Success depends on the adoption of best practices from the most innovative programs.
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Introduction

As the business of university-based technology development and commercialization continues to grow and evolve, the importance of benchmarking with our peers grows with it. Success depends on the adoption of best practices from the most innovative programs. And while universities in different parts of the country and around the world are driven by their own unique policies, pressures, and regional or national agendas, their goals are the same: to help to transform the research and ideas of their faculty, staff, and students into commercially viable innovations that can be licensed to industry or start-up companies.

Such desire to achieve greater success in technology commercialization spawned a series of relationship-building discussions that began in 2004 between the University of Pittsburgh and Dublin City University (DCU). The relationship began when Sheila Rathke, assistant provost for strategic and program development at the University of Pittsburgh, spoke to an Irish group about regional marketing in late 2004.

That led to an educational trip to the United States and the University of Pittsburgh in 2005 by Patrick McDermott of the DCU Educational Trust and Professor Ciarán Ó hÓgartaigh, theme leader in business and innovation at DCU, to discuss economic development and technology commercialization.

That meeting opened the door to the idea that the two universities—each of which approaches innovation development and commercialization in unique and innovative ways—should plan a conference to share trends, differences, challenges, and best practices that contribute to the success of their efforts.

In May 2006, the group finally converged for two information-packed days in Dublin, Ireland, at DCU for what became University-driven Commercialization and Entrepreneurship: A Transatlantic Comparison of Commercial Innovation Development. Also participating in the conference were the Universities of Cambridge
and Nottingham in the United Kingdom and Helsinki University of Technology in Finland.

During that conference, the universities presented brief histories of their respective commercialization activities within the context of their own business environments as well as the driving forces that guide and influence their efforts. The universities also shared some of the creative initiatives that they developed and employed to engage faculty in commercialization and increase both the quality and quantity of innovations entering the commercialization process.

The following pages of this monograph document the extensive, in-depth discourse that occurred over those two days, thus allowing the conference’s participants to compare and contrast philosophies, approaches, frustrations, and successes. Indeed, time passes quickly, and we must honestly acknowledge that changes occur just as quickly within this fast-growing discipline of academic entrepreneurship.

Still, this monograph represents an important snapshot in time within this evolution and should motivate all participants to remain both innovative and vigilant in their respective pursuits of innovation commercialization success.
“Over the last decade, we have come a long way. But there still is a tension. Part of it is just the sheer rate of change.”
Section 1: Commercialization Philosophies and Environmental Influences

Without question, technology commercialization had taken on great significance at all of the participating universities, both old and young, in recent years, placing each university in a position of regional and even national leadership within the realm of technology-based economic development.

However, each attested to different driving forces, particularly government related, and environmental influences that led to a variety of unique initiatives aimed at fostering commercialization and entrepreneurship while taking advantage of their available resources.

Among the goals of the conference was to help the participants understand those influences and the philosophies that had arisen as a result. Consider the following:

Republic of Ireland: Dublin City University

Dublin City University (DCU), only 25 years old in 2006, had thrived in its research and technology commercialization endeavors, largely unencumbered by entrenched politics and university tradition. Apparently, tradition would dictate, as it seemed to do universally, that industry and academia should have kept their respective distance.

“The commercial world and academic world should know each other but preferably should never meet,” Ferdinand Von Prondzynski, president of DCU, in his opening remarks to the conference attendees, noted with regard to the prevailing academic attitude toward commercialization until recent years.
DCU had the good fortune to emerge at a time when Ireland not only was beginning to embrace technology as an economic driver but also was beginning to recognize the importance of its location as a strategic gateway to the European Union, particularly for U.S.-based technology companies. That realization had led to proactive programs to attract new business to the country and to invest in infrastructure and incentives to support those programs. Once those programs were established, Ireland then began to invest in research and development that would, ultimately, form the foundation for an innovation-driven economy.

In 2006, according to DCU’s president during his opening remarks, some tension still existed between industry and academia, “but the opportunities now are very significant.”

Among the early drivers for many of those innovation development opportunities was the fact that Ireland had recently established a national innovation system made up of a number of national research centers. As such, the country had invested in basic science endeavors, with long-term goals that included the development of new technologies that would make a positive impact on the Irish economy. During the same period, Ireland also established two research councils, one focusing on science and technology and the other on the humanities. In addition, the government created Science Foundation Ireland.

All were part of the six-year, two-part National Development Plan that was established by the government in 2000 to spur the development and commercialization of new innovations throughout the country while also acknowledging and developing a full-fledged knowledge economy.

Ireland launched the second part of the National Development Plan by introducing and administering a technology cluster-driven €4.5 billion innovation investment program to foster the development of new high growth-potential technologies as well as innovation development collaborations with industry.
The plan was designed to increase awareness of the importance of developing and protecting intellectual property, provide adequate incentives for conducting targeted research, develop a national code of practice with regard to intellectual property issues, and establish the notion that intellectual property developed at Irish universities would be owned by those universities. It’s also important to note that the plan’s support of industry collaborations was driven by science and not simply tax incentives.

The plan also called for a study of technology transfer operations throughout Ireland’s universities. As described in *University Collaboration on Technology Transfer: An All-Island Feasibility Study*, the effort yielded the following seven recommendations, all of which revolved around the notion of pooled resources to strengthen their collective technology transfer activities:

1. Development of joint marketing among the universities’ technology transfer functions
2. Development of shared intellectual property policy and strategies
3. Development of shared entrepreneurial training programs
4. Establishment of comprehensive and effective campus support for their respective innovation development and commercialization efforts
5. Coordinated interaction with Ireland’s venture capital community
6. Development of ways to share expertise in a wide range of research disciplines
7. Development of a program that would identify technologies from throughout the university system that could be bundled for more effective licensing to industry or to start-up companies

Amid this positive atmosphere of technology-based economic development, Dublin City University (DCU) had adopted its own variation of the overall innovation development philosophy that became prevalent in Ireland. DCU operated under the premise that
“absolutely first-rate” research feeds good teaching, which then enables the whole research community to better pursue first-rate research. And that translates into economic gain for the country through innovation development and commercialization.

