stanford ecosystem, since many of the people involved come from Stanford and there is a Stanford link required for at least one founder of a StartX entrepreneurship team. However, StartX does not offer entrepreneurship courses for university credit and does not collaborate with the university on the education or training offered by the program. The same can be thought of for continuing education. While many who go through the StartX program have graduated from the university, whether as undergraduate or graduate students, the program's entrepreneurship training is not coordinated with the university.

4.4.2 Mobility/placements and internships in the US

The Center for Advanced Ceramic Technology uses the university office that deals with internships and career development, so they do not duplicate services. CACT has an Associates program that provides some financial leverage for hiring students. Students can work for a summer or some period of time for a NY state company and they are considered an employee of Alfred University (and get their pay check from Alfred). The company pays a portion of wages to CACT and CACT covers the rest.

At **FIT School of Graduate Studies**, students in the Cosmetics and Fragrance marketing and management program are generally working and are sent by their employers to gain leadership skills, so they are not able to do internships, though the combination of school with their daily work offers them a mixed academic and practical experience as well. Some students in the other professional program in global fashion are working as well, though some may use the opportunity of being in school to explore other areas of interest through internships. The students in the other Master's program with the exception of Illustration and Sustainable Interior Design are required to do internships that, as previously mentioned, are run as two-pronged academic programs that include both on-site professional/work experience supervised by an organization executive and classroom instruction. Internship sites have included various museums and galleries, foundations, auction houses, the textile conservation lab at the Cathedral Church of St. John the Divine. At **FIT School of Business and Technology** all the students do several internships as this is thought to be the best way for them to make employment contacts and get real world experience in their areas of study.

At **the Technology Venture Development office of the University of Utah**, the Technology Commercialization Office (TCO) coordinates a number of student internships at TCO focused on technology transfer. Student interns assist in the analysis and commercialization of university technologies, under the guidance of a Licensing Manager. Eligible students for these internships need to have a technical background in either physical or life sciences to understand, evaluate and discuss candidate technologies, as well as a current field of study in business or legal. Other internships are managed by the University of Utah's Career Services. *UCareerLink* is a database where students can search for internship opportunities, various student positions, registration to the Student Job Fair in the fall semester and the Summer Job Fair in February, as well as job postings for both recent grads and more experienced alumni.

The Silicon Flatirons Center at Colorado University offers student internships through two programs:

- The Dale Hatfield Scholars & Research Program, which encourages student interest in public service by providing grants for summer internships in government or public interest positions.

It has also been used to support the CU's New Models of Governance Project, which evaluates technology policy issues for policy-makers. With the support of many generous sponsors, the Hatfield Program has become a flagship program at CU and has already helped to bring several students to Washington, D.C. to take positions in government and non-profit organizations since its 2006 inception.

- The Padden Scholars Program, which provides financial support of at least \$3,500 for students with summer internships in private sector organizations involving technology and communications issues in D.C. The award helps pay summer expenses, such as travel, housing, etc.
- In addition, the CU Entrepreneurship Center for Music also offers internships in Music Business to upper students who wish to work in public or private organizations on assignments relating to their career goals, and explore theory and practice in their major.

The Centre for Innovation and Entrepreneurship at West Virginia University has not had a formal internship program in the past and is working towards that now. In 2011 it created one of its first internship experiences. Students worked with a non-profit organization to create a profit-making business that would provide revenue to cover the non-profit's operational costs. Students prepared a feasibility study and a business plan and presented it to the Board of Directors where it was accepted.

OSF-SOU mobility/placements and internships include OSF staff members who teach at SOU at both graduate and undergraduate levels, as well as SOU students regularly doing internships for OSF, having thus an opportunity to practice their craft and to put into practice what is learned in the classroom. Both SOU and OSF benefit from this relationship as OSF uses SOU as a source for interns. While being an acting student at OSF does not automatically guarantee one an internship with OSF, it is certainly an advantage for SOU students in attaining an internship. For acting internships alone, 10 to 14 SOU students intern almost every year with OSF, while perhaps only one non-SOU student receives an acting internship with OSF every other year. SOU has the advantage of having auditions for OSF acting internships specifically for its students. The collaboration through placements is obvious given the number of SOU alumni employed with OSF. At any given time, about 40 SOU theatre program alumni work in administration, lighting, sound, and performance at OSF. Interns are treated like company members and are thrown into a very professional environment where they are expected to be on time and to know their lines. An internship leads to employment and further education benefits, and also helps actors in finding agents. Having OSF on a CV is also impressive. Having experience acting in OSF was also a plus for students wishing to apply for Master of Fine Arts (MFA) programs. There are many OSF staff member benefits for which interns are eligible.

Cogswell Polytechnical College has an Internship Program managed by the Career Development Service that works closely with academic departments. Career Development has a list of companies and studios with on-going internships, as well as information to help students search for the right experience. Internships are received on a weekly basis and posted on the Job Board. Faculty and staff members are also notified about openings and help inform students. Students who are interested and qualified will apply for the internship by sending their resume and sample work directly to the company contact. The College attaches great importance to internships as a way to better prepare students for work in their related fields of study, and recommends every student to take an internship before graduating.

StartX has no formal arrangement with Stanford University to provide placements or positions for people from the university within the StartX program. Nonetheless, the lack of a formal arrangement does not prevent Stanford University and StartX to have a closer relationship; the proto-firms being mentored consist mostly of Stanford students and some faculty and 7% of Stanford's student population has made application to StartX.

4.4.3 Staff mobility in the US

At **CACT**, engineering faculty do consulting with outside firms as it helps keep them current and publicizes CACT's capabilities to a wider audience.

FIT has only a limited number of full-time faculty members in the School, so that many of its professors are industry professionals such as designers, executives, consultants, freelancers, artists and business owners who teach as adjuncts in their specialty areas.

Technology Venture Development's EFS Executive Committee members are all serial entrepreneurs with outstanding results who combine academic research with entrepreneurial achievements. Also, the Lassonde New Venture Development Center is run by an accomplished local entrepreneur, with an Advisory Board made up of venture capitalists and inventor/entrepreneurs. Many of the David Eccles School of Business faculty members involved in Executive Education programs provide expert advice to Fortune 500 companies.

At the **Silicon Flatirons Center**, the best example of staff mobility is Phil Weiser, the Center's Executive Director and Founder and Dean of the Law School, Thompson Professor of Law. Phil Weiser joined the CU in 1999 and took a leave of absence from July 2009 to June 2011 to serve as Deputy Assistant Attorney General at the US Department of Justice's Antitrust Division (July 2009-April 2010) and Senior Advisor for Technology and Innovation to the National Economic Council Director at

the White House (April 2010-June 2011). Dean Weiser is also engaged in public service, arguing a number of pro bono cases before the Tenth Circuit Court of Appeals, co-chairing the Colorado Innovation Council, and serving as the lead agency reviewer for the Federal Trade Commission as part of the 2008 Presidential Transition. Another example of staff mobility is Prof. Brad Bernthal, the SFC's Entrepreneurship Initiative Director and Associate Professor of Law at the CU. His comprehensive academic work is complemented by mentorship at TechStars, which is the no. 1 start-up accelerator in the world (<http://www.techstars.com/program/>).

The Center for Innovation and Entrepreneurship at West Virginia University involves business executives in its activities. Some, such as the Vice President of a local IT company, come in to teach, others serve as judges in the various competitions and others are brought in on a regular basis as speakers. In November 2012, a speaker from BB&T, the largest bank in West Virginia, spoke about financing options for small business startups. In 2011, the Center brought in a WVU graduate who spoke about private equity development.

At ***StartX***, while the mentors, the administrative team, and the entrepreneurs are drawn heavily from the Stanford community, StartX is independent of the university. However, the level of informal interaction between the two organizations is high, as people in the StartX community are also part of the Stanford community, either as alumni or faculty. StartX has been able to recruit many people into its community through Stanford outlets, such as e-mails from organizations or at events related to the Stanford community. Many people within the university are aware of StartX. StartX mentors are also drawn from the university's faculty and these mentors play important roles in helping the companies during their time in StartX and even afterwards.

At ***Cogswell Polytechnical College***, most faculty members, especially in the Entrepreneurship & Innovation MA program, have strong industry experience and connections and a strong entrepreneurial background.

4.4.4 Lifelong learning in the US

At ***Colorado University***, lifelong learning opportunities are provided by the Division of Continuing Education, which offers a variety of programs⁶⁰, from courses for university credit, to career-boosting computer, technology and business classes. CU attaches great importance to expanding outreach, lifelong and distance learning programs and included these activities as one of the eight Core Initiatives of the CU's Strategic Plan *Flagship 2030 'serving Colorado, Engaged in the World'*

⁶⁰ See full overview of programs at University of Colorado "Programs" <http://conted.colorado.edu/programs/> Last accessed 13/02/2013

(<http://www.colorado.edu/flagship2030/downloads/flagshipsummary.pdf>) that aims to transform CU-Boulder into one of the nation's leading public research universities and a leading model of the "new flagship university" of the 21st century.

At the **University of Utah**, lifelong learning courses are managed by the Continuing Education Department, which offers a variety of academic classes, career classes and personal enrichment classes. In the career class category, Professional Education and Technology Education courses provide knowledge that is relevant to business, innovation and entrepreneurship and offer hands-on learning applicable in the real world.

SOU ran an Elderhostel program for senior citizens, from 1980-2010, which typically ran for six days, with three classes that each met for about 5-6 hours over the week, as well as attendance at three OSF plays.⁶¹⁶² SOU's relationship with the OSF Elderhostel program included OSF actors teaching the Elderhostel classes. The collaboration helped OSF fulfill its education mission while helping to improve the quality of SOU's Elderhostel program. SOU's Master of Theatre Studies in Production and Design, an "intensive, two-week program, aimed at theatre teachers at the high school and community college level,"⁶³ hires OSF staff members for half-day or full-day workshops. The guest lecturers are part of the graduate faculty list and come from referrals from faculty or from people at OSF. A big draw of this program was that students got to attend at least one OSF play. This benefits SOU since students are able to see a professional production while OSF benefits as the Master's program pays regular group ticket prices. While some of the guest lecturers work for the entire course, a regular professor remains the teacher of record. The program also hires an OSF actor who works on script analysis, leads a formal talk back for each play, and discusses the plays. This formal employment arrangement with an OSF actor leads to informal benefits, for example, through the actor's OSF network, guests from OSF also may appear at the talks. Another benefit for students are the backstage tours, for example, of the costume shop, and greater access behind the scenes, as when the artistic director took questions from students on a backstage tour during a rehearsal break.

