



## IMPROVING INNOVATION THROUGH BETTER MANAGEMENT

The Expert Panel on Innovation Management Education and Training



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**The Expert Panel on Innovation Management Education and Training**

**THE COUNCIL OF CANADIAN ACADEMIES****180 Elgin Street, Suite 1401, Ottawa, ON, Canada K2P 2K3**

**Notice:** The project that is the subject of this report was undertaken with the approval of the Board of Directors of the Council of Canadian Academies (CCA). Board members are drawn from the Royal Society of Canada (RSC), the Canadian Academy of Engineering (CAE), and the Canadian Academy of Health Sciences (CAHS), as well as from the general public. The members of the expert panel responsible for the report were selected by the CCA for their special competencies and with regard for appropriate balance.

This report was prepared for Innovation, Science and Economic Development Canada. Any opinions, findings, or conclusions expressed in this publication are those of the authors, the Expert Panel on Innovation Management Education and Training and do not necessarily represent the views of their organizations of affiliation or employment, or the sponsoring organization, Innovation, Science and Economic Development Canada.

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All CCA assessments undergo a formal report review and are published and made available to the public free of charge. Assessments can be referred to the CCA by foundations, non-governmental organizations, the private sector, or any level of government.

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## The Expert Panel on Innovation Management Education and Training and Workshop Participants

Under the guidance of its Scientific Advisory Committee, Board of Directors, and the Academies, the CCA assembled the Expert Panel to lead the design of the workshop, complete the necessary background research, and develop the report. The Panel directed the CCA in identifying the experts who participated in the workshop. Each expert was selected for his or her expertise, experience, and demonstrated leadership in fields relevant to this project.

### Expert Panel

**John R. McDougall, FCAE (Chair of Panel and Workshop)**, President, DALCOR Innoventures Ltd.; Adjunct Professor, Alberta School of Business and Faculty of Engineering, University of Alberta (Edmonton, AB)

**Deborah Ancona**, Seley Distinguished Professor of Management, MIT Sloan School of Management (Cambridge, MA)

**Colleen Collins**, Vice President, Canada West Foundation; Adjunct Professor, Beedie School of Business, Simon Fraser University (Vancouver, BC)

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**Laurent Simon**, Full Professor, Department of Entrepreneurship and Innovation and Co-Director, Mosaic, Creativity and Innovation Hub, HEC Montréal (Montréal, QC)

### Workshop Participants

**Max Blouw**, Former President and Vice-Chancellor of Wilfrid Laurier University (Waterloo, ON)

**Richard Boudreault, FCAE**, Chairman, Sigma Energy Storage (Montréal, QC)

**Judy Fairburn, FCAE**, Past Board Chair, Alberta Innovates; retired EVP Business Innovation & Chief Digital Officer, Cenovus Energy Inc. (Calgary, AB)

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The CCA also recognizes the important contribution to this assessment of **Robert G. Cooper**, ISBM Distinguished Research Scholar, Pennsylvania State University.



## Message from the Chair

This report addresses the most critical issue for Canadian innovation. While research is world-class and technology start-ups are thriving, few companies grow and mature in Canada. Canadian innovation confronts a long-standing paradox — an innovation system that struggles to achieve global excellence within an economy that relies on global competitiveness for success.

Canada would clearly benefit from more managers with the culture, knowledge, and skill sets to systematically manage people, ideas, and business processes in order to develop, grow, and mature innovative Canadian-based enterprises. Canada could also leverage its inclusive social environment to create a national culture of inclusive innovation as a source of competitive advantage in the global innovation economy. Achieving such outcomes requires changes in the competencies and motivation we develop in Canadian managers of innovation.

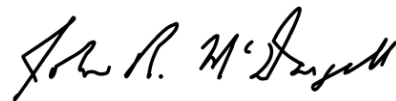
The Expert Panel tasked by Innovation, Science and Economic Development (ISED) Canada addresses key competencies required to manage innovation, and identifies some of the leading practices for teaching these skills in business schools, other academic departments, colleges and polytechnics, innovation intermediaries, and industry. The Panel's work included surveys and extensive literature research, with findings based on the collective insights and experience of Panel members and 15 Canadian Workshop Participants. Panel and Workshop Participants reflected a diverse mix of disciplinary and sectoral expertise including innovation management and engineering as well as aerospace, energy, health, and software.