As a result, DCU had grown in 25 years to include nine research centers, including national centers (funded through the Programme for Research in Third-Level Institutions [PRTLI]) in areas such as sensors, cellular biotechnology, and plasma. PRTLI and the support of Science Foundation Ireland led to a sea change in public funding of research in Ireland. This carried with it an expectation of contribution to economic growth, and DCU thus placed much greater importance on commercialization and other interactions with the commercial sector. Meanwhile, research funding had grown from an estimated €5 million to €45 million annually—despite a decline of roughly 40 percent in public funding over the previous few years.

Still, DCU strove for more interactions with industry as well as even better resources and support as Ireland overall continued to forge ahead in the development of its knowledge economy.

Said Eugene Kennedy, vice president for research at DCU: “Over the last decade, we have come a long way. But there still is a tension. Part of it is just the sheer rate of change.”

**United States:**
**University of Pittsburgh**

The philosophy that the job of U.S. universities is to help the local economy goes back to 1862, when the U.S. Congress passed a law issuing land grants for establishing colleges and universities in every congressional district. But the philosophy in 2006 that universities should play a key role in the commercialization of technologies developed within their walls was built around a congressional act known as the Bayh-Dole Act of 1980. Provisions include the following:

- Universities own all intellectual property derived from federally funded research.
• The inventor nonetheless must be treated well—and that includes sharing in a portion of the royalty revenue from any licenses to industry.

• Innovations must be licensed to industry or start-up companies at “fair-market value,” which means universities can’t give undue consideration to start-up companies or to those who agree to locate within a given region.

• Universities must, however, show some preference in licensing to small businesses (classified by the U.S. Small Business Administration as companies with 500 or fewer employees).

• A substantial amount of the manufacturing of products derived from university intellectual property must remain in the United States.

• Excess revenue from licensing must support ongoing research and education endeavors.

• The U.S. government retains nonexclusive license rights—and march-in rights—to innovations developed with federal funding.

As of 2006, the Bayh-Dole Act remained a primary driving force behind technology commercialization efforts at universities across the country—including the University of Pittsburgh—and their participation in regional economic development activities. But, even then, universities were only beginning to get aggressive in building and fostering substantive, successful innovation development and commercialization operations that adhered to the act’s various provisions while also elevating the commercialization concept to a greater status among their faculty, staff, and students.

That said, though, faculty expectations regarding commercialization remained split between those in favor of such activities and those who weren’t in favor. Therein remained one of the fundamental challenges for universities, such as the University of Pittsburgh, that supported an active commercialization endeavor.
In addition to the Bayh-Dole Act, local communities in the United States had become a serious and visible driving influence in the new millennium when it came to encouraging more innovation commercialization activities at universities within their regions. This had proved to be both a positive influence on local economies—particularly those relying on technology-based economic development—and a challenge to the fair-market value provisions of the Bayh-Dole Act.

Most challenging, perhaps, was the fact that some communities, Pittsburgh included, sometimes put pressure on research universities to make what ultimately would be bad business decisions regionally in the guise of economic development. That included pressure to launch new companies around university-based technology that would remain and grow in a given region.

The pressure often revolved around the licensing deals themselves, with communities encouraging universities to reduce or even eliminate up-front fees and other financial considerations typically aimed at vetting financially sustainable ventures from those that weren’t. However, universities in the United States did typically place some emphasis on starting new companies around university-derived innovations.

Regional economic development drivers differed, however, from region to region in the United States. In some cities, universities served as the hub not only of commercialization activities but also of regional entrepreneurial assistance activities, with many services spinning out of the universities. Pittsburgh, however, was home to literally dozens of economic development and business assistance organizations aimed at helping start-up companies and others grow and prosper, relocate, raise capital, manage family succession planning issues, etc.

The University of Pittsburgh, therefore, worked to complement those existing initiatives while striving to maintain a leadership role in the region’s economic development efforts. Still, in 2006, the University employed more than 12,000 people, making it one of the largest
contributors to jobs in the region, and it served an estimated 34,000 students. Research at the university was supported by more than $600 million in sponsored research grants and contracts.

Moreover, the university hosted a number of programs and services aimed at providing complementary entrepreneurial support in the region. Its Institute for Entrepreneurial Excellence administered a state- and federally funded Small Business Development Center for the region as well as the Entrepreneurial Fellows Center and Family Enterprise Center. Across campus, the Swanson School of Engineering’s John A. Swanson Center for Product Innovation provided state-of-the-art prototype development and computer-aided testing services, which were available to local businesses as well as innovators from throughout the Pitt campus in Pittsburgh.

At the same time, the University continued to work toward commercialization activities that best represented the interests of the University and its faculty, staff, and students as well as the community. Over a six-year period ending in fiscal year 2006, Pitt facilitated the start-up of 41 new companies revolving around innovations licensed from Pitt, and it secured 262 licenses and options with industry for its innovations during that same time.

Perhaps even more telling, though, was the fact that, since 2001, faculty, staff, and student innovators had submitted a total of 696 invention disclosures to Pitt’s Office of Technology Management for commercial consideration. For the University, that number spoke volumes in demonstrating the changing commercialization philosophies of its faculty members and the notion that more of them were embracing innovation commercialization as a legitimate and even important facet of their research culture.

Philosophical challenges did remain, though, according to James V. Maher, provost and senior vice chancellor of the University of Pittsburgh, in his remarks to conference attendees. For instance, Pitt continued to try to resolve a “complexity of issues” around the establishment of an effective balance among the University’s teaching, research, and “academic entrepreneurship” roles.
Such complexity, perhaps, was compounded at times by those faculty members who still didn’t accept innovation commercialization as a legitimate role of the University. One group in particular, the humanities side of the School of Arts and Sciences, had proved to be the most challenging in its “malaise” over such a role. But the group had evolved from being “hostile” 10–15 years previously to at least tolerating the University’s growing commercialization efforts.

Such an attitude made the University’s ongoing education activities related to innovation commercialization all the more important. Thus, the University planned to continue to offer courses to its faculty, staff, and students that would focus on the virtues of commercialization as well as practical strategies for effective commercial innovation development on campus. The courses and seminars, which will be addressed in greater detail later in this monograph, would remain crucial for Pitt as it attempted to change the academic culture on campus to one that fully embraced innovation commercialization and encouraged active—and knowledgeable—participation from its faculty, staff, and even students.