4.4.5 Governance in the US

Silicon Flatirons Center's governance is closely tied to the advice received from various business people and entrepreneurs involved in the three SFC Advisory Boards:

- Silicon Flatirons Board (includes successful venture capitalists, top executives at publicly traded corporations, and partners at large law firms);
- IT & IP Advisory Board (includes leaders in the educational, entrepreneurial and legal communities); and

⁶¹ SOU also previously ran another similar program called Senior Ventures.

⁶² Stallman, "E-mail November 3, 2012".

⁶³ Southern Oregon University, "Ashland Center for Theatre Studies". <http://www.sou.edu/acts/> Last accessed 13/02/2013

- Entrepreneurship Advisory Board (includes law and business schools students and professors, venture capitalists, successful entrepreneurs, top executives at established companies and attorneys).

Technology Development Venture's EFS Executive Committee members are all serial entrepreneurs with outstanding results who combine academic research with entrepreneurial achievements. Also, the Lassonde New Venture Development Center is run by an accomplished local entrepreneur, with an Advisory Board made up of venture capitalists and inventor/entrepreneurs. Many of the David Eccles School of Business faculty members involved in Executive Education programs provide expert advice to Fortune 500 companies.

The West Virginia University Board of Governors includes quite a few business executives and the 30 members of College of Business and Economics Visiting Committee are from a wide variety of private sector companies.

Cogswell Polytechnical College is managed by a President, a Dean for Institutional Advancement, and a 12-member Board of Trustees, affiliated with the College, but also with companies like TOWONA Media Holding Company Ltd. and The Multiverse Network, Inc.⁶⁴ Palm Ventures, the private equity firm that acquired Cogswell College in 2010 has four members on the Board of Trustees.

4.4.6 Knowledge sharing and transfer in the US

The **OSF-SOU collaboration** has always been a two-way street that provides an excellent example of knowledge sharing and transfer. As OSF gained greater prominence relative to SOU's theatrical activities, the university was able to draw upon OSF personnel to augment its teaching resources. This has helped the competitiveness of SOU's Theatre Arts department over time. The formal educational links between the two institutions include the OSF staff members who serve as adjunct professors in SOU courses. Having OSF members as instructors at SOU allows students to be mentored by theatre professionals and to develop relationships with them. Thus, even students who do not get to intern with OSF are able to make connections with the festival. The relationship between the school and the festival is from years of working together and "the access is unimaginable."⁶⁵ OSF and SOU collaborate on activities including: SOU acting students having their own specific auditions; SOU students interning at OSF; SOU's hiring of OSF professionals; and OSF staff having access to the SOU library.

⁶⁴ Bloomberg Business. "Company Overview of Cogswell Polytechnical College" <http://investing.businessweek.com/research/stocks/private/people.asp?privcapId=13190425> Last accessed 13/02/2013

⁶⁵ Kaan, "Interview with Kate Torcom".

4.4.7 Engagement of academic staff and students in solving specific business problems in the US

The **Silicon Flatirons Center at Colorado University** has developed five initiatives that illustrate the deep engagement of its staff in solving specific business and policy problems:

- The Technology Policy Initiative⁶⁶ – in this framework, SFC attracts thoughtful policy leaders, legal and business professionals and entrepreneurs to discuss various technology policy issues. The Center's recent initiatives in this area include an Innovation Policy conference, a Patent Conference, a Health IT conference, and roundtable discussions on cybersecurity and cloud computing.
- The Privacy Initiative – addresses one of the most important issues in technology law and policy: information privacy. SFC aims to fill part of a great need for academic engagement and leadership and acts towards this purpose in several ways: (i) through scholarship and research, by housing more legal scholars who focus in a large part on information privacy than any other law school in the country and publishing the Journal on Telecommunications and High Technology Law; (ii) by holding conferences and roundtables on information privacy; and (ii) through student training and engagement, courses in information privacy law and research projects and seminar papers. Every year, many important names in information privacy visit the Law School, and they are often asked to engage with the students.
- The Energy Innovation Initiative⁶⁷ – in this framework, the SFC hosts conferences and roundtables and conducts research on such issues as the rise of the smart grid.
- The Public Safety Initiative⁶⁸ – reflects the SFC's concern for the needs and limitations of public safety communications with an eye toward breaking down institutional barriers that prevent public safety agencies from adopting the capabilities needed to make them effective and reliable.
- The Spectrum Policy Initiative⁶⁹ – reflects SFC's interest in wireless networking technology as the fastest growing segment in the US telecommunications market. SFC helps achieve these objectives by conducting interdisciplinary research that pulls together policy, electrical engineering, and computer science expertise, specifically by looking at the interaction of Information Systems and Social Systems.
- The SFC also sponsors the Institute of Regulatory Law and Economics (IRLE) as a means of supporting regulatory decision-making. In particular, the IRLE hosts an annual four-day

⁶⁶ Silicon Flatirons Center. "Technology Policy Initiative" <http://www.siliconflatirons.com/initiatives.php?id=techpolicy> Last accessed 13/02/2013

⁶⁸ Silicon Flatirons Center. "Public Safety Initiative" <http://www.siliconflatirons.com/initiatives.php?id=pubsafety> Last accessed 13/02/2013

⁶⁹ "Silicon Flatirons Center. Spectrum Policy Initiative" <http://www.siliconflatirons.com/initiatives.php?id=spectrum> Last accessed 13/02/2013

intensive seminar for educating state public utility regulators about economic analysis of regulatory policy issues, as well as engaging in state outreach activities. In so doing, it works with two related SFC initiatives described above – the Samuelson-Glushko Technology Law & Policy Clinic and the Hatfield Scholars & Research Program.

4.4.8 Changes in curricula as a result of UBC in Canada

The examples below present cases of curricular adaptation as the result of exposure to cooperation with businesses outside of the curriculum per se. For example, the curriculum is adapted in co-operative (co-op) education programs to include students' work placements in the course structure. The University of Waterloo is a flagship institution for co-op education, although other universities adopted it in other regions in the US and at English polytechnics. The University of British Columbia is also moving toward co-op education. The curriculum at the University of Waterloo places a key importance on student employability. Adjustments to courses are by university professors, rather than through the co-op education council, which formally has representatives from business and academic environments. Finally Waterloo's hiring process places a high emphasis on professors' abilities to adjust their curricula to the need for employability. Some of the entrepreneurial ideas and methods developed in Ryerson's Digital Media Zone feed into the curriculum. ICT programs in particular encourage collaboration, rapid prototyping and client relationships.

Curricular influence is also noticeable in the case of NovaNAIT. NAIT created its first Bachelor's degree program (B. Tech in Technology Management) in the mid-2000s. Students complete an eight-month capstone project in their final year; and a result, there was suddenly a much larger demand from within the institution for applied research projects. These collaborative applied research projects may require an adaptation of the curriculum by the faculty in order to accurately prepare students. The incorporation of changes in curricula has been comparatively slow because of the need to change collaborative agreements in order to reflect different workloads under the new arrangements, and because faculty were initially resistant to change (NAIT seeing itself as a teaching rather than research institution). The requirement placed on deans to expand applied research in their respective faculties, and to choose new hires as part of their capacity to work on applied research, favours the context necessary for curricular adaptation.

4.4.9 Entrepreneurship education and promotion in Canada

UBC is also concentrating on developing entrepreneurship across the University. Entrepreneurship@UBC, a project set up by various faculties (Faculty of Applied Science, the Sauder School of Business, the Faculty of Science, along with the UILO, the Faculty of Arts and student entrepreneurship clubs on campus, aims to nurture and foster the nascent student entrepreneurship culture at UBC, and to assist in the growth of start-up SMEs. Ryerson's DMZ also promotes entrepreneurship, by providing support for new businesses in its business incubator/accelerator space.

4.4.10 Mobility/placement and internship of students in Canada

Mobility/placements and internships of students are an important part of co-op education, developed at Waterloo and planned at UBC. Students enroll in classes in the normal way for the first four or eight months of their program. Thereafter, they alternate between one semester in work and one semester in school (including over the summer semester) for another four years. The typical co-op program lasts for five years, and includes eight semesters of academic work and six work terms. UBC also seeks to develop co-op education, for example with smaller companies working with a Master's student for a summer.

4.4.11 Knowledge sharing and transfer in Canada

PTRC aims to share and transfer knowledge to companies who pay the membership fees. PTRC respects 'curiosity driven research', but may also gather teams from across different research areas and institutions in order to respond to a member company's research proposal. The University-Industry Liaison office of the University of British Columbia also aims to share and transfer knowledge through its various activities (patenting and licensing/spin-offs and contracting). Interested businesses, largely the high-tech community of British Columbia, are particularly interested in accessing the research infrastructure at the University of British Columbia. The university also represents the major new stream of scientific talent for businesses in the region.

4.4.12 Applied innovation and involvement of academic staff and students in solving specific business problems in Canada

NovaNAIT manages applied research for companies (on the side of its incubator), and hence provides applied innovation and involves academic staff and students in solving specific business problems. Applied research includes partnerships with local small and medium enterprises in which faculty, staff

or students collaborate with an enterprise in solving a problem of relevance to that business. (NAIT was among the institutions in the forefront of this process). Incubator companies, supported by NovaNAIT, are also encouraged to collaborate with faculty, staff and students working in the same field (they are charged at cost, rather than a market rate, if they wish to make substantial use of the institutions' facilities as part of their start-up activities).

PTRC also includes applied innovation, where companies contact PTRC to commission applied research projects. Ryerson's DMZ facilitates applied innovation through its innovator/accelerator program.