The Panel endorses a competency-based and people-centred approach to innovation within a life-long and experiential learning framework that embraces and pursues diverse strengths, and seeks to remove barriers experienced by some individuals, social groups, or regions. The five key innovation management competencies (IMCs) identified (finding opportunities, commercializing opportunities, managing diverse teams, leveraging innovation ecosystems, and leadership) apply generally across most companies and

innovative organizations although the relative emphasis of each IMC will vary across an innovation manager's career depending on their role, company, and industry.

It takes an ecosystem to raise excellent innovation managers. STEM departments, colleges and polytechnics, innovation intermediaries, and companies should all participate in innovation management training, collaborating with each other and with business schools to provide interested students with education and training opportunities throughout their careers. This final report is intended as a launchpad for additional work by all these stakeholders, so it does not provide comprehensive surveys, analyses and evaluations of programs and approaches. It emphasizes, however, that students at all levels would benefit from teachers experienced in managing innovation who incorporate leading-edge theory with their experience in how innovation works in practice, and incorporate "learning by doing" approaches.

It has been an honour to serve as Chair of this Panel. I would like to thank ISED for making this work possible and also to the staff of the Council of Canadian Academies for their key roles in gathering the data and organizing our sessions. Finally, I would like to thank my fellow Panel members for their contributions and assistance, and for their future involvement in strengthening innovation management education.



**John R. McDougall, FCAE**

Chair, Expert Panel and Workshop on Innovation Management Education and Training

## Message from the CCA President and CEO

This report comes at an auspicious time. Canada is increasingly recognized as a hub of world-class research punching above its weight in technology start-ups. The federal government is investing in infrastructure, superclusters, and fundamental science. Some of this was well documented in the CCA's April 2018 report, *Competing in a Global Innovation Economy*. This same report, however, also found that Canada is less competitive internationally than it could be, that we fail to grow start-ups to scale, and that we do not fully take advantage of our many strengths. Although there is no single explanation for why this is the case, one possibility is that we do not have sufficient leadership in innovation management to move us to the next level.

To help understand how to better support innovation management in Canada, Innovation, Science and Economic Development (ISED) Canada asked the CCA to turn our attention to this issue and address two critical questions: What are the key skills (including traits, behaviours, and practices) required to manage innovation? What are the leading practices for teaching these skills in business schools, other academic departments, colleges/polytechnics, and industry?

We assembled a five-member Panel to carry out preliminary research and facilitate a two-day workshop with 15 expert participants from management research, education, and industrial practice. This report, *Improving Innovation Through Better Management*, is the result of their deliberations, combining academic and grey literature, and analysis of

STEM programs and courses taught by leading national and international universities and colleges. Collectively, it identifies the competencies that are likely to enhance innovation management, describes what is currently known about where and how to effectively teach these competencies, and outlines the prospects for the future. As with every CCA report, we expect this work to contribute to the ongoing conversation about innovation policy in Canada.

The report would not have been possible without Panel Chair John R. McDougall (FCAE) and his fellow expert panelists and workshop participants. I thank them for their efforts in bringing this project to completion. The CCA Board of Directors, Scientific Advisory Committee, and our three founding Academies — Royal Society of Canada, Canadian Academy of Engineering, and Canadian Academy of Health Sciences — provided guidance, leadership, and insight throughout the entire assessment process.

Finally, I would like to thank ISED Canada for referring this important question to the CCA.



Eric M. Meslin, PhD, FCAHS  
President and CEO, Council of Canadian Academies



## Peer Review

This report was reviewed in draft form by reviewers selected by the CCA for their diverse perspectives and areas of expertise.

The reviewers assessed the objectivity and quality of the report. Their confidential submissions were considered in full by the Panel, and many of their suggestions were incorporated into the report. They were not asked to endorse the conclusions, nor did they see the final draft of the report before its release. Responsibility for the final content of this report rests entirely with the authoring Panel and the CCA.