The other challenge of being able to effectively package and market the growing range and diversity of innovations arising from Pitt research efforts would become even more prevalent as the aforementioned attitudes changed in favor of commercialization. Limited resources would be expected to prevent the university from maintaining strong marketing expertise within all of the many specialized disciplines that were developing new innovations. The University, therefore, planned to find new and creative ways to address that diversity in an effort to effectively capture and market the literally hundreds of innovations being submitted for commercial consideration. But the challenge also would serve as a good indication that the efforts to effect cultural change throughout the University were working.

**United Kingdom: Universities of Cambridge and Nottingham**

For years, according to conference participants, the University of Cambridge and the University of Nottingham, both in the United
Kingdom, directed most of their academic attention at two areas: teaching that provided learning and skills for students and produced graduates with relevant job skills, and research that was curiosity-driven with a “blue-skies focus” that allowed researchers to test their hypotheses.

That focus, until recently, left the country strong in its science endeavors but rather weak when it came to technology commercialization—that is, until the country fully embraced philosophically (and then supported substantially) the added academic role, or “third mission,” of knowledge transfer into the community. Moreover, the government eventually had given the country’s universities the responsibility to transfer knowledge into the community, largely through technology commercialization.

Knowledge transfer, from the U.K. perspective at the time, could be divided into the following five categories:

- Graduates: regenerating the “gene pool” of industry
- Research: making results of leading-edge research available to the public
- Intermediate activities: include consulting, executive education, student projects, embedded labs, and teaching specific company “schemes”
- Licensing: knowledge that is packaged into intellectual property with commercial potential and made available to industry
- Spin-out companies: the formation of new commercial entities

Since 1999, the U.K. government had been showing its support via significant funding aimed at activities that ultimately produced spin-out companies. Universities had been given the opportunity to bid for funds from specific development programs such as the Science Enterprise Challenge and the University Challenge funds. In fact, the government had established a permanent stream of funding totaling £300 million. As those start-ups were launched, the government then offered more money. At the same time, the
government invested resources in “lots” of ongoing economic development research that led to informative reports.

When it came to university-based technology commercialization, though, a perception persisted that the government was overemphasizing the development of spin-off companies—not unlike a prevailing perception in the United States—while underemphasizing the benefit of licensing innovations to existing companies. Ironically, though, the country in general remained short of venture capital investment to support the more high-growth potential companies.

University of Cambridge

First, some history: The university began as a means of educating priests but had a history of hosting great research minds, including the likes of Isaac Newton, Francis Crick and James Watson, Charles Babbage, and Frank Whittle, to name a few. The university at the time laid claim to 80 Nobel Prizes via its faculty and alumni.

The region’s technology revolution began in the 1960s, when “huge economic needs” arose within close proximity to the university and throughout the community of Cambridge as technology companies began to emerge in the region. In fact, the number of technology companies located in Cambridge grew from a small handful in the 1960s and 1970s to slightly more than 600 by 1990. By 2000, the number had grown to close to 1,500 firms and numerous clusters of technology—an economy that by 2006 served as a key economic driver in the region and a key focus of the university’s technology knowledge endeavors. The university, of course, had positioned itself as the center of economic growth in that region of the United Kingdom.

The change in culture and focus didn’t occur overnight, though. Initially, commercialization efforts were viewed as indirect and under-resourced. “In the early days, we said we won’t ‘actively discourage’ commercialization,” noted Tim Minshall, a lecturer at the university’s Centre for Technology Management and director of its St. John’s Innovation Centre.
By 2006, commercialization efforts were direct, driven largely by focused research programs aimed at “packaged knowledge transfer,” industry collaboration, and delivery of services back to industry. That dramatic change in philosophy had led to considerable commercialization activities and other industry collaborations. Consequently, the Cambridge region managed to attract roughly 8 percent of all European Union-based venture capital investment and an estimated 25 percent of all U.K.-based venture capital funding.

University of Nottingham

Traditionally, the region around Nottingham had been very strong in textile and other manufacturing enterprises along with mining—none of which existed anymore by 2006. So, given the size and stature of this university, serving 32,000 students with six different faculties and five campuses in 2006, the University of Nottingham eventually played a significant role in economic development and technology-based entrepreneurship in both the region and the country. In fact, the university ranked among the top five in the United Kingdom in the amount of research funding it received annually from industry. In 2003–04, for instance, it generated £11 million in funding from industry. Among its partners were Powergen, Boots, GlaxoSmithKline, Ford Motor Company, AstraZeneca, and Rolls-Royce plc.

As a result, the university largely had embraced a philosophy of innovation commercialization, although academic faculty members did “remain very suspicious” of technology transfer proponents and professionals, according to Simon Mosey, who oversaw the university’s commercialization efforts. Overall, though, the culture there had allowed for a number of innovative commercialization and industry collaboration programs, which will be discussed in more detail later in this report.
Finland: Helsinki University of Technology

This university, founded in 1849, maintained a long history as a leader in research and technology development, particularly in industrial engineering and management. Its status made it one of the easiest places from which to attract research funding, according to Peter Kelly, a professor at the university at the time and head of a new program called the Helsinki School of Creative Entrepreneurship.

However, he told the conference attendees, Finland itself tended to be more focused on design than technology, which may have closely reflected the focus of Finland’s most prominent corporate patron. Interestingly, the economy, economic development, and technology commercialization efforts all were driven largely by electronics giant Nokia, which represented an estimated 30 percent of Finland’s gross domestic product.

Generally, the university’s “innovation strategy” included a strong commitment to cooperate with industry, including start-up companies, to generate mutually funded know-how and intellectual property. The university also pursued the protection of that intellectual property in cooperation with its researchers, who owned the intellectual property, and partner companies.

In 2006, the University had arrived at a crossroads as it explored new partnering paradigms for teaching entrepreneurship and combining it with innovation commercialization.
Representatives from both Dublin City University (DCU) and the University of Pittsburgh supported the idea for this conference largely to be able to compare and contrast their individual commercialization efforts. DCU, for instance, was a young university, relatively speaking, unencumbered to some extent by centuries-old academic traditions and politics. Its brief history paralleled the aggressive course of the country overall in transforming the economy of Ireland into a technology development leader within the European Union.

The University of Pittsburgh, in contrast, supported a more than 220-year academic history, with technology commercialization efforts beginning in the mid-1990s to comply with federal laws. The other participating universities maintained similar histories that tended, in some respects, to slow the acceptance—and thus the adoption—of commercialization as an academic norm. This section will showcase the organizations that had arisen amid those histories—and, in DCU’s situation, without such encumbrances.