4.5. Objectives and benefits of UBC

An overall assessment of the **objectives of UBC in the US** case studies reveals two broad categories:

- **“Internal” objectives** focused on strengthening the research and education capacity of the university, while benefitting both students and faculty:
 - **In regard to students**, objectives include introduction of new experiential learning programs, provision of new business management and entrepreneurial skills, leadership and creative thinking capabilities, inclusion in joint research projects with business partners, increased exposure to and connections with prospective employers through mobility placements and internships, broader opportunities for employment arising from broader skill sets, independent and creative mindsets, support for start-up formation by students and student employment in university start-ups, etc.
 - **In regard to faculty**, objectives include exposure to real-world business problems and collaboration with business partners to advance the academic research agenda, promotion of interdisciplinary research, raising of research funds to support the academic labs, recruitment of new professors from the business and/or entrepreneurial community, provision of business management and entrepreneurship skills to faculty and support for start-up formation by faculty, etc.
- **“External” objectives** focused on strengthening the links with the local and regional community, including business firms, government agencies, professional associations, entrepreneurs, venture capitalists, etc. These local actors are not only potential employers for students and collaborators for the academic staff, but they are also an important source of knowledge and expertise to tap for bringing real-world expertise to the classroom, for solving specific problems of the community and for connecting the university to broad networks of partners.

More insights into specific objectives for UBC in the US case studies are provided in Table 8 below.

Table 8 – Objectives for UBC in the US case studies

MIT TLO	<ul style="list-style-type: none"> Foster commercial investment in the development of inventions and discoveries flowing from the research at the MIT research, through licensing of the intellectual property
MIT MTC	<ul style="list-style-type: none"> Foster and develop MIT's entrepreneurial activities and interests in three primary areas: Education and Research (educational courses and executive programs powered by MIT's technology and business research), Alliances (business and technology partnerships for commercializing breakthrough academic research) and Community (a network of academic, government and industry leaders around the vision of entrepreneurial success)
MIT Desh	<ul style="list-style-type: none"> Increase the impact of MIT technologies in the marketplace by providing a sustainable source of funding for innovative research and guidance to help it reach the marketplace
CACT	<ul style="list-style-type: none"> Promote the research interests and capabilities of faculty through industrial collaborations Help New York State companies retain and create jobs, increase their productivity and boost their profitability through research in advanced ceramic materials and processing
FIT School of Graduate Studies	<ul style="list-style-type: none"> Provide students with the expertise and confidence to make significant, creative contributions to their professional environments Foster leadership and innovative thinking through scholarship, research, and professional development Act as an interdisciplinary center of academic and creative excellence that anticipates the evolving needs of the communities, industries, and institutions it serves Conduct research in the creative industries and foster collaboration between leading professionals, faculty and students Strengthen FIT as a Creative Hub and its mission and organizational structure to provide professional level education
FIT School of Business and Technology	<ul style="list-style-type: none"> Recruit professors who bring real-world insights and expertise to the classroom Ensure up-to-date curricula in rapidly changing fields Make use of New York City's vast business resources and visiting top-level fashion and cosmetics companies, manufacturing firms, advertising agencies, showrooms and retail stores
TVD	<ul style="list-style-type: none"> Provide funding for faculty's productive research without compromising the academic freedom to choose own research themes Expose academic researchers to real-life problems of industry and business firms that they wouldn't encounter in the absence of industry-sponsored research Provide business management and entrepreneurship skills to faculty and students Match the industrial relations of the faculty with the support from the university which manages the research contracting services

CIE-WVU	<ul style="list-style-type: none"> • Provide best education for students through experiential learning, opportunities to work with businesses, provide business skills to non-business degree students • Increase employment opportunities for graduates through contacts with businesses • Solve problems for private industry and state and local governments • Contribute to the community and create closer ties with state economic development efforts to create the conditions necessary for reciprocity • Raise money for the Center to become self-sustaining
SFC	<ul style="list-style-type: none"> • Realize the university objective to become a convening platform for congregations of innovation actors at local, national and international level • Aggregate local community support for university start-ups and reinforce SFC's role as a catalyst of collective entrepreneurship and contributor to local socio-economic development • Help students become more attractive for employers and more prepared for building their own careers as entrepreneurs, by developing their entrepreneurial skills and mindset
CPC	<ul style="list-style-type: none"> • Improve student education and employability, attract new students
StartX	<ul style="list-style-type: none"> • Provide entrepreneurial education to teams of entrepreneurs (including Stanford undergrads to PhDs, postdocs, alumni and professors in any discipline) to accelerate the development of the highest-potential Stanford founders through collective intelligence and experiential education
OSF-SOU	<ul style="list-style-type: none"> • Increase internship opportunities and employability of SOU graduates and alumni

Note:

CACT: Center for Advanced Ceramic Technology at Alfred University

FIT: Fashion Institute of Technology's School of Graduate Studies and the Jay & Patty Baker School of Business and Technology

TVD: Technology Venture Development at University of Utah

SFC: Silicon Flatirons Center for Law, Technology and Entrepreneurship at Colorado University Law School

CIE-WVU: Center for Innovation and Entrepreneurship at West Virginia University

UMKC-KF: University of Missouri-Kansas City and the Kauffman Foundation

CPC: Cogswell Polytechnical College

StartX: StartX at Stanford University

OSF-SOU: Oregon Shakespeare Festival and Southern Oregon University

The **benefits** derived from UBC in the US case studies are manifold, and have been reported for all the stakeholders involved, from students and faculty to business partners and the local community. Table 9 below summarizes these benefits.

Table 9 – Benefits of UBC in the US case studies

Institutions	Students	Faculty	Business	Community
CACT	<ul style="list-style-type: none"> • Access to an Associates program that provides funding for hiring students. • Participation in faculty/business research projects 	<ul style="list-style-type: none"> • Research funding, cutting-edge facilities and equipment 	<ul style="list-style-type: none"> • Job creation, sales increases, cost savings, quality research, access to state-of-the art equipment and testing 	<ul style="list-style-type: none"> • Economic benefits: state development
FIT School of Graduate Studies	<ul style="list-style-type: none"> • Internships, • Access to one of the best museums, with regular exhibits, public programs, at least one major symposium every year • Practical hands-on experience in the exhibition and fashion and textiles programs 	<ul style="list-style-type: none"> • Recruitment of industry professionals to teach, updates on the latest technologies and new trends, consulting opportunities • 	<ul style="list-style-type: none"> • Industry professionals teaching at FIT as adjunct help develop the next generation of leaders in the creative industries and learn about the newest thinking and trends among young people • Executive training offered by the school to company employees • Access to skilled workers for the garment industry • Access to graduate interns working on particular projects, bringing new ideas and new knowledge 	<ul style="list-style-type: none"> • NYC galleries and museums, have a lot of graduate students to choose from for internships and employment • One of the best fashion museums in the world and public events sponsored by the school and its business partners
FIT School of Business and Technology	<ul style="list-style-type: none"> • Internships and other collaborations with industry professionals that improve the employability of graduates 	<ul style="list-style-type: none"> • Updated information for teaching, • Give students the opportunity to interact with industry people who can inspire and hire them. 	<ul style="list-style-type: none"> • Courses for industry marketing or finance executives to the School to get more specific expertise. • Access to potential future employees • New ideas from students who work with them on particular projects 	<ul style="list-style-type: none"> • NYC galleries and museums have a lot of students and graduates to choose from for internships and employment. • One of the best fashion museums in the world and public events sponsored by the school and its business partners.
CIE-WVU	<ul style="list-style-type: none"> • Multi-disciplinary programs and 	<ul style="list-style-type: none"> • Additional funding source for 	<ul style="list-style-type: none"> • Expertise from the Center in 	<ul style="list-style-type: none"> • Economic benefits from

	<p>training in entrepreneurship and small business creation and management</p> <ul style="list-style-type: none"> • Funding for business and app ideas • Direct experience with businesses who are also potential future employers • Contribute to solving community and business problems 	<p>the College of Business and Economics, WVU by taking students from outside the College</p> <ul style="list-style-type: none"> • Opportunity to contribute to solving community and business problems • 	<p>areas in which the company has additional opportunities, but not the internal expertise to develop them</p>	<p>graduates who have participated in the Center's activities, and businesses that are started and/or strengthened by collaboration with the Center.</p>
TVD	<ul style="list-style-type: none"> • Entrepreneurial skills, theoretical and practical experience in developing a business, • Possibility to find a job and to work with companies through various internships 	<ul style="list-style-type: none"> • Research funding for academic projects, • Stability of the research labs and continuous engagement of students employed by the lab • Easier management of industry funding compared to funding from national or regional government programs 	<ul style="list-style-type: none"> • Strong focus on and support to university spin-offs • Access to university graduates and student interns 	<ul style="list-style-type: none"> • Economic benefits: job creation, tax revenues from university start-ups • Social and cultural benefits: positive social perception of entrepreneurs, stronger bonds between the university and the community, increased attractiveness of the university and the region to national and international talent and investors
SFC	<ul style="list-style-type: none"> • New ways of learning • Achieving an entrepreneurial mindset as an additional asset in approaching careers • Contact with real world challenges 	<ul style="list-style-type: none"> • Greater responsiveness to the needs of local business and entrepreneurs • Research funding from companies and alumni giving greater economic viability of academic projects 	<ul style="list-style-type: none"> • Access to academic expertise, graduates as interns and future employees, to latest ideas and trends in their respective fields, ability to intervene in policy-making debates 	<ul style="list-style-type: none"> • Access to university knowledge and expertise
UMKC-KF	<ul style="list-style-type: none"> • Access to a stronger entrepreneurial program at UMKC made possible by KF grants 	<ul style="list-style-type: none"> • Recruitment of faculty for UMKC • Work with KF an access to KF resources 		<ul style="list-style-type: none"> • A legal services clinic for entrepreneurs at UMKC – entrepreneurs receive access to legal assistance pro-bono

	<ul style="list-style-type: none"> • Law students work in the legal services clinic under the supervision of faculty who are licensed attorneys 	<ul style="list-style-type: none"> • KF grants for partial salary support of professorships at IEI • KF grants for academic research and education in entrepreneurship, and for a stronger entrepreneurial program at UMKC 		
StartX	<ul style="list-style-type: none"> • Access to accelerated entrepreneurship education, Stanford professors and alumni, mentors • Access to fundraising from Silicon Valley investors, and entrepreneurs 	<ul style="list-style-type: none"> • Faculty and mentors can help firms with their strategy and help StartX recruit other mentors • Mentors learn from the mentee StartX firms, keep in touch with Stanford entrepreneurial community, keep informed of new technologies 	<ul style="list-style-type: none"> • Venture capital firms and strategic investors look at StartX companies for valuable new ideas with high commercial potential and talented individuals 	<ul style="list-style-type: none"> • Valuable assistance to entrepreneurs going through the program, by pointing them to investors, government grants and to earmarks, learning from speakers, mentors and trainers
CPC	<ul style="list-style-type: none"> • Access to industry professionals and real-life projects for digital media industry • High employability rate 	<ul style="list-style-type: none"> • Credibility as a top higher education institution in the Bay Area and nationally, access to high-quality faculty and advisory boards. 	<ul style="list-style-type: none"> • Opportunity to teach in the College's entrepreneurial classes, develop real-life projects with students and staff 	
OSF-SOU	<ul style="list-style-type: none"> • Theatre education and employment opportunities 	<ul style="list-style-type: none"> • Recruitment of SOU teachers 		<ul style="list-style-type: none"> • Economic benefits: OSF is an engine of economic regeneration for the SOU, Ashland and the region. Ashland turned into an arts, theatre and tourism town from a market and transportation hub • OSF and SOU are the largest employers in Ashland