The CCA wishes to thank the following individuals for their review of this report:

**Sylvie Albert**, Professor, Faculty of Business and Economics, University of Winnipeg (Winnipeg, MB)

**Claudia De Fuentes**, Associate Professor, Sobey School of Business, Saint Mary's University (Halifax, NS)

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**Carol Stephenson, O.C.**, Corporate Director and Former Dean of Ivey Business School, Western University (London, ON)

**Leonard Waverman**, Dean, DeGroot School of Business, McMaster University (Hamilton, ON)

The peer review process was monitored on behalf of the CCA's Board of Directors and Scientific Advisory Committee by **Jean Gray, C.M., FCAHS**, Professor Emeritus, Medical Education, Medicine, and Pharmacology, Dalhousie University (Halifax, NS). The role of the peer review monitor is to ensure that the Panel gives full and fair consideration to the submissions of the peer reviewers. The Board of the CCA authorizes public release of an expert panel report only after the peer review monitor confirms that the CCA's peer review requirements have been satisfied. The CCA thanks Dr. Gray for her diligent contribution as peer review monitor.

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## Executive Summary

### Executive Summary

Canada has an abundance of raw ideas, talented people, and entrepreneurial spirit. While research is world-class and technology start-ups are thriving, few companies grow and mature in Canada. This cycle — invent and sell, invent and sell — allows other countries to capture much of the economic and social benefits of Canadian-invented products, processes, marketing methods, and business models. Escaping this cycle will be aided by more effective innovation managers who can systematically manage ideas for commercial success and motivate others to reimagine innovation in Canada.

#### The Charge to the Panel

To understand how to better support innovation in Canada, Innovation, Science and Economic Development Canada (the Sponsor) asked the CCA to undertake an assessment on innovation management education and training. The CCA appointed a five-member panel (the Panel) to assess relevant evidence, lead a workshop, and develop a report. Since the acquisition of innovation management skills is not limited to business schools, the Panel and the Sponsor agreed to expand the scope of the charge to focus on the following two questions:

*What are the key skills (including traits, behaviours, and practices) required to manage innovation?*

*What are the leading practices for teaching these skills in business schools, other academic departments, colleges/polytechnics, innovation intermediaries, and industry?*

In keeping with these questions, this report explores ways to provide innovation management training to a large, diverse population of students throughout their careers. It is not a comprehensive review of innovation management curricula and does not evaluate particular programs or

institutions. The courses, learning experiences, and programs identified as leading practices are the product of the Panel's deliberations and reflect the consensus of its members. No single curriculum will or can satisfy all needs for the development of the next generation of innovation managers. The catalogue of formats, styles, methods, approaches, and platforms is growing and innovating — which is a positive development. Identifying leading practices is a work in progress; many activities, programs, courses, and experiences exist in Canada and internationally, and are rated highly by those who experience them. Formal evaluation of leading practices, however, was beyond the scope of this assessment.

#### Evidence and Approach

Despite the importance of innovation and innovation management to economic performance, little research has been published on how innovation management is best taught. The Panel undertook four main data collection exercises: 1) a literature review of innovation management and innovation management curricula; 2) a survey of courses, experiences, and programs offered at leading Canadian and international business schools and selected STEM (science, technology, engineering, and mathematics) departments, colleges, innovation intermediaries, and companies; 3) a survey of Canadian business school deans; and 4) interviews with management experts from around the world. Together, this knowledge helped inform a two-day workshop attended by the Panel and 15 innovation experts from across Canada. The collective insights of workshop participants factored heavily in the Panel's final report.

The Panel adopted a competency-based education approach. Competency-based education (CBE) is popular in professional programs, such as medicine and law, because it focuses on abilities students will need for practical work rather than on knowledge alone. Competencies take the

skill or ability (the *what*) needed to do a job and expand it to include *how* the job is done. Applying the concept of competencies to innovation management gives focus to *innovation management competencies* (IMCs), defined by the Panel as: the knowledge, skills, and attitudes that help people manage innovation effectively.