Dublin City University

Technology development and commercialization began at Dublin City University (DCU) within the multidisciplinary framework of its five different academic faculties:

1. A business school, which included accounting, finance, marketing, and innovation
2. Engineering and computing, which encompassed electronics, mechanics, and manufacturing
3. Humanities and social sciences, which emphasized communication, educational studies, entrepreneurship, and law and government
4. Science and health, which included biotechnology, mathematics, chemical sciences, nursing, health and human performance, and physical science

5. Distance education

Then in its 25th year, the university had grown to 12,000 undergraduate and 2,100 graduate students, supported by 300 faculty members and 120 staff members as well as €24 million in annual research expenditures.

Perhaps even more noteworthy, though, was the young university’s aggressive, proactive emphasis on research that led to commercial development of intellectual property. The university kept the ideas flowing on campus through an infrastructure built around a well-rounded group of designated research centers. As outlined below, DCU in 2006 also boasted four national research centers and nine university-designated research centers.

**DCU Research Centers (2006)**

**National Research Centers:**

1. National Centre for Plasma Science and Technology
2. National Centre for Sensor Research
3. Research Institute for Networks and Communications Engineering
4. National Institute for Cellular Biotechnology

**University-designated Research Centers:**

1. Centre for Digital Video Processing
2. Centre for International Studies
3. Management Learning and Development
4. Centre for Society, Information and Media
5. Centre for Translation and Textual Studies
6. Materials Processing Research Centre
A Long-term Commitment

These centers served as the primary targets of Invent, a wholly owned subsidiary of DCU that was established, with its own funding resources, to assist in the rollout of start-up companies that were based on technologies developed at DCU. The university’s long-term commitment to commercialization could be seen in its €10.5 million innovation/incubator center, which included five floors and 52 incubator units. The on-campus building also housed biotechnology laboratory facilities and a conference center.

At the time of the conference, this “commercialization gateway,” as the university promoted Invent, housed 23 incubating start-up companies and served 33 clients, representing 87 percent capacity. Facilitating the incubation efforts, along with ongoing, proactive connections between industrial researchers and faculty researchers on campus, were three licensing professionals.

They had been busy, indeed. As an organization that claimed to be more intellectual property-driven than opportunity-driven, Invent in 2006 maintained 53 patents in its technology portfolio and had been receiving an estimated two or three invention disclosures a month for commercial consideration. Its efforts as of 2006 helped to build up the total collective valuation of its start-up companies to about €21 million. Invent owned an estimated €750,000 in shares, collectively, of its start-up ventures.

Faculty Incentives

To encourage more faculty members to participate in the commercialization process, Invent paid inventors €200 for their efforts, in addition to an annual award of €1,000 to the inventor with the best disclosure. The incubator also provided some additional development
funding for proof of concept and other development gaps. And while the university claimed ownership of the intellectual property developed there, it did maintain the following royalty distribution policy: For the first €50,000 in royalties, the inventor received 75 percent, the university got 15 percent, and the faculty member’s school/unit received 10 percent. For the next €50,000–€150,000, the inventor earned 50 percent. Inventors also could own up to 85 percent of spin-off companies based on their innovations.

The university more recently established the Biomedical Diagnostics Institute to focus on “innovative, high-sensitivity platform” technologies. The facility in 2006 housed a team of 55 collaborators from both the university and industry and remained anchored by six major industrial partners, including Bristol-Myers Squibb Company and Wyeth.

University of Pittsburgh

The University of Pittsburgh, founded in 1787, had evolved into a major research university that, in 2006, stood in the top tier among its U.S.-based university peers. As of 2006, the university had 33,400 undergraduate and graduate students. Supporting that effort were 4,700 faculty members and 6,800 other employees—making the university one of the largest employers in the Pittsburgh region.

Pitt, located in the urban Oakland section of the city of Pittsburgh, offered 16 undergraduate, graduate, and professional schools at its Pittsburgh campus as well as four regional campuses. It also boasted a close affiliation with a major medical center (University of Pittsburgh Medical Center) and its affiliate hospitals, which helped to support the University’s largely medical-related research and innovation development activities. Overall, Pitt’s research endeavors by 2006 had grown to more than $600 million in sponsored research annually, including nearly $400 million in funding from the U.S. government’s National Institutes of Health. The research grant proposal process, along with all funding documentation, was managed by Pitt’s Office of Research.
All of that growing research activity provided an active breeding ground for the development of innovations that were commercialized by the University’s Office of Technology Management (OTM). The University officially established the office in the center of its Oakland campus in 1996 to comply with the federal Bayh-Dole Act of 1980. The office, which served as the hub of all commercialization activity on campus, managed all intellectual property protection issues, including patenting; facilitated business development and licensing; managed all government reporting requirements; and provided education and outreach opportunities for faculty members who were interested in the process.

A Commercialization Evolution

As Pitt’s commercialization endeavor had grown over the previous 10 years, the office had evolved considerably. From 1996 until 2001, OTM operated with more of an “inventory” mentality, submitting patent applications on most innovations that were presented by faculty to OTM for commercial consideration.

That approach proved costly, and in 2001, the office, under new leadership, introduced a framework of best business practices, a more rigorous innovation evaluation process, and a deal-making philosophy based on the concept of fair-market value. Its mission was “to extract the fair-market value of the University’s intellectual property using best business practices for the benefit of the University, its faculty and staff, and the community.”

The advantages of the new approach became clear: OTM processed fewer, but stronger, patents and more licensing deals, which meant significant improvement in OTM expenditures and greater chances for start-up success. However, the best business practices and more stringent controls were perceived by some academics as counter to academic freedom and intellectual friendliness and led to some faculty disenchantment with the process. Meanwhile, other organizations around campus had been offering some levels of commercialization services to faculty independently of OTM.
In response, in January 2002, the Office of the Provost established the Technology Commercialization Alliance (TCA). Its goal was to bring together the diversity of resources on campus aimed at commercialization and entrepreneurship. It also adopted the role of providing outreach and education to faculty, staff, and students, as well as the outside community, on behalf of OTM in hopes of fostering more commercial innovation development on campus.