				<ul style="list-style-type: none">• Cultural benefits: OSF has grown into a national cultural phenomenon, paving the way for other theatre companies to succeed as well
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Note:

CACT: Center for Advanced Ceramic Technology at Alfred University

FIT: Fashion Institute of Technology's School of Graduate Studies and the Jay & Patty Baker School of Business and Technology

TVD: Technology Venture Development at University of Utah

SFC: Silicon Flatirons Center for Law, Technology and Entrepreneurship at Colorado University Law School

CIE-WVU: Center for Innovation and Entrepreneurship at West Virginia University

UMKC-KF: University of Missouri-Kansas City and the Kauffman Foundation

CPC: Cogswell Polytechnical College

StartX: StartX at Stanford University

OSF-SOU: Oregon Shakespeare Festival and Southern Oregon University

The **objectives of UBC for the Canadian case studies** include raising funds, launching new and innovative companies, contributing to regional growth by remedying the lack of advanced technical talent or developing world-leading technologies and economic sustainability. In the case of NAIT, NovaNAIT seeks to achieve diversification by involving more schools in more applied research contracts, the engineering and technical schools being close to capacity (see Table 10 below).

Table 10 – Objectives of UBC

UBC	Raise funds
NAIT	Cooperate with a larger number of schools and faculties in order to continue to grow. Achieve better student outcomes through a modification of curricula in order to improve applied learning and contribute to the regional economy
PTRC	Develop world-leading technologies and processes to ensure that the recovery of Canadian hydrocarbon resources is environmentally and economically sustainable for the benefit of stakeholders. Raise funds
Ryerson	Create a successful digital media incubator capable of launching new and innovative companies created by Ryerson students and alumni
Waterloo	Improve student outcomes and remedy a lack of advanced technical talent, seen as a major factor hampering regional growth

Benefits

UBC benefits students, faculty, businesses, the community and universities. (Businesses include companies established outside of the University nexus). Benefits of start-ups or companies created through the university or UBC are listed as benefits to students.

Table 11 - Benefits of UBC in Canada

Institution	Students	Faculty	Business	Community	University
UBC	<ul style="list-style-type: none"> Access funds for business ideas through Entrepreneurship@UBC 	<ul style="list-style-type: none"> Help with maintenance of research infrastructure and better research 	<ul style="list-style-type: none"> Access to state-of-the-art research infrastructure 	<ul style="list-style-type: none"> Increased economic activity 	<ul style="list-style-type: none"> Develop better receptor capacity and more
NAIT	<ul style="list-style-type: none"> Students involved in practical problem 		<ul style="list-style-type: none"> Recruit talent at competitive prices 	<ul style="list-style-type: none"> Develop the regional economy Retain high value jobs 	<ul style="list-style-type: none"> Raised funds Increased institutional reputation Improve student outcome through changes in the curriculum
PTRC		<ul style="list-style-type: none"> Access to funding 	<ul style="list-style-type: none"> Recruitment tool by working with students Competitively priced research services 		<ul style="list-style-type: none"> Raise funds
Ryerson	<ul style="list-style-type: none"> Exposure to businesses 		<ul style="list-style-type: none"> Recruit talent Find solutions even prior to companies leaving the incubator Access to competitively priced services 		<ul style="list-style-type: none"> Increased reputation Improvements to curriculum
Waterloo	<ul style="list-style-type: none"> Wage premium while in school of between 20-70% compared to other students increased employability upon graduation, and wage premium in the first couple of years after graduation 		<ul style="list-style-type: none"> Find quickly operational recruits 	<ul style="list-style-type: none"> Diffuse entrepreneurial spirit Densest university-business cluster in Canada 	<ul style="list-style-type: none"> Increased reputation Development of alumni base which contributes back to university (e.g. RIM founder Mike Lazarides, who created the Perimeter Institute for Theoretical Physics,

	<p>compared to non-co-op graduates in their fields (interestingly, the advantage is strongest among students in the social sciences)</p> <ul style="list-style-type: none"> • Increased engagement in learning according to surveys conducted under the rubric of the National Survey of Student Engagement (NSSE). 				a collaboration with the University)
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4.6. Drivers and barriers for UBC

UBC in the US case studies appeared to be driven by several **drivers**, including:

- **Availability and stability of financial resources:** This driver has been mentioned as important in all case studies, which benefit from funding from various sources, including state and federal government, the university, business companies, alumni, foundations, venture capitalists, local entrepreneurs, etc. – see “Financial resources” in section 4.2.3 for details.
- **Availability of excellent human resources (students, faculty, mentors, alumni, local entrepreneurs):** This driver has been mentioned as crucial for MIT’s success, but also by CACT, StartX and Cogswell Polytechnical College. Hiring people with significant business experience was listed as a significant factor for CACT, where the Deputy Director is an expert in business development and sales with a long career in the private sector. He carries out the marketing and other outreach activities, while the Director, a scientist, works with the university researchers and partner companies on content and organization of the projects. Most of Cogswell’s faculty members have strong industry experience and connections, in particular the faculty involved in the Entrepreneurship & Innovation MA program. Also, the mobility of faculty between university and business has been mentioned as important at FIT’s Jay & Patty Baker School of Business and Technology, where the Dean highlighted the fluidity of adjunct and regular faculty movement between the School and the businesses that they are working with and emphasized the opportunities that those connections bring to students. A particular aspect of this driver is the presence of institutional champions, who played a key role in the development of Technology Venture Development at the University of Utah and of the Silicon Flatirons Center for Law, Technology and Entrepreneurship at Colorado University. For example, the creation of the Technology Venture Development Office was supported by Michael Young, who served as President of the University of Utah from August 2004 to May 2011 (after which he became President of the University of Washington). Under President Young’s leadership, the University of Utah raised its stature nationally and internationally, becoming the nation’s no. 1 university in terms of new start-ups commercializing university research, significantly raising the academic profile of the student body, expanding international education and building more than two million square feet of new research and teaching facilities. Many of these achievements were made possible by increasing sponsorships by private donors, which more than doubled in number during President Young’s tenure⁷⁰. Another institutional champion for Tech Ventures was Jack Brittain, the Tech Ventures Vice-President, whose vast academic and entrepreneurial experience had a crucial role in Tech Ventures’ success. At the Silicon Flatirons Center, the

⁷⁰ University of Washington, President Biography. <http://www.washington.edu/president/biography/> Last accessed 13/02/2013

key institutional champion is the SFC founder and Executive Director, Dean Phil Weiser, who acted pretty much on his own in leading the Center in the first five to six years of SFC operation and was later joined by the two SFC directors Brad Bernthal and Paul Ohm, as well as by some people from the local community, like Brad Feld, who is involved in several activities of SFC.

- **A favorable geographical environment for education, research, innovation and entrepreneurship:** This driver has been mentioned as particularly important in the case of StartX and the Silicon Flatirons Center, who are located in the vibrant innovation and entrepreneurship ecosystems of Silicon Valley, and of Boulder and of the Colorado state, respectively (see “stakeholders” in section 4.2.1 for details on the attractive environment of Boulder and Colorado state). The geographical proximity of industries and potential donors has facilitated the transfer of knowledge, as exemplified by the UMKS-KF collaboration. In this case, the close proximity of the two organizations makes attending events, having meetings, and working together easier. Proximity also played a key role in the case of OSF-SOU, so that SOU does not have to compete with other universities for a relationship with OSF.
- **Regional development needs:** Some case studies emphasized the regional economic development needs as a strong driver for the development of their UBC. For example, CACT mentioned the important role of the urgent development needs of New York State and the potential offered by the collaboration to retain and create jobs and increase industrial profitability. Also, the Fashion Institute of Technology felt that its position in the fashion industry itself that is centered in New York City accelerated the development of its collaborative links, as the fashion industry needs large numbers of qualified graduates to employ and a reputable institution where their executive staff can receive further training. The industry's drive to find the newest trends also pushes it into collaboration with the two FIT Schools and their students and faculty. The Center for Entrepreneurship and Innovation at West Virginia University sees itself as playing a role in regional development and has created some of the new activities to better fulfill this role. Regional development needs have also been mentioned as an important driver at the Silicon Flatirons Center, considering SFC's strategic institutional policy to turn the university into a local convening platform for local and regional innovators.
- **Institutional culture of collaboration, research, entrepreneurial education and technology commercialization, fostered by institutional history:** This driver has played an important role for MIT, which has a unique history and institutional goals to bring science to industry and agriculture and to learn by doing – “Mens et Manus” (mind and hand). These goals contribute to the institution's fascination with using technology to solve real world problems. Faculty have been consulting and working on industrial problems since 1865 and

have been spinning off companies since the 1950s. Faculty, staff and students all echo the conviction that innovation and entrepreneurship are in MIT's institutional DNA and they share none of the ambivalence about business that typify many institutions whose original mission was to educate affluent young men. A similar importance to this driver is given at CACT, which has a hands-on research culture that pervades all levels of education at Alfred University, coupled with a long history of collaboration with industry. Research at Alfred is very responsive to industry needs and the most recent example of this is its establishment of a Center for High-Temperature Characterization of Materials that will analyze new materials and their characteristics as a step towards the development of new products. Also, FIT culture, born of its needle trade roots, supports the flow and exchange between university and business in terms of people (students and faculty) and ideas. FIT and its Schools strongly believe that such exchanges add to the educational process. The Center for Innovation and Entrepreneurship at West Virginia University places a strong focus on the institutional culture of cooperation with business, which receives full support from the administration (e.g. the Dean of the College of Business and Economics and one of the Associate Deans who is responsible for outreach and is always on the lookout for opportunities to connect with the community, businesses, non-profit organizations) and from state and local government agencies.