### Innovation Management Competencies

Successful innovation depends, in part, on having well-trained managers throughout an organization, from the C-suite to the shop floor. Since different industries and environments tend to demand different knowledge, skills, and attitudes, the relative emphasis of each IMC varies across an innovation manager's career depending on their role, company, and industry. Although the ideal innovation manager does not exist, the Panel identified five IMCs associated with high-performing innovation managers across a range of companies: finding opportunities, commercializing opportunities, managing diverse teams, leveraging innovation ecosystems, and leadership. There is no competency hierarchy as each continues to be reinforced and refined well after the completion of formal academic training. The competency-based approach adopted by the Panel is intended to begin a dialogue among business schools, companies, and other stakeholders that educate and train innovation managers. Yet, as there are many different ways to conceptualize the IMCs, the five IMCs are not definitive. Rather they are more of a first take, which the Panel encourages others to refine and further develop.

### Education and Training for Early-Career Students

The global economy's increasing reliance on innovation implies that future employees will need to understand — if not manage — some aspect of innovation in their careers. University and college students can begin learning innovation theory early in their careers, applying tools and techniques in their first jobs designing products, researching markets, and interacting with diverse teammates and their managers. Undergraduate and college business programs are a key leverage point for exposing more than 300,000 students each year to innovation management education, representing 20% of annual enrolment in Canada. Expanding the courses and learning experiences offered to STEM and other interested students may increase the likelihood that future Canadian innovation managers are equipped with the competencies needed to effectively manage innovation. Academic institutions can build an inclusive innovation culture by expanding access to innovation management education to all students. Collaborations with innovation intermediaries and companies expose these students to innovation management as practiced throughout the innovation ecosystem.

While innovation management is not part of all core business school curricula, the number of innovation management undergraduate courses offered in Canada have increased four-fold over the last decade, according to the survey of business school deans. Teachers with experience as innovators can provide students with an understanding of how innovation works in practice, especially its associated challenges and failures. Whether as teachers, co-teachers, or guest lecturers, teacher-practitioners may become role models or mentors for students. Innovation management education is more valuable to students when it reflects leading-edge theory and provides meaningful experiences. Incentivizing teachers to experiment in course content and delivery will result in innovation in innovation management curricula. Innovation management education is most effective when it provides students with active learning experiences such as entrepreneurial projects, flipped classrooms, innovation competitions, hackathons, work-integrated learning, and mentorship programs. Teacher-practitioners and learning by doing are core features of leading innovation management courses and programs in Canada, the United States, and Europe.

The Panel identified three principles in educating and training early-career students:

- Joint courses and programs that expand access to the teachers, theory, learning experiences, and innovative culture housed in business schools to a greater number of students.
- Innovation management education that provides students with experiential learning opportunities.
- Effective teachers that expose students to leading-edge theory and meaningful experiences. Communities of practice among teachers, researchers, and practitioners that encourage innovation in curricula and diffusion of leading practices.

### Education and Training for Mid-Career Students

Innovation management will be increasingly synonymous with management in the future. Graduate business programs are a key leverage point to provide targeted and specialized training to more than 30,000 future innovation managers each year, representing 25% of annual enrolment in Canada. These mid-career students, enrolled in MBA or other specialized programs, can learn how to manage product portfolios, access capital, and partner with organizations to help implement their company's vision. While innovation management is not part of the core curriculum in most Canadian and U.S. MBA programs, the number of innovation management MBA courses offered in Canada have increased five-fold over the last decade, according to the survey of business school deans. Where offered, MBA elective

courses in innovation management tend to focus on three of the five IMCs — finding opportunities, commercializing opportunities, and leveraging innovation ecosystems — with gaps in managing diverse teams and leadership. Striking the right balance between core and elective course offerings will depend on the needs of students and expertise of faculty in each business school.

The emergence of specialized innovation management programs reflects a growing demand from students for in-depth education that cannot be provided in MBA programs. According to the Panel's survey of curricula, Canadian business schools offer more specialized courses in innovation management than their U.S. counterparts. Courses and learning experiences can be customized to the expertise and needs of students entering these programs. However, not all managers of innovation will attend business school programs. For those who are unable to access or uninterested in graduate training, innovation intermediaries provide another opportunity for peer learning, networking, and mentorship, empowering more people with diverse skills, backgrounds, and perspectives. Innovation managers at all stages in their career experiment together, share resources, and learn from each other's failures. Innovation intermediaries are excellent places for students to experience and manage innovation.