And in 2001, the University of Pittsburgh Cancer Institute created what eventually would be named the Office of Enterprise Development (OED), another organization aimed at assisting faculty members in the commercialization of their innovations. OED, which worked closely with OTM, evolved and grew to serve all six schools of the health sciences at Pitt.

Both organizations successfully managed to attract more faculty members into the commercialization process, adding a level of service orientation to the process that hadn’t previously existed. However, they also added a layer of confusion both internally and externally as to which office managed the commercialization process officially.

**Just-in-time Service-oriented Model**

In 2005, new leadership moved OTM and the overall commercialization effort toward a more service-oriented organization that emphasized a “just-in-time” model for commercialization, patenting only those innovations with the most commercial potential and that could be licensed quickly. Its mission was to facilitate the development of products and processes from University technology for the benefit of the University; its faculty, staff, and students; and the community. Its new philosophy was simple: “Good products bring in good revenue.”

By 2006, OTM’s staff included a director, four licensing managers, a strategic relations manager, a technology marketing manager, two business development professionals, and 11 management and support staff members. Moreover, the operations of both TCA and OED were being integrated into OTM’s to present Pitt’s
commercialization efforts as a unified one-stop shop, with support from other resource partners.

By 2006, success was measured using two key metrics: the number of invention disclosures submitted to OTM for commercial consideration and the number of licenses/options being executed annually. Both climbed considerably since the latest approach began. Invention disclosures climbed from 74 in fiscal year 2003 to 165 in fiscal year 2006. Licenses/options rose from 44 in 2003 to 58 in 2006. In all, more than 300 faculty, staff, and students joined the commercialization process in 2006. As for start-up companies, 31 new companies were launched between 2003 and 2006.

Supporting that model were several sources of “gap” funding from the Commonwealth of Pennsylvania, local foundations, and the University to assist in proof of concept, prototypes, and other related precommercialization activities. OTM provided the funding to Pitt innovators at its own discretion and often used the funding to leverage postcommercialization gap funding and venture capital locally to help new ventures get started.

Community Partnerships

The University of Pittsburgh had served as a major partner in technology-based economic development initiatives, including state-funded initiatives such as the Pittsburgh Life Sciences Greenhouse, Innovation Works, the Technology Collaborative, and the Greater Oakland Keystone Innovation Zone, as well as the MIT Enterprise Forum of Pittsburgh. However, it did not assume a role as central facilitator of such development efforts because of the abundance of existing resources throughout the region that provided entrepreneurial assistance.

The University did provide direct entrepreneurial assistance and educational services to businesses in the community, though, through its Institute for Entrepreneurial Excellence. The institute was part of Pitt’s Joseph M. Katz Graduate School of Business and was composed of four different programs.
• Small Business Development Center (SBDC): This state- and federally funded organization offered entrepreneurial education, counseling, and general assistance to small businesses in the region. It was part of a statewide network of SBDCs.

• Entrepreneurial Fellows Center: This center’s yearlong educational program regularly brought together the CEOs of smaller companies for seminars and networking programs throughout the year. Tuition from participants funded the program.

• Family Enterprise Center: This program, which was similar in structure to the entrepreneurial fellows program, focused on multigenerational businesses and the unique issues they faced, particularly when it came to assigned roles in a company, getting along, and business succession planning.

• PantherlabWorks: Similar to SBDC, this initiative provided assistance to technology-based entrepreneurs in the region who wanted to start new companies around their technologies.

OTM also promoted industry partnerships that led to intellectual property licenses and other similar relationships. Its technology marketing staff members reached out to industry via several Web-based databases of available technologies as well as face-to-face meetings at industry conferences and other venues. However, unlike those of Dublin City University, Pitt’s commercial innovation development efforts did not receive corporate funding support at this time other than in the form of sponsored research and contributions to support University-based research centers.

University of Cambridge

The University of Cambridge, considered a major research university, was built on 800 years of academic history and tradition. Founded in 1209, it served nearly 18,000 students in 2000 and claimed a direct connection to more than 80 Nobel laureates. Supporting its research
endeavor was annual research funding of more than €250 million and a substantial technology transfer effort that took a much broader view of “transfer” than one of pushing intellectual property into the marketplace.

The university’s transfer philosophy revolved more around the notion of knowledge transfer, which encompassed the development of graduates; publicly available research; and intermediate activities, such as faculty members consulting with industry, executive education programs, embedded laboratories, and other related activities that expanded into the Cambridge region.

**Managing Its ‘Transfer’**

That transfer philosophy, carried over into the university’s extensive commercialization efforts. The university managed those activities from a well-established organization called Cambridge Enterprise Limited, which “exists to help University of Cambridge inventors, innovators and entrepreneurs.” It also served as an entrepreneurial assistance hub for innovators and entrepreneurs from the Cambridge community at large. Its mission was “to help University of Cambridge inventors, innovators and entrepreneurs make their ideas and concepts more commercially successful for the benefit of society, the U.K. economy, the inventors and the university.”

In 2006, Cambridge Enterprise comprised 22 staff members who served in one of seven primary functions: licensing (patenting and licensing of intellectual property along life sciences and physical sciences tracks), business creation, investments, consultancy, business incubation, teaching and training, and external relations. In fact, the teaching and training function helped to demonstrate its broader transfer philosophy. This organization facilitated a university program that engaged at least 240 businesspeople from the region and beyond who contributed time to teach at the university.

**Entrepreneurial Outreach**

As a catalyst for entrepreneurship in the region, Cambridge Enterprise also ran a student-led business plan competition called
Cambridge University Entrepreneurs. The university established the program, which also included extensive training for participants, in 1999 with help from the Massachusetts Institute of Technology and $50,000 in sponsorships from venture capital funds, local companies, and the Cambridge-MIT Institute.

Since its inception, and up to 2006, the competition resulted in 26 start-up companies that were awarded a collective €250,000. Moreover, the participating entrepreneurs had been able to leverage those awards to raise a combined €6.3 million in venture capital and other investment funding. As of 2006, those start-ups boasted a combined valuation of about €27 million.

Cambridge Enterprise aggressive outreach into the community netted had some impressive results since 1999, according to the conference presenter. For instance, it had developed a network of at least 150 business mentors who assisted entrepreneurs in their new ventures—not to mention the 240 businesspeople who offered their time and expertise to teach the students of the university. In addition, the organization raised €400,000 in sponsorship funding from businesses in 2005 and another €20 million for collaborative research efforts. And 80 companies joined the organization in 2003 for technology showcase events as well as the Cambridge Enterprise Conference.