Barriers to UBC highlighted in the US case studies include:

- **Differences in research approach and priorities in intellectual property approach, lack of adequate infrastructure and facilities.** Research capacities and priorities may be different between parties, as was the case in the cooperation between Kaufman and Missouri Kansas City. There may also be a lack of adequate infrastructure and available facilities for the needs of businesses, as pointed out in the case of StartX (which lacks the wet lab space for biotech firms for example), or a break in resource sharing, as was the case for the Oregon Shakespeare festival because of intellectual property issues.
- **Financial resources, the conditions attached to funding and financial sustainability were also considered as a barrier.** Very early development stage of inventions require additional funding by venture capital investors for the further development of technologies before licensing for example. This has been mentioned by MIT's Technology Licensing Office as an obstacle that prevents the TLO from licensing faculty/student discoveries immediately. In response, the TLO helps inventors identify venture capital companies to finance start-ups where the additional development can be done. Financial sustainability has become an issue particularly in the context of the economic crisis and the resulting cutbacks that many companies have been forced to make.

The Director of MIT's Deshpande's center has a goal of raising \$40 million over the next five years, of which he had raised only about \$5 million up to October 2012. CACT responded to the situation by setting up an spending strategy and balancing its portfolio between more profitable larger companies and more interesting smaller companies. It also moved away from a membership collaboration model in which industrial partners pay membership dues that grant them access to certain kinds of research, to a project model that allows them to sell their capabilities in areas that are of interest to their faculty members. CACT also relies on a few partners who provide a blanket purchase order for a certain amount that they spend against throughout the year. The Center for Innovation and Entrepreneurship at West Virginia University also mentioned the time and resources necessary to do the outreach necessary for each program as the main obstacle facing the Center. About \$250,000 will be needed to support all of these initiatives over and above what the college provides. Strategies that the Center uses to overcome these barriers/obstacles include: starting new initiatives, finding like-minded people and structuring programs to meet the objectives of other stakeholders (such as the venture capitalist mentioned above) that also fulfill the Center's goals to increase funding opportunities.

- **Adequate infrastructure facilities:** This obstacle was highlighted also by StartX, who felt they were facing a partial lack of fit between the need of biotech entrepreneurs and the facilities that StartX has available. The StartX office space is amenable to the needs of software and internet firms, but lacks the wet lab space required by biotech firms. Nevertheless, several nascent biotech firms have gone through the StartX process, and StartX is trying to better assist these entrepreneurs through initiating the StartX Med program. StartX saw that life sciences/research and healthcare companies needed a longer amount of time to incubate and required different mentors as well, so they took action to address these issues through StartX Med, including making the StartX Med program six months instead of three months.⁷¹
- **Lack of centralization of UBC activities at the administration level:** This issue was raised by some in FIT's School of Graduate Studies, who felt that the School, and FIT in general, do not have a robust office of sponsored research and that the patenting and licensing of research does not exist yet in the form it needs to. The School is beginning to build the infrastructure for this, using some of the recommendations that were in an earlier consultant's report about the Creative Hub, as well as the services of some of their faculty members who are legal experts in the area of fashion. The School's collaboration activities were deemed to be all over the place, and while this lack of centralization is working as

⁷¹ Geron, "StartX Expands Stanford Accelerator With StartX Med". In: Forbes Magazine <http://www.forbes.com/sites/tomiogeron/2012/05/31/startx-expands-stanford-accelerator-with-startx-med/> Last accessed 13/02/2013

demonstrated by its plethora of activities, there are those who feel that it could be brought into focus around the idea of the Creative Hub, without smothering its dynamism.

- **Faculty attitude towards academic entrepreneurship:** At the Technology Venture Development office, faculty opposition to academic entrepreneurship embraced many forms in the early days of the UBC, all being rooted in various fears of losing control over their research: fear of industry influence over their research direction, fear of industry forcing a delay in publication of the joint research results, fear of industry having information deleted from papers prior to publication, and fear of refusal to share research results upon request. Eventually, none of these potential threats turned out to be true in practice, which showed that faculty only feared what they did not know. Once they started to gain experience in collaborating with business partners, the university was able to use faculty peer-to-peer advising and training to address questions and keep fears in check. At the Silicon Flatirons Center FC of Colorado University, the inertia of the academics' status quo was mentioned as an obstacle to the development of collaborative links with industry, which was also combined with a certain skepticism accumulated in the local business community vis-à-vis the university engagement with companies. Prior engagement efforts of the university didn't come to fruition and the university's entrepreneurial efforts were seen as a fundraising vehicle, without offering much in exchange. This brought to the fore a fundamental question for the university: how can the CU best serve the community, and how can trust and belief in the CU's capacity to serve the community be built, especially as these efforts require a longer time frame (10-20 years) to be realized. Another barrier was the lack of university incentives for rewarding spin-off creation by academics in the process of getting tenure. Therefore, the university entrepreneurship efforts didn't target the pre-tenured professors as much as the students and the involvement of local entrepreneurs in various events organized by the university and teaching of entrepreneurship classes.
- **Availability of experienced human resources:** This obstacle was mentioned by MIT's Martin Trust Center, who faced difficulty identifying academic faculty members with real business experience.

In **Canada**, the key **drivers** emerging from the study are the following:

- **Ensuring sustainable financial resources and research infrastructures**, i.e. the possibility to raise funds and access the latest research infrastructure funded by the federal government was a driver for UBC at the University of British Columbia, as well as for PTRC, which obtained approximately \$10 million from the federal government in 2008, and NovaNAIT and the University of Waterloo, who have a pool of alumni who give back to the university. Conversely, faculty collaborated with businesses in order to be able to maintain and sustain such infrastructure. Accessing the latest research infrastructure funded by the

federal government was a main driver for businesses at UBC. Conversely, faculty collaborated with businesses in order to be able to maintain and sustain such infrastructure.

- **Availability of human resources:** The tech sector is relatively small, and the University of British Columbia represents the major new stream of scientific talent for the region, seeking to increase the supply of businessmen who are savvy in science and technology. Working on projects which involve University of British Columbia graduate students is thus an easy way for businesses to gain early access to new talent “coming on the market”. Hence, UBC is, to some degree, about talent-scouting. Availability of human resources is also a driver for businesses in the case of the DMZ at Ryerson, which seeks to expand the business skills of scientists and high-tech researchers. An increasing number of Fortune 500 companies are coming in addition to the existing small and medium size companies for recruitment purposes and looking for cheaper alternatives to the kinds of solutions on offer from major consulting firms. Businesses interested in the PTRC of Regina University are also driven by the availability of human resources.
- **Development of a university-business nexus:** Waterloo is located within and contributed to the densest cluster of university-business connections of any institution in Canada. This led to a pool of potential collaborations between individual professors and industry contacts; most people within the university credit this as having a direct bearing on the university’s success in tech transfer. Other universities, including UBC and Ryerson, also aim to increase the density of networks across the university-business divide to create an innovation ecosystem around the university. They believe in the positive externalities created by such cooperation (a better set of intellectual and commercial opportunities for academic staff, which improves both the university’s hiring prospects and its academic productivity).

In terms of **barriers** emerged from the Canadian case studies, the following emerge:

- **Institutional resistance internal and external to the university:** The resistance of some institutional actors to setting up UBC can act as a barrier. For example, the co-op education program was originally resisted to by most Ontario universities, who claimed that co-op education would undermine the student’s education, even if the idea was supported by the local community and big businesses in Southern Ontario. Faculty may be resistant to the costs of setting up UBC given that their promotion relies on publications more than supporting industry partners to use research to develop technological advantage, as mentioned in the case of NAIT, where the faculty is relatively resistant to embrace applied research for undergraduates.
- **Competitive pressures:** Businesses traditionally have various competitive pressures. Convincing businesses of the need to cooperate by contracting out-of-house research, rather than in an in-house service, may also be challenging, as underlined in the case of PTRC (in

the case of PTRC, medium-size companies invest in research for non-mission-critical, process-type research because they are limited in doing such research internally). Competitive pressures between in-house and contracted research can be a barrier to cooperation. The emergence of new players, such as the federally-funded Centers of Excellence in Commercialization of Research (CECRs) which aim to bring science to a particular area and help with the commercialization process, also introduced some competitive pressures, with university services offering a liaison with businesses, such as the liaison office at the University of British Columbia. However, in this case, the university saw the emergence of CECRs as complementary rather than competing.

- **Absorptive capacities in the local economy:** At the University of British Columbia in particular, there was little absorptive capacity for scientific research in the local economy, given that the region concentrates on relatively low-tech industries. The local economy, although it evolved in the mid-1990s, held these back, has a limited pool of venture capital for non-natural resource ventures, and also a limited pool of talented managers who could take a start-up and turn it into a sustainable mid-size company.
- **Availability of sustainable funding:** UBC relies on available funds. For example Ryerson's DMZ can only continue its activities and growth with continuous university funding. The location of the DMZ, in an expensive real estate zone, limits the institution's ability to provide a contiguous space. The costs of maintaining the co-op program, which fall entirely on the University of Waterloo, also constituted a significant constraint in Waterloo. The institution has to offer many more course sections, spread out over the full calendar year. Each co-op student costs roughly 18% more to teach than a non-co-op student, in addition to the costs of maintaining the institution's physical plant.
- **Availability of spatial and human capacity:** The incubator of NovaNAIT is limited in its growth by space constraints. The institution has experimented with a "virtual incubator" (i.e. providing companies with all the business services and mentorship services but no physical space) to overcome the problem. The availability of researchers may also be a constraint. Demand for industry project is so high at NAIT that there is in effect a waiting list for projects. NovaNAIT is seeking to establish collaboration with further schools in order to increase human capacity.

Misalignment of ways to do research, infrastructure, or needs and resources which affect the sustainability: Research universities conduct research based on curiosity, with relatively long time-frames, while research in large organizations is carried out in a fairly regimented fashion and tends to be timely at the University of British Columbia.