The Panel identified three principles in educating and training mid-career students:

- Specialized graduate programs that target students planning to manage innovation in the next stage of their career with in-depth education that cannot be provided in more general MBA programs.
- Innovation management education that provides students with opportunities to take risks and allows for failures.
- Innovation intermediaries that contribute to innovation management training through mentoring and networking.

### Education and Training for Executive Students

Given their experience, leadership role, and influence over company-wide innovation culture, executives are well-positioned to improve innovation management across Canada in order to compete in the global innovation economy. These students can update and refine their IMCs as they learn to execute innovation strategies, access global markets, and build a vision for their company and industry in executive education programs. However, innovation management is not part of the core curriculum of most Canadian and U.S. Executive MBA programs. According to the Panel's survey of curricula, Canadian business schools offer fewer executive courses in innovation management

than their U.S. counterparts. Expanding executive student access to innovation management education in both the five IMCs and in specialized areas of particular weakness such as scaling, would help produce innovation leaders in Canada who drive creativity, promote diversity, disrupt markets, think globally, scale companies, and ultimately enhance the innovation ecosystem both within and outside their companies.

Excellence in innovation management requires lifelong learning, refining and reinforcing competencies throughout a career. Lifelong learning ensures that executives constantly strengthen their IMCs and keeps them up-to-date on current trends in innovation. Today's innovation leaders can also be valuable role models for the next generation of Canada's innovation managers. They can help employees acquire innovation management competence through on-the-job training and by providing resources for external educational opportunities. Executives can co-teach or guest lecture in undergraduate and graduate classrooms and mentor start-ups and scale-ups through innovation intermediaries and professional networks. A virtuous cycle of innovation leaders mentoring students who themselves become mentors will help produce generations of Canadians who can lead innovative companies at the forefront of the global economy.

The Panel identified three principles in educating and training executive students:

- Specialized training in how to scale high-tech companies.
- Innovation management education that provides students opportunities to reflect on their experiences.
- Laddered courses and programs in business schools that encourage students to supplement on-the-job training with more formal innovation management education.

### Final Reflections

The Panel imagines a more innovative Canada made up of more and larger companies that start, grow, and scale within the country. These companies are propelled by effective innovation managers at all levels and motivated by a national culture in which all stakeholders are aware of and broadly support innovation that is inclusive as a national priority. The report's value proposition — more effective innovation managers improve Canada's innovation performance — begins with improving innovation management education and training. In considering a broad sample of leading practices, the Panel hopes to spark a national conversation among a diverse set of stakeholders responsible for producing Canada's next generation of innovation leaders.

The Panel recognizes that scaling and growing companies in Canada is an urgent national priority. This challenge extends beyond companies that innovate or business schools that teach innovation. It requires a cultural shift — across academic institutions, governments, and citizens — that celebrates and reveres innovators alongside leaders in other fields. One step in addressing this priority could be endorsing and supporting a vision of strengthened competencies in innovation management. More widespread education and training in the five IMCs identified by the Panel would help in creating the necessary capacity and expanding the pool of Canadians who can push this national agenda forward. This goes well beyond isolated courses or learning experiences; it requires full-fledged programs that are integrated across the innovation ecosystem using the common language

and approach of the IMCs. Stakeholders in all sectors and jurisdictions can coordinate and align their collective efforts to support, develop, and deliver experientially based inclusive innovation education programs, taking into account the framework set out in the Panel’s report and building on Canada’s inclusive social environment as a source of competitive advantage in the global innovation economy.

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# 1

## 1 Introduction

Innovation refers to new or better ways of doing valued things. It is usually associated with human imagination, creativity, and risk-taking rather than with systems, processes, and management. Since the coupling of science and markets that began during the Industrial Revolution, however, it has been the systematic development of technology that has underpinned the waves of innovation and sustained explosion of economic growth (Harari, 2014). Indeed, some companies, especially over the last 100 years, have learned to systematize much of how new products and processes enter the market (Brynjolfsson & McAfee, 2014). They have, in short, learned to *manage* innovation — fostering ideas and turning them into products, processes, marketing methods, and business models that produce commercial value. Similar to accounting, finance, and strategy, innovation has become a business process that can be managed (Tidd & Bessant, 2013). As a result, some modern economies have become tremendously innovative.