The university’s technology commercialization efforts fared equally well. In 2005, university inventors submitted 127 invention disclosures to the organization for commercial consideration. Cambridge Enterprise also filed 41 U.K.-priority patent applications and granted 40 licenses and options. Licensing income totaled €2.71 million. In addition, it spun out three start-up companies, assisted 30 other start-ups, and facilitated 70 consulting contracts that generated €1.58 million in income for the university. Patent costs, meanwhile, totaled €689,000, although the university also received €485,000 in reimbursement of patent costs.
Helping Manufacturers

Cambridge Enterprise aside, the university also had invested considerable time and funding to support the region’s manufacturing economy via its Institute for Manufacturing. In general, the institute’s aim was to assist manufacturers in their efforts to grow and increase their global competitiveness as well as to create wealth more effectively. Its services to the region included the following:

- **Education:** The institute provided manufacturing workforce development programs at the undergraduate, post-graduate, and industry leadership levels.

- **Research:** It offered two different types of centers that helped manufacturers to develop innovative tools and processes. Its innovation centers focused on production processes, industrial photonics, automated distribution and control, auto-identification, and industrial sustainability. Its management and strategy centers targeted strategy and performance, technology and management, economics and policy, international management, and decision support.

- **Practice:** This represented the technology transfer arm of the institute.

At the same time, the institute supported what it called its Industry Links Unit, an embedded program that served as a key interface with industry. As of 2006, this unit served 95 industrial and economic development members.

University of Nottingham

Since its founding in 1881, the University of Nottingham had evolved into one of the United Kingdom’s top 10 universities, according to *The Sunday Times*. The university partly credited its aggressive research efforts, which had been deemed world class by a then recent Research Assessment Exercise. This position also placed the university among the drivers in a regionwide initiative to position Nottingham as a so-called “science city.”
The university, as of 2006, served 32,000 students, including 8,000 undergraduates and 6,000 international students. It managed six faculties: arts, education, engineering, business law and social sciences, medicine and health sciences, and science. The university also maintained five campuses, including branch campuses in Kuala Lumpur, Malaysia, and Ningbo, China.

Also, the university ranked in the top five in the United Kingdom for research funding from industry, with €11 million generated in 2003–04. Accentuating that support were long-term relationships that had been developed with Powergen, Boots, GlaxoSmithKline, Ford Motor Company, AstraZeneca, and Rolls-Royce plc (which supported two technology centers at the university).

An Embedded Approach

To manage its technology commercialization efforts, the university adopted what it described as an embedded business development model, beginning with a central office that provided research and innovation services and employed five intellectual property executives. At the same time, the university proactively sought opportunities through a network of 21 business development executives who were based within the six faculty areas.

For example, the university employed one full-time business development manager in chemistry and its lab facilities. That operation built a portfolio of 20 patents and 40 commercialization projects, using numerous student fellows and advisors along the way.

In addition to the business development model, the university also had developed a Medici fellowship scheme with other regional universities to train academic innovators in technology commercialization. Since 2002, the partner universities had offered 100 one-year fellowships to faculty members with considerable academic experience and a desire to learn about commercialization. Those fellows received “local” training in finance, marketing, intellectual property, and business strategy that was complemented by “global” training.
The results going into 2006 had shown promise for the program. Of the 100 fellows, 30 went into technology transfer as a profession. Another 15 went into start-up companies, and 10 went into industry. The other 45 people went back into academia.

Helsinki University of Technology

Helsinki University of Technology, founded in 1849, has maintained a long and extensive history in technology-oriented research and innovation development based primarily in industrial engineering and management. In 2006, it was serving 15,192 students via 19 degree programs and 11 separate research institutes—all supported by 227 professors and 3,663 staff members. In fact, 131 students earned their doctoral degrees in 2005. The research institutes as of 2006 were as follows:


The university’s research efforts, as of 2004, were supported by €212.9 million in research funding—€97.3 million in external funding and €115.6 million in budgetary funding.

Its innovation development strategy, meanwhile, was built around the premise of close cooperation with industry, particularly Nokia. It did actively take steps, though, to protect intellectual property coming out of the university, in cooperation with the researchers and partner companies, and it assumed ownership of all intellectual property as it sought to exploit its commercial potential with domestic companies.

The university did take a slightly different view when it came to its intellectual property licensing strategy. Not only were the researchers acknowledged as the inventors, but they and their labs received 80 percent of any licensing income. However, they also had to pay the university 20 percent for its commercialization services along with any real costs for patenting, marketing, and other expenses.

Running the technology commercialization endeavor on behalf of the university was the Otaniemi International Innovation Centre, which provided protection, management, and marketing of innovations as well as training for international industry leadership, start-up training, and other business services. It also provided research and liaison services as well as career and alumni services.
Section 3: Motivational and Educational Initiatives

The universities participating in this conference acknowledged that they faced many ongoing challenges in pushing the technology commercialization agenda forward. But perhaps most challenging was to engage more faculty, staff, and students in the process. In some cases, such efforts still required a cultural shift among academics to accept and promote the notion of moving from a mindset focused on basic research to one of applied or translational research that could be transformed into products and processes with great commercial value.

For each of the universities, this cultural change had led them to proactively create and pursue initiatives that aggressively offered ongoing education, incentives, high-level recognition, and new opportunities for interaction and collaboration with industry and the communities around them. All admitted that their strategies continued to evolve as they conceived of and employed new tactics to increase both the quantity and quality of participation. Still, the following represent some of the most successful strategies of the day, which were, in fact, changing the commercialization cultures collectively.

Dublin City University

Representatives within Dublin City University (DCU)’s Invent initiative were quick to acknowledge that their biggest emphasis was on creating a culture of commercial innovation. But they also noted that they had limited resources (three people at the time of the conference were managing the commercialization process) in trying not only to commercialize technologies through the university’s various research centers but also to change the culture.

“We see ourselves as a coalition of the willing” rather than as a group that could “make noses go the same way,” one Invent representative, Ron Immink, noted during his presentation.
From an education perspective, DCU did provide ongoing training for faculty, including the Enterprise Fellows program that encouraged interaction with industry and the prospect of spin-off enterprises. Some of that education focused on the management of expectations both internally and externally, with faculty, for instance, often approaching innovation development with more of a 10-year view and industry approaching it with a much shorter-term outlook.