4.7 Impact of the cooperation

On an overall analysis of the impact of UBC reported in our US case studies, we can identify two broad types of impact:

- An “internal impact” on the university, faculty and students:** In terms of **Impact on the university**, arising from commercialization of university research and technologies and the revenues it generates to the university. This impact is particularly relevant in the case of very high research-intensive universities, such as MIT, where it is quantified by specific indicators (e.g. number of invention disclosures, number of patents filed and issued, number of licenses granted, number of companies started, etc). 2011 statistics show that, overall, MIT produced more patent applications than any other single university in the world, and has earned \$147.5 million in cash income: \$54.09 million from royalties, \$10.43 million from patent reimbursements and \$2.75 million from equity cash-ins⁷². The Martin Trust Center monitors the number of graduates who start companies, thanks to the Shingle Project that collects information on companies started by MIT graduates.⁷³ Since 2002, the Deshpande Center has funded more than 90 projects involving more than 300 faculty members and their students with over \$11 million in grants. About a quarter of the projects (26) have moved their technology to an outside venture, in most cases in the form of a start-up company in which the innovators are engaged, having collectively raised over \$350 million in outside financing. Together the companies have more than 400 employees. The commercialization of university research and technologies is also very important at the University of Utah's Technology Venture Development. UBC turned the university into a research funding generator: as the University is the sole owner of the patents generated by its research, it receives royalty income (about 3-4%) from the product sales of its start-ups. The university also owns a small percentage of equity in these companies. Impact is quantified by a variety of indicators (e.g. total research funds, number of university inventors, number of intellectual property disclosures, number of students involved in commercialization and innovation, number of technology licenses executed, total revenues from commercialization, number of start-ups, number of jobs created at state level, amount of tax revenues for the local economy, etc.) that are made available in publications like the annual surveys of the Association of University Technology Managers (AUTM), reports of the Eccles School of Business or the Tech Ventures Annual reports (see the 2011 Annual report⁷⁴ and the 2012

72 “TLO Statistics for Fiscal Year 2012” http://web.mit.edu/tlo/www/about/office_statistics.html Last accessed 13/02/2013

73 People sign on to this voluntarily, so there are certainly companies missing.

74 Tech Ventures 2011 Annual Report, p. 5.
<http://content.yudu.com/Library/A1tbz4/2011AnnualReportTech/resources/index.htm?referrerUrl=http%3A%2F%2Fwww.techventures.utah.edu%2Fnews%2F2011%2F08%2F2011-annual-report-released%2F> Last accessed 13/02/2013

Annual report⁷⁵ for an overview of recent performance indicators). At CACT, patenting and licensing activities have a much lower profile – one patent and some potential licensing agreements so far, and the creation of spin-offs and start-ups was never the point. Also at FIT, the work on patents and licenses remains limited, but there have certainly been some start-ups by faculty and students, though statistics have not been collected. In terms of start-ups by FIT alumni in general, there are 16 of them on AngelList.com, a website that brings together start-ups and investors.

Impact on faculty and students: MIT Martin Trust Center monitors how the Center is being received by students by keeping track of the number of students in its classes and the number of wealthy alumni who make donations. The impact for students is measured by tracking the post-graduation activities of those who graduate with the minor and the number of start-ups created by Business Plan Competition winners. The latter are monitored on an annual basis. Winners of the Business Plan Competition have started 27 businesses over the last 10 years throughout the state. At CACT and Alfred University, the impact on faculty and students is measured in terms of the on-going and reliable funding for faculty research (the research of about 12 to 15 faculty members is supported) and infrastructure, including state-of-the-art equipment and increased prestige for the university, as well as in terms of research experience and exposure to potential employers. At Tech Ventures, the impact on faculty and students is measured in terms of large involvement of students in research projects (about 2,000 students) and in university start-ups, sometimes compensating for limited personnel resources, which is a distinctive feature of the University of Utah⁷⁶. The impact on students is also important for the Silicon Flatirons Center, where it is monitored in terms of student participation in the events hosted by the Center, students' satisfaction and feedback, opportunities for student employment, etc. StartX attaches great importance to the impact on the program participants, aiming to obtain maximum value for the trainees from program activities like the Demo Day, or unique program resources, like the mentors. The impact on students and the importance of the mentors was also highlighted in the E-Scholars Program developed as a part of the UMKC-KF cooperation. Cogswell Polytechnical College also reported monitoring student impact indicators such as student employability rate.

- **An “external” impact on the local and state economy:** At MIT, the economic impact of companies started by MIT graduates was assessed in a study conducted by Ed Roberts, the founder of the Martin Trust Center, who found that since 2009, these companies have

⁷⁵ Tech Ventures 2011 Annual Report, p. 5. <http://content.yudu.com/Library/A1tbz4/2011AnnualReportTech/resources/index.htm?referrerUrl=http%3A%2F%2Fwww.techventures.utah.edu%2Fnews%2F2011%2F08%2F2011-annual-report-released%2F> Last accessed 13/02/2013

⁷⁶ Sutherland, S. (2012), “Launch Pad. The Secret Formula for University Tech Commercialization”, *Utah Business*, May 1, 2012. http://dev.utahbusiness.com/articles/view/launch_pad/?pg=1 Last accessed 13/02/2013

brought in total revenue of \$2 trillion. The local and state economic impact is also important for CACT, which is a state-wide initiative, so while it does work with some start-ups locally (thereby helping the community), it is more of a state-wide resource. CACT has had some interesting discussions on how to respond to regional economic development needs. There was concern that it was going to be too isolated to a particular region, but while they do have clients in those regions (like Western NY), they are not exclusive. CACT even has clients outside the state and partners with companies in Japan and Germany.

The activities of Technology Venture Development at the University of Utah have a very important local and state economic impact. University start-ups provide jobs for students and other employees, being the largest local employer. The cooperation with business has strengthened the links between the university and the local community, and has generated important revenues for the economy. According to the University's Bureau of Economic and Business Research 2011 Report⁷⁷, the economic impacts of university start-ups in 2009 were 'significant and impressive' and consisted of: 15,767 jobs state-wide and an employment multiplier for the university of 2.66; state-wide earnings of \$754.5 million and an earnings multiplier for the university start-ups of 2.10; \$1.2 billion contribution to Utah's gross state product (\$112.7 billion in 2009) and \$76.6 million contribution to state and local tax revenue by university start-ups and licensees. In 2010 the economic impacts were even stronger, with a total number of 28,724 jobs state-wide, state-wide earnings of \$1.3 billion, and \$129.6 million total tax contribution⁷⁸. In the case of the UMKC-KF, the E-Scholars program, whereby IEI – and to some extent the Foundation – benefits Kansas City by helping entrepreneurs launch businesses which then create jobs in the local area. In the case of OSF-SOU, the economic impact of OSF on Ashland and Oregon's economy is significant and has increased over time, with notable influence especially on tourism and the economic sectors which benefit from tourism (services, hotels, restaurants, etc.). Audience surveys found that from 1991-2010, 75% to 84% of the annual OSF audience visited Ashland specifically to attend OSF, and, from 1997-2010, at least 59% of the audience surveyed stated that they attend OSF every year.⁷⁹ Also, the expenditure of OSF audience members has increased over time, from \$70 in 1991 to \$153 in 2010. The OSF/ASU cooperation has also led to the creation of a theatre cluster in Ashland with various theatre companies and festival. The OSF-SOU partnership has also led to an increase in attractiveness of the region, particularly for senior citizens.

⁷⁷ Crispin, J. E. (2011), *The Economic Impact of Start-up Companies and Invention Licensees Originating from Research at the University of Utah*, Bureau of Economic and Business Research, David Eccles School of Business, University of Utah, March 2011.

⁷⁸ Jack Brittain (2012), 'Papers, Patents and...Products' Presentation at the Triple Helix Workshop 'Building the Entrepreneurial University', Stanford University, 12 November 2012. <http://triplehelix.stanford.edu/node/51> Last accessed 13/02/2013

⁷⁹ Oregon Shakespeare Festival, "Oregon Shakespeare Festival 2010 Audience Survey", p. 1.

The same distinction between **internal and external impact** holds for **Canada**:

- **Internal impact on the university, students and faculty:** The impact in the university consists primarily of revenue generation. The University of British Columbia's research enterprise expanded its research income from C\$50 million in the mid-1980s to over \$500 million by the mid-2000s. The largest part of this income comes from the Government, which significantly increased its R&D expenditures in the years 1997-2004. At this university about \$2 million has been generated a year over 30 years, i.e. a total of \$600 million. Limited absorptive capacity reduced the liaison's office ability to generate funds at the University of British Columbia.

Regarding students and faculty, several companies incubated/accelerated at DMZ became a success. These companies include TeamSave, a social buying website which formed an alliance with Kajiji, which now has over 50 staff. Finizi, an online platform where financial institutions could bid for customer business by auctioning Guaranteed Income Certificates (GICs); handled \$70 million worth of auctions in eight months. Given this success, the DMZ has been growing. It had space for 40 individuals; by mid-2012, it has come to host 50 companies and 220 people funded by the University of Ryerson.⁸⁰

- **External impact on the local economy:** Positive impacts on the local economy are reported in all the cases of UBC. Metrics and estimates of this impact are not necessarily available, but are currently being developed in some instances, as in the case of NovaNAIT. Contribution to the local economy is a by-product of co-op education for Waterloo (the choice of programs not being influenced by the local economy). The impact includes attracting companies (including Microsoft and Google) to form a regional hub. In British Columbia, a large part of the province's life sciences industry and some of its high-tech industry comes from the University of British Columbia. The provincial government has recognized such impact by providing financial support. DMZ contributed to develop a 'tech' oriented hub in Toronto's downtown area. This downtown area, occupied only by University of Toronto's St. George campus and Ryerson University, had a density of small tech companies. There was therefore a receptor capacity for a DMZ-type incubator arrangement, which filled in a 'niche'. The establishment of DMZ led to various instances of business cooperation of benefit to the region. For example Metrolinx, the GTA's regional rail and transport agency, created an online app which would provide smartphone users with schedules and schedule updates. PTRC brings forward a study conducted in September 2012 study showing that the net

⁸⁰ Ryerson did not provide financial details for this project

impacts in the province of Saskatchewan are \$7-8 million per year in output, and 70-80 jobs. This estimate could be even higher including the long-term impacts of research.