Poor innovation performance has long been a feature of Canada's modern economy. Several studies have identified innovation management, or rather the lack of it, as one of the culprits. The 2018 Council of Canadian Academies (CAC) report, *Competing in a Global Innovation Economy*, found that few companies scale and grow in Canada, despite world-class research and thriving start-ups, suggesting a possible deficit of management competence (CCA, 2018). Similarly, a survey of industry stakeholders in Canada identified experienced management and executive talent as the primary barriers to innovation and scaling (Lazaridis Institute, 2016). Others, however, have argued that Canadian management has been effective, generating higher corporate profits than U.S. counterparts by focusing innovation strategies on U.S. business customers rather than global consumers (Nicholson, 2016). This perspective is in keeping with Canada's fifth place rank in the *World Management Survey* (Bloom *et al.*, 2014). Canadian firms that adopt the practices highlighted in this

survey are more likely to innovate (Brouillette & Ershov, 2014). For both sides of this debate, management is central to explaining Canada's poor innovation performance.

### 1.1 THE CHARGE AND SCOPE

To understand how to better support innovation management in Canada, Innovation, Science and Economic Development (ISED) Canada (the Sponsor) asked the CCA to undertake an assessment on innovation management education and training. Specifically, ISED was interested in the following questions in their initial charge to the CCA: i) What are the management skills required to ensure innovative corporate culture?; ii) What are some leading practices in teaching those skills?; iii) How have the learning experiences offered by Canadian business schools evolved over the last decade, for students and business managers, younger and older, to incorporate the management of innovation?; iv) How do the programs and experiences provided in Canadian business schools compare with other innovative countries and what are some promising initiatives that could be adopted in Canadian business schools?; and v) What is the role of other faculties in enhancing an innovation culture and how do business schools integrate these efforts into their programs?

To respond to the charge, the CCA appointed an Expert Panel (the Panel) to assess relevant evidence, lead an expert workshop, and develop a report. The Panel was comprised of five leading innovation scholars and practitioners with significant experience in academia, industry, and government. As with all CCA assessments, the charge was discussed by the Sponsor and the Panel at its first meeting to clarify the scope and focus the study as necessary. In its initial deliberations, the Panel queried the sole focus on business schools since innovation management skills are also taught in university STEM (science, technology,

engineering, and mathematics) programs, colleges and polytechnics, innovation intermediaries, and companies. In broadening the charge beyond business schools, it was agreed to focus on the following two questions:

*What are the key skills (including traits, behaviours, and practices) required to manage innovation?*

*What are the leading practices for teaching these skills in business schools, other academic departments, colleges/polytechnics, and industry?*

To address these questions, this report explores ways to provide innovation management training to a large, diverse population of students throughout their careers. It is neither a comprehensive review of innovation management curricula in Canada and abroad, nor an evaluation of particular programs or institutions. The courses, teaching practices, learning experiences, and programs identified as leading practices are the product of the Panel's deliberations and reflect the consensus of its members.

The Panel imagines a more innovative Canada made up of more and larger companies that start, grow, and scale within the country. These companies are propelled by effective innovation managers at all levels and motivated by a national culture in which all stakeholders are aware of and broadly support innovation that is inclusive as a national priority. The report's value proposition — more effective innovation managers improve Canada's innovation performance — begins with improving innovation management education and training. In considering a broad sample of leading practices, the Panel hopes to spark a national conversation among a diverse set of stakeholders responsible for producing Canada's next generation of innovation leaders.