Helping to guide such efforts was the Ryan Academy for Entrepreneurship, which was funded by a Ryan family foundation. (Tony Ryan, who died in 2007, was one of Ireland’s leading entrepreneurs and founder of Ryanair Ltd.) The center included a resident entrepreneur who helped to facilitate the development of start-up companies.

To promote such activities, Invent pointed to the production of a high-end booklet on Invent and DCU, which representatives described as both a “great-impact publication” and their number-one marketing tool.

**Innovator Recognition**

Despite the limited resources, Invent did place a high value on providing worthwhile incentives to its faculty innovators for their participation in the process. To encourage more faculty to file invention disclosures and, therefore, enter the commercialization process there, Invent offered to pay faculty €200 for each submission. And to encourage better-quality invention disclosures, Invent sponsored an annual contest that offered a €1,000 award to the faculty member who submitted the best invention disclosure during the given year.

Another motivational resource for Invent was its available funding for proof-of-concept development efforts and other commercialization gaps.

As mentioned earlier in this report, Invent also paid faculty innovators 50 percent in royalties collected beyond the first €50,000 received by the university for technology licenses outside the university.
Overall, DCU officials saw their role as one of creating a “buzz” on campus and beyond, managing a hub of innovation commercialization and entrepreneurial activities, and increasing the value of university-owned innovations as much as possible before entering any licensing agreements.

**University of Pittsburgh**

The University of Pittsburgh took a two-pronged approach to its commercialization activities beginning in 2002. To address faculty concerns over the Office of Technology Management (OTM)’s rigorous, seemingly less-than-friendly business focus, as well as the growing confusion over the establishment of other organizations on campus that supported commercialization, the University’s Office of the Provost in January 2002 officially launched what it called the Technology Commercialization Alliance (TCA).

The mission of this alliance was to bring together all of the seemingly competing organizations under one umbrella to provide entrepreneurial education, support, and outreach for Pitt innovators in their development of commercial innovation. This brief history bears repeating in this section because, ultimately, TCA also served as a testing ground for a number of education, outreach, and recognition activities that eventually would become the foundation for Pitt’s commercialization activities.

In short, the Office of the Provost positioned TCA as the “warm and fuzzy” side of the process, focusing more on the innovator and the long-term goal of fostering a more entrepreneurially minded culture of innovation commercialization among faculty, staff and students. Meanwhile, OTM then could focus its attention directly on the innovation side of the process, including intellectual property protection, licensing, and federal compliance and reporting.

By late 2005, Pitt’s commercialization efforts improved significantly enough for all parties to agree that it was time to merge TCA into OTM. By then, though, many of the initiatives conceived and implemented by TCA and the Office of the Provost earlier had
proved to be successful in trying to motivate, educate, and engage faculty, staff, and students in the process, and they remain today.

**Education and Outreach**

TCA, with funding from the provost’s office, launched **Academic Entrepreneurship: The Business of Commercial Innovation** in the fall of 2002. The seven-week course (three hours per week) focused on the realities of entrepreneurship while emphasizing the earlier stages of the commercialization process. The course, paid for by the provost’s office, was offered to Pitt faculty, staff, and students, with roughly 20 participants taking the course twice a year. The course was administered in partnership with the University’s graduate business school and its Center for Executive Education.

As the course description explained, the course “isn’t just about giving up the academic life to become CEO of a technology-based start-up company. Rather, it’s about an innovation process—and willingness—that contemplates market problems and solutions, marketability, collaborative idea sharing, entrepreneurial dynamics, profit-driven economics, and successful technology transfer.”

TCA also successfully tested another innovation development support concept, called **i-Lab Innovation Brainstorming Workshops**. The workshops were designed to allow a Pitt innovator to present an innovation idea to a small, confidential panel of faculty peers who were considered smart, creative thinkers. A professional facilitator then would lead the panel through a series of brainstorming exercises aimed at drawing out additional application ideas to help the innovator identify the most promising possibilities for commercialization.

The brainstorming concept also had been adapted for use as an effective tool to kick off discussions for the development of new research centers and institutes on campus, including the Gertrude E. and John M. Petersen Institute of NanoScience and Engineering, Center for National Preparedness, Center for Energy, and others.

TCA, in partnership with the Office of the Provost, also hosted a number of so-called poster receptions, which basically were
showcases of innovations and research built around food with a diverse group of attendees that included members of faculty, students, industry, and representatives from the local investor community. The showcases typically focused on one broad topic and then included participation from a diversity of schools and departments around the Pitt campus.

Among the topics were “cool devices,” nanoscience, energy, computer modeling and simulation, and national preparedness.

Faculty, staff and student innovators also received education and outreach opportunities through the University’s Office of Enterprise Development (OED), schools of the health sciences, one of the aforementioned organizations on campus established to better support the commercialization efforts at Pitt. Since the conference, the office has been placed under the direction of OTM, becoming largely its business development arm.

Among other programs, OED offered its own 10-week course, titled From Benchtop to Bedside: What Every Scientist Needs to Know, for faculty, and it hosted a regular entrepreneurial education seminar series titled the Limbach Lecture Series (named after a corporate benefactor who helped to fund the establishment of OED).

**Innovator Recognition**

In 2005, TCA established what would become an annual event on campus: the Celebration of Innovation. This upscale reception was designed to recognize two groups of Pitt innovators. TCA invited to the reception faculty members, staff members, and students who were involved in the submission of invention disclosures to OTM that year for the purpose of thanking them for their participation.

TCA also invited any innovator whose technology had been licensed to industry or a start-up company that year. The second group then received a special Pitt Innovator Award, presented by the University’s chancellor and several other top officials. To emphasize the University’s commitment to commercialization from the highest levels of the University, the chancellor agreed to serve annually as the keynote speaker.
The annual receptions have each attracted close to 150 attendees, including members of the local economic development community as well as a few investors and foundation representatives. And some faculty members had been known to add the honors to their CVs, indicating that they are taking the honor seriously.