5 Conclusion and policy recommendations

The detailed exploration of the ten US and five Canada case studies shows some important differences in the UBC context not only between these two countries, but also in relation to the Europe. These differences pertain, on the one hand, to the institutional types of the higher education institutions concerned, their origin and time since inception, organizational formats, stakeholders of the UBC, funding sources and relationships with the government, objectives, drivers and barriers of UBC. On the other, we also distinguish differences that pertain to the broader social and economic environment where these institutions operate, the legal framework ruling their activities, including the IP regulations and their culture of collaboration.

These differences have an important influence on Europe's performance in higher education, research and innovation, which lags behind that of the US and Canada in many respects. The "European paradox" (i.e. strong research capacity and results, but lower capacity to translate them into innovative products), although much reduced in recent years, could be further reduced by removing several gaps and obstacles at the university-business interface and beyond.

Based on the findings from the 15 case studies carried out within this study, we provide below a set of policy recommendations aimed to improve Europe's innovative performance, highlighting the US and Canadian examples that provide not only the rationale for the respective recommendation, but also possible suggestions for implementation. Our recommendations fully resonate with the recommendations made in the 2011 Communication of the European Commission on the modernization of higher education⁸¹ and are addressed to higher education institutions, EU institutions, national governments and businesses.

Recommendations for higher education institutions

Develop the strategic, structural and human capacity for UBC

- **Develop collaboration as a strategic institutional policy**

Doing UBC as a strategic institutional policy has been reported as a top motivation for UBC in all the US case studies, where it is seen as a major way to strengthen both education and academic research activities. Also, the experience of several Canadian cases show that

⁸¹ European Commission (2011), Supporting growth and jobs – an agenda for the modernisations of Europe's higher education systems, COM(2011) 567

universities' educational mission offer strongly benefit from UBC (e.g. by attracting more students, diversifying the curriculum and strengthening students' employability).

- **Develop a university-wide system for UBC**

In contrast to the usual concentration of UBC in the business or engineering schools, as tends to be the case in Europe, the existence of a university-wide system for entrepreneurship and collaboration with businesses has been identified as a key success factor in the US and Canadian universities examined, in particular:

- The Silicon Flatirons Center at Colorado University, which is a part of a “confederated centers of entrepreneurship”, consisting of several university departments and centers across the campus working in synergy to teach and promote entrepreneurship and business education.
- The Technology Venture Development Office and its departments, which are also part of a university-wide system for entrepreneurship and business education that works for the implementation of the goal of “total mission integration” of university education, research and entrepreneurial activities, with large involvement of the students in all these activities.
- The Center of Innovation and Entrepreneurship at West Virginia University works closely with other offices in the university, like the Office of Technology Transfer and the Linking Innovation Industry and Commercialization Project, as a way to avoid duplication of services and thus, better focus on its own core goals of delivering better education services, getting better students and ensuring a high student employability.
- StartX is highly successful at Stanford due to a number of other elements of a university innovation system that were already in place, such as a broad variety of entrepreneurial education initiatives, a well-funded and well-organized academic research system, a university community with relevant expertise willing to volunteer, a network of entrepreneurs and venture capital firms surrounding the university, a strong alumni network, Stanford's brand in regards to entrepreneurship and technical education.
- MIT has a loosely connected, yet incredibly successful entrepreneurial ecosystem that has been established to bring MIT research to market and develop the next generation of entrepreneurs. MIT allows different members of the ecosystem to bring different tools to the table, whose sum is far greater than what could be contributed by a technical transfer office alone, in order to maintain a “free-flowing physical and emotional structure of the institution”.
- All of MIT's offices are involved with entrepreneurship, with the exception of the TLO, have volunteers from the business community. Faculty members, in turn, consult with

outside companies in order to see what is going in practice and such consulting is looked at favorably as they bring back new ideas.

- NovaNAIT aims to transform institutional culture to accommodate curricular change and UBC, and supports the need for a “point person” responsible for coordinating and developing applied research and acting as a single point of contact.
- University of British Columbia has an experimental strategy that sees UBC as part of the innovation ecosystem, rather than a way to generate funds. This leads to positive feedback and activity in the university.

- **Ensure institutional capacity development for UBC**

The pursuit of UBC requires institutional capacity development, including UBC offices, recruitment of experienced and suitable staff, organization of specialized training courses for tech transfer managers, and organization of fundraising support from diverse sources of funding. For example:

- The University of British Columbia liaison office was set up to address different companies’ needs in different types of collaboration, ranging from multi-dollar collaborations for large companies to summer internship programs for smaller ones, contractual research to entrepreneurship and company formation, in order to be able to create long-term synergies and innovation hubs.
- CACT has a university office that deals uniquely with internships and career development, to avoid duplication of services, and runs its own Associates Program that provides some financial leverage for hiring students.
- The University of Waterloo has a specific office to organize co-op education programs, namely the Office of Co-operative Education (OCE).
- Various institutional resources are available to find internships at FIT, at the University of Utah’ Technology Venture Development, Technology Commercialization Office (TCO) and Career Services office (UCareerLink’s database).
- PTRC has been created to match university offer with industry demand by pursuing focused, results-driven field research and applied projects, which tend to be more attractive to industry than more abstract research.

- **Diversify funding sources and adjust fundraising strategies accordingly**

While university, business and alumni funding is present in all the cases, government funding seems to be the most important differentiating factor, as some cases rely more heavily on government funding (e.g. MIT, CACT, FIT, Tech Ventures, CIE, the University of British Columbia and PTRC at the University of Regina that receive substantial funds from the Canadian federal Government), while others rely only minimally or not at all on this source

(e.g. Silicon Flatirons Center at Colorado University, UMKC-KF), StartX, Cogswell Polytechnic College, University of Waterloo, Ryerson's DMZ, NovaNAIT).

- NovaNAIT pointed to the need to adapt its fundraising capacities to the peculiarities of different funding sources: business funds require more relationship management, while government funding requires a high capacity to fill in grants.
- MIT's research is funded by the federal government to about 70%, while state, local and foreign governments contribute about 6%. The Deshpande Center was founded with an initial donation of \$20 million by Desh Deshpande, the co-founder and chairman of Sycamore Networks Inc. and his wife Jaishree, and depends on the financial and professional support of alumni, entrepreneurs and investors to provide a sustainable funding for its operating costs, and also requests that spin-outs donate some equity, but this is not mandatory.
- CACT's main funding sources include a 10-year NYSTAR grant and payments from partner companies, as well as state grants - a strategy adopted in response to the significant tightening of company budgets in the last several years as a result of the financial crisis.
- FIT and its schools also rely on state funds, as well as on several other sources (e.g. tuition fees paid by students or their employers, revenues from business, etc. The balance over time between these sources has remained relatively constant, though New York State funding to FIT declined by about \$1.3 million in 2012 compared to 2011 (FIT 2012).
- For Tech Ventures, the most important funding source (far ahead of the others) is business, in the form of industry-sponsored research overheads and commercial sponsorships, royalties from licenses and patents, and endowment returns. In 2011, Tech Ventures raised seed funding of over \$100 million for investments in the university start-ups. Venture funding over the last five years accounted for nearly \$300 million, plus nearly \$430 million in commercialization grant funding from the government. Government funding is present in the form of the Utah Science, Technology and Research Initiative (USTAR), a long-term investment in Utah's economic future funded through SB (Senate Bill) 75 passed in 2006.
- The Center for Innovation and Entrepreneurship at West Virginia University benefits from state appropriations that are funneled through the College of Business and Economics, but state funding only covers less than half of its budget, the rest coming from the university and private sources. There are threats that state funding to WVU will be cut by 7.5 % in the 2013 state budget.

- Ryerson's DMZ tends to avoid government funding⁸² because of the stringent conditions and onerous reporting requirements it would involve. The experimental stage of the DMZ also required release from external commitments in order to enhance DMZ's ability to innovate.
- PTRC, on the other hand, values government funding. Federal funding allows industry to have a competitive deal on investments, including tax relief (companies spend on average 30 cents for \$1 million worth of research).

Facilitate the participation of business representatives in universities, as well as the participation of academics and students in business activities

- **Encourage the participation of business representatives in university governance, in departments and centers through teaching entrepreneurship education, in compliance with the tradition and principles of academic autonomy.**
 - At FIT, business representatives participate in the design and implementation of the School of Graduate Studies' professional Master's programs, leading to a very popular program.
 - Silicon Flatirons Center's Entrepreneurship Initiative (EI) comprises a multitude of initiatives involving business professionals and local entrepreneurs, as the one of the key instruments to connect the CU Boulder campus to the Colorado area's software, internet and telecom start-ups, start-up community professionals and students across the campus.
 - StartX mentors are largely drawn from Stanford alumni who are active in start-ups and venture capital investments. They work as lead mentors and board mentors. Lead mentors are more involved as they meet one-on-one with the company multiple times during the company's time in the program. Board mentors serve as a mini-board of directors, giving the entrepreneurs the experience of what it is like to have an actual board of directors, setting-up formal board meetings, and presenting to the board. Mentors can act as a board for the startups without the legal and fiduciary duties.
 - At, Silicon Flatirons Center, many individuals and organizations from the local community are important private sponsors and advisors to SFC through the SFC Advisory Boards⁸³. These close links with the community contributed to the success of a fundraising campaign, organized in 2011 by the local entrepreneurs and championed by SFC Entrepreneurship Initiative Advisory Board Chair and Adjunct

⁸² Some project-based funding has come in from a regional development grant program called the Applied Research and Commercialization Initiative in which higher education institutions partner with small business on commercialization efforts. Some of the Ryerson projects have involved teams from the DMZ, and some funding has been acquired this way.

⁸³ The Silicon Flatirons Board includes successful venture capitalists, top executives at publicly traded corporations, and partners at large law firms. The IT & IP Advisory Board includes leaders in the educational, entrepreneurial and legal communities. And the Entrepreneurship Advisory Board includes law and business schools students and professors, venture capitalists, successful entrepreneurs, top executives at established companies and attorneys.

Professor Jason Mendelson. The fundraising campaign was supported by many of the entrepreneurial community members and the amount raised (\$1 million) was matched by a contribution from the Colorado University to create a professorial position in entrepreneurial law.

- In the UMKC-KF collaboration, the involvement of Kauffman Foundation has led to numerous benefits for the UMKC community including research grants, the use of Foundation's facilities and network, ideas, the ability to co-host events and the recruitment of Dean Tan and a faculty member, in addition to funding for the Regnier Institute for Entrepreneurship and Innovation (IEI). Also, UMKC's rapid expansion of entrepreneurship education is a direct effect of the interest that the Foundation took in its neighbor. The collaboration was led in such a way to create advantages for the university, the donor and the supporters.
- At Cogswell Polytechnical College, most faculty members have strong industry experience and connections, particularly the faculty involved in the Entrepreneurship & Innovation MA program.

- **Provide career incentives for academics**

Such incentives are important for faculty participation in UBC. As an example, at the University of British Columbia, the engineering faculty does not receive tenure unless it engages in UBC. At the University of Waterloo, faculty members are hired on the assumption that they would contribute to developing a curriculum suitable to co-op education.

- **Provide more company placements and internships for students and encourage the recognition of students' work experience for qualifications and integration in curricula**

Work placements and internships are a very important component in student's education in most of the case studies analyzed:

- CACT students can work for a summer or some period of time for a NY state company and they are considered an employee of Alfred University. The company pays a portion of wages to CACT and CACT covers the rest.
- Internships constitute an integral part of degrees in various programs at FIT's School of Business and Technology. (FIT also accommodates various professionals who come to improve their skills particularly students of the Cosmetics and Fragrance marketing and management program or the program in Global Fashion).
- The Silicon Flatirons Center at Colorado University has two student internships programs (the Dale Hatfield Scholars & Research Program and the Padden Scholars Program). Also, the Colorado University Entrepreneurship Center for Music offers internships in Music Business.

- The Centre for Innovation and Entrepreneurship at West Virginia University has started its internship program in 2011 and is currently working for its development.
- OSF-SOU mobility/placements and internships include OSF staff members who teach at SOU at both graduate and undergraduate levels, as well as SOU students regularly doing internships for OSF, having thus an opportunity to practice their craft and to put into practice what is learned in the classroom. Both SOU and OSF benefit from this relationship as OSF uses SOU as a source for interns. An internship leads to employment and further education benefits, and also helps actors in finding agents; it elevates the CV and provides acting experience in OSF, which is also a plus for students wishing to apply for Master of Fine Arts (MFA) programs. There are many OSF staff member benefits for which interns are eligible.
- At the University of Waterloo, and increasingly across Canada, students obtain a degree through dual study/work experience in coop education.

Gain further understanding of the complexity of UBC

- **Ensure management of conflict and expectations, supporting UBC according with the development stage of the cooperation**

As the Director of the Center for Innovation and Entrepreneurship at West Virginia noted, based on the experience of his institution, “nothing happens quickly in academia” and managing the university’s expectations in terms of the time it takes for collaborations to pay off is very important. CACT’s case study also reflects the importance of managing expectations on both sides, the activities of universities (learning, curiosity-based or fundamental research) requiring a longer timeline than companies’ preferences. Regular two-way communication and flexibility and capacity to adapt to changing situations are required (e.g. CACT changed its business model in 2009 from one that had been more of a membership program, to one that was more project-oriented, introduction of joint grant proposals between CACT and companies, recruitment of a business person - the Deputy Director- to do the business development with companies). MIT established a clear set of conflict of interest rules to avoid confusion and the need to create time-consuming regulatory committees. These rules allow for a porous, yet well defined, university-business boundary. Some of these rules include: the requirement that a start-up company be created outside of MIT. Companies often stay close to MIT, but they are not part of MIT; faculty members may not be line officers in such companies, but they may be advisors and spend one day a week consulting; faculty members may take a leave of absence for a maximum of two years (one time) if they arrange it properly. In most cases, it would be the post-doc or grad student who would go to the company.

Recommendations for EU institutions

Disseminate information on the potential benefits of UBC

- **Promote a greater social acceptance of the “entrepreneur” and the culture of entrepreneurship**

While failure in an entrepreneurial endeavor (“the culture of failure”) is recognized in the US as a normal part of the development of a business and as a part of a learning curve, and is even celebrated in highly entrepreneurial environments like Silicon Valley (“fail early and fail cheap”), Europe has a much less tolerant attitude towards business failures. The financial clearance after a business failure is much more costly and time-consuming and the ‘stigma’ of the entrepreneurs that have failed can often be long-lasting.

- **Encourage and fund more university-business fora or executive exchanges at the local, national and EU level expanding on the existing University-Business Forum**

The case studies point to centrality of a mutual understanding and trust on the two sides of the relationship. Many initiatives in the US aim to sharing ideas and best practices among individuals from the two spheres ultimately leading to bridging differences in communication between academia and industry. Examples of this are present at the University level (e.g. the One Million Cups workshops that involves the Kauffman Foundation and the University of Missouri) and at the federal level (e.g. the GUIRR).

Develop a regulatory environment conducive to UBC

- **Continue to support to universities’ autonomy and links with the community**

European higher education institutions do not have the same tradition of service to the community as in the US, a tradition emerging from land grant universities and the Morrill Act of 1862, which contributes to shaping the frequency and forms of relationships with businesses. Yet, European universities benefit from some general conditions to facilitate links with the community, even if this activity is not as widespread as in the US. A majority of European universities have, like many universities in the US, the right to set up legal entities without constraints, which implies that they can set up partnerships with businesses, while others can only create not-for-profit entities. These rights need to be fostered in accordance to the principle of university autonomy.

- **Encourage the recognition of professional experience and work placement in the curriculum**

Further support the integration of entrepreneurial skills training in qualifications could be provided through the European Credit Transfer System.

Simplify administrative procedures and reduce administrative costs of participation in relevant EU initiatives

- **Make co-funding rules less stringent and set-up a two-stage grant application process**

The US and Canadian federal government played a significant role in incentivizing UBC (see details in in section 3 about seven federal programs and 12 non-governmental initiatives worth several billion dollars in the US, as well as 11 federal initiatives in Canada, where federal funding was in some cases key to a program's sustainability). In addition, several large foundations, such as Kauffman, sponsored universities. Federal programs appear to be tied to less restrictive conditions, for example co-funding is less necessary to obtain federal grants (e.g. from the National Science Foundation) than in Europe⁸⁴. One suggestion for simplifying administrative procedures is to set up a two-stage grant application (which would consist of a pre-selection based on a three-page pitch followed by a longer application process), which could lower the administrative costs required for some of the existing EU initiatives, such as Knowledge Alliances⁸⁵.

Recommendations for governments

Develop a regulatory environment conducive to UBC

- **Encourage UBC in a broader range of institutions and disciplines and acknowledge both education and research as development paths for achieving UBC**

Both the US and Canada cases, UBC appears across a board spectrum of institutions and disciplines, ranging from highly prestigious research-intensive universities to more technically-oriented ones. Universities with a stronger focus on their education mission are also successful entrepreneurial players by providing high-quality entrepreneurial education and training, new forms of experiential learning that give students higher grades, greater engagement in learning and better opportunities on the job market. Both education and research can be good starting points and development paths for achieving UBC. These two approaches are not mutually exclusive – on the contrary, they need to be pursued together in order to consolidate the “knowledge triangle” between education, research and business that takes a central role in the European Commission modernization agenda.

- **Fund chairs to encourage movement of individuals across academia and industry**

Chairs for exchange of experts across academia and industry could be established or strengthened, with a precise mandate for the chair holders to work at the interface of

⁸⁴ These programs were targeted at various aspects of UBC. Programs geared toward research also had an impact on student's educational experience, positively influencing curriculum adaptation, or student involvement in projects for example.

⁸⁵ Knowledge alliances are multilateral projects bringing together businesses and higher education institutions to strengthen and develop Europe's innovation potential, via the provision of a comprehensive set of joint activities, involving new learning and teaching methods, the design and delivery of new multidisciplinary curricula and innovative courses, and the promotion of entrepreneurial attitudes, see Lifelong learning, Erasmus Multilateral projects, URL: http://ec.europa.eu/education/lfp/doc/call13/fiches/era12_en.pdf

academia and industry, either through education or research activities. Chairs could be sponsored by the university, business, or government (as it has been described in Canada).

Recognize UBC as a tool for regional development

- **Foster the relationship with the local community and the contribution of UBC to the regional economy**

Strong examples on the importance of UBC for regional development through strong links with the local economic actors emerge from the study:

- Creating institutional clusters may leverage the value of universities in regional development, as was the case with the Fashion Institute of Technology.
- FIT's evolved alongside the creative industries of its region, and continues to fill a particular need for qualified employees in a geographical area where industries are concentrated. FIT's location is, therefore, a critical part of its successful collaboration with business.
- Silicon Flatirons Center at Colorado University is located in the vibrant innovation and entrepreneurship ecosystem of Boulder and of the Colorado state, and has greatly benefitted from it. This particular location provides fertile ground for start-up formation and for relocated serial entrepreneurs, often at second- and third-generation. The good opportunities and opening towards entrepreneurship are complemented by high connectivity and a pleasant life environment.
- OSF-SOU, based in Ashland, also benefitted from proximity to San Francisco Bay Area and Portland, Oregon, which allows easy access of people from two large metropolitan areas, even when fuel costs rise. At the same time, OSF-SOU contributed to the economic development of the region by bringing in a strong economic and social potential of cultural entrepreneurship, whether as an alternative or an addition to technological, scientific and business entrepreneurship. The profits generated by OSF for Ashland and Oregon's economy are significant and has increased over time, with notable influence especially on tourism and the economic sectors that benefit from tourism (services, hotels, restaurants, etc.).
- StartX and Cogswell Polytechnical College have also greatly benefitted from the location in the Bay Area and Silicon Valley, as discussed before.
- The incubator for Ryerson's DMZ fills in a 'niche' for small businesses in the area of Downtown Toronto.
- CACT is a state-wide initiative and a state-wide resource, which works not only with some start-ups locally (thereby helping the community), but also with clients outside the state and partners with companies in Japan and Germany.

Recommendations for businesses

Create specialized departments for collaboration with higher education institutions and encourage the development of initiatives and programs focusing on specific knowledge needs of the company that can be addressed by higher education institutions

The case studies strongly point in the direction of significant returns from UBC for businesses, including:

- Venture capital firms and strategic investors look at StartX companies for valuable new ideas with high commercial potential and talented individuals
- At Cogswell Polytechnical College, business people have the opportunity to teach in the College's entrepreneurial classes and develop real-life projects with the College's students and staff
- At the Silicon Flatirons Centre, businesses have access to academic expertise, graduates as interns and future employees, to latest ideas and trends in their respective fields, ability to intervene in policy-making debates

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