The Pitt Innovator Initiative

To create more of a cohesive community of faculty, staff, and students participating in the commercialization process at Pitt while also attracting more to the process, TCA developed a multifaceted marketing and outreach strategy called the Pitt Innovator Initiative. The concept borrowed from the idea of an affinity group model, creating a group set apart in the University. The initiative included recognition (the Celebration of Innovation actually was part of the initiative), educational opportunities, and other special events that encouraged collaboration with others.

More tangibly, the initiative’s aim was to directly support OTM’s efforts to increase the number of invention disclosures as well as to provide an identity for the “product” that OTM offered generally to industry and the community. Faculty, staff, and students became Pitt Innovators simply by submitting an invention disclosure to OTM for commercial consideration. Then OTM marketed the Pitt Innovators, showcasing both the innovators’ expertise and their specific innovations, to the rest of the world.

The Pitt Innovator designation also was supported with marketing materials and a blue and gold lapel pin, given to each innovator, that was diamond shaped with “Pitt Innovator” along the edges and a distinctive red “i” in the middle. The Pitt Innovator credo was “changing the world through imagination … ingenuity … innovation.”

University of Cambridge

The University of Cambridge, while certainly active in its commercialization activities, offered most of its discussion within the realm of philosophy, regional trends, and organization, as noted in
this report’s previous sections. However, university officials noted that many of the university’s commercialization activities did revolve around its Institute for Manufacturing initiative, which is outlined in more detail in the second section.

In general, though, the initiative placed great emphasis on bringing together faculty and students with committed industry partners. In fact, its corporate partnership was membership-driven and, as of the conference, included 95 members. Meanwhile, the institute hosted numerous educational courses, workshops, symposia, and conferences, all focusing on various aspects of innovation development and commercialization. The institute also delivered industrial consulting services and other types of engagements locally, nationally, and even internationally.

**University of Nottingham**

The University of Nottingham, in addition to its wide scope of commercialization activities, played host to a successful business plan competition for postgraduates and postdocs in the biosciences throughout the United Kingdom for the previous 10 years. Called Biotechnology YES (Young Entrepreneurs Scheme), this competition attracted more than 1,000 participants and focused on developing entrepreneurial skills, not business plans.

Overall, according to a university official at the conference, the program required a longer-term perspective of the development of entrepreneurs and an entrepreneurial culture within academia. The program was supported financially by numerous corporate sponsors, particularly in the biotechnology sector. Nestlé also was a sponsor.

In general, contestants competed in teams of five, assuming different roles as founders of proposed new ventures. Those ventures were built on plausible science issues with no intellectual property problems. Ongoing instruction, often given by representatives from industry, included I.P. strategy, financing, financial planning, marketing/commercialization strategy planning, and business plan requirements (including a presentation), among other classes. Teams also attended one of four regional three-day workshops.
Winners were awarded €1,000 as well as the opportunity to participate in a business plan competition in the United States. Recent winning ideas included a company with disposable contact lenses for diabetics, where the lenses changed color with glucose level fluctuations, and a company that produced a synthetic wine bottle cork that was grown in the lab.

Exit questionnaires completed by participants revealed that most of the participants believed that they had developed new and valuable skills as a result of the initiative. For instance, 85 percent claimed new financial awareness, 75 percent gained knowledge about working in teams, 59 percent added to their management skills, and 56 percent learned new interpersonal skills. In addition, 34 percent of the respondents suggested that they now aspired to form their own companies. Another 43 percent wanted to conduct industrial research, and 40 percent wanted to achieve industrial management positions. Thirty-five percent wanted to remain in academia.

The university, in conducting this contest over the years, learned several things. First, traditional metrics may not capture unexpected outcomes of policy initiatives. Also, a longer-term view is necessary to see hard and soft benefits. And finally, business plan contests don’t have to aim to create real business plans or even real entrepreneurs to contribute significantly to the development of a region’s entrepreneurial culture.

**Helsinki University of Technology**

Helsinki University of Technology was only one of three prominent Helsinki schools of higher education that came together to forge an ambitious initiative that would spur innovation creativity by bringing together the elements of design, technology, and business in one combined program. Its goals were twofold: to stimulate and support innovation commercialization in the region and to provide entrepreneurial training for the students.

The initiative, called the Helsinki School of Creative Entrepreneurship, was a partnership among the University of Art and Design Helsinki, Helsinki School of Economics, and Helsinki University of
Technology. To keep the partnership balanced, this school operated independently of the partners while still offering credits and experience to master’s-level students. The school also was supported financially by the country’s Ministry of the Interior and the cities of Helsinki, Espoo, Vantaa, and Kauniainen, among other supporters.

The three schools launched the initiative largely as the result of four influences:

- Government desires
- The contention that the universities conducted lots of research, very little of which was developed into commercial products
- Peer pressure
- Growing, pent-up demand for more innovation and entrepreneurial development

This program was team oriented, with each team consisting of a design student, a technology development-focused student, and a business student. Students were selected for the program based on their academic records and entrepreneurial spirit—which was necessary to drive the momentum of their projects.

The program also required each project to include the development of a business plan that could attract money and management realistically within a period of nine to 12 months. Projects also had to be built around technology to which they had “clean” intellectual property rights. And lastly, the projects had to include idea originators who didn’t want to lead the projects but simply contribute to them.

To support the teams’ efforts, the school then gave each team funding to cover various expenses. Funding included €10,000 for market research, €5,000 for outside expertise, and another €9,000 for internships. The program also supported the teams with intensive education and training, team-building exercises, and periodic project board meetings (once every four–six weeks). Boards were set up with an experienced businessperson chairing them along with an academic representative and the idea originator. The boards ultimately controlled the teams’ budgets.
Perhaps the greatest incentive for the participants to strive for success was the fact that each participant had the opportunity to share in ownership of the enterprises developed by his or her teams. The idea originators received 45 percent ownership, each student on the team received 15 percent, and the student project manager received 10 percent.

A board made up of university directors, an intellectual property expert, a project financier, a venture capitalist, and an entrepreneur ultimately would conduct evaluations of the projects to rate their success.

At the time of the conference, the program had not yet been fully implemented. In time, though, success of the overall initiative, according to the Helsinki University of Technology official at the conference who was directing the program, will be measured by the following criteria: the number of ventures developed in the program, the number of ventures started by graduates, the ability of the ventures’ teams to attract financing and human capital, the depth of interest in the research community to participate, and the societal benefits from university research.
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