## 1.2 APPROACH

### 1.2.1 Defining Innovation and Innovation Management

The academic literature offers many definitions of innovation. For simplicity, the Panel adopted a definition of innovation used in a prior CCA (2009) report: new or better ways of doing valued things. At its base, *innovation* is the collective product of the scientists, engineers, marketers, investors, and managers who create, sell, and use new products, processes, marketing methods, and business models. It is the conversion of ideas into commercial success,

a process akin to *invention x commercialization*. However, companies do not innovate in isolation. As emphasized by workshop participants, companies are part of a complex innovation ecosystem that includes other companies, universities, colleges, innovation intermediaries, and governments (Arthur, 2009; CCA, 2013).

*Innovation management* is a core activity that helps companies create new value for customers and users. It is the application of the tools and techniques of management to the highly uncertain outcomes of innovation. It involves managing a “coherent set of interdependent processes and structures that dictates how the company searches for novel problems and solutions, synthesizes ideas into a business concept and product designs, and selects which projects get funded” (Pisano, 2015). Managers stimulate the demand for innovation inside and outside of their organization, support the supply of innovation by providing key resources and setting priorities, and help bring innovations to the marketplace by providing financing (Tidd & Bessant, 2013; Dodgson *et al.*, 2014; Dougherty, 2016). To manage innovation effectively, chief executive officers (CEOs), chief technology officers (CTOs), product managers, and others need various knowledge, skills, and attitudes. Depending on the job and career stage, a single innovation manager may be responsible for product development, market research, finance, people, and corporate leadership.

### 1.2.2 Recognizing Inclusive Innovation

The Panel and workshop participants strongly affirmed the need to recognize *inclusion* in an innovation and innovation management context. As noted by Schillo and Robinson (2017), inclusive innovation involves consideration of outcomes beyond just economic — rather, it seeks to reduce “inequality-increasing effects of innovation.” Inclusive innovation is important to the extent that it facilitates the participation of more people in the innovation economy (Jacobs & Mazzucato, 2016) and considers the changing nature of employment (Schillo & Robinson, 2017). In modern, progressive countries such as Canada, inclusion and innovation often go hand-in-hand. Inclusion can be a key source of innovation and represents a fairer way to distribute prosperity. For the purpose of this report, *inclusive innovation* is a people-centred approach to innovation that embraces and pursues diversity strengths, and seeks to remove barriers experienced by some individuals, social groups, or regions.

### 1.2.3 Adopting a Competency-Based Education Approach

The Panel adopted a competency-based education approach. Competencies are “a cluster of related knowledge, skills, and attitudes that affects a major part of one’s job (a role or responsibility), that correlates with performance on the job, that can be measured against well-accepted standards, and that can be improved via training and development” (Lucia & Lepsinger, 1999). Competencies take the basic abilities needed to do a job (the *what*) and expand them to include *how* the job is done. In contrast to personality traits, such as openness and conscientiousness, that may also help one manage innovation, competencies can be taught and acquired in academic institutions as well as in more applied settings.

Competency-based education (CBE) has become popular in professional programs, such as medicine (Snell *et al.*, 2011) and law (Law Society of Ontario, n.d.), because it prepares students for practical work rather than focusing only on teaching them knowledge (Voorhees, 2001). Educators design curricula to develop the abilities that students need to do their jobs, rather than the knowledge they should incorporate or the time they need to devote to a given topic (Voorhees, 2001; Frank *et al.*, 2010). This focus on outcomes helps to adjust education and training to meet the needs of students. If a class excels in some competencies but needs more training in others, an outcome-focused approach can dictate how to design and tailor courses (Frank *et al.*, 2010). Evaluation can be a challenge for CBE since competencies are often more difficult to assess than knowledge.

Applying the concept of competencies to innovation management gives focus to *innovation management competencies* (IMCs). The conceptualization of the IMCs is the Panel’s main contribution to the field of innovation management. This is the first conceptualization of the skills, attitudes and behaviours required to effectively manage innovation.

### 1.2.4 Linking Competencies to Career Stage

It is not clear *when* innovation managers should acquire which IMC. In 2016, business was the most popular field of study for undergraduate, college, and graduate students in Canada (StatCan, 2017) (see Figure 1.1). Certainly, innovation management can be taught to these 350,000 business students in business schools, which are perhaps the best places to link theory and practice. However, all interested university and college students can begin learning innovation theory early in their careers, applying tools and techniques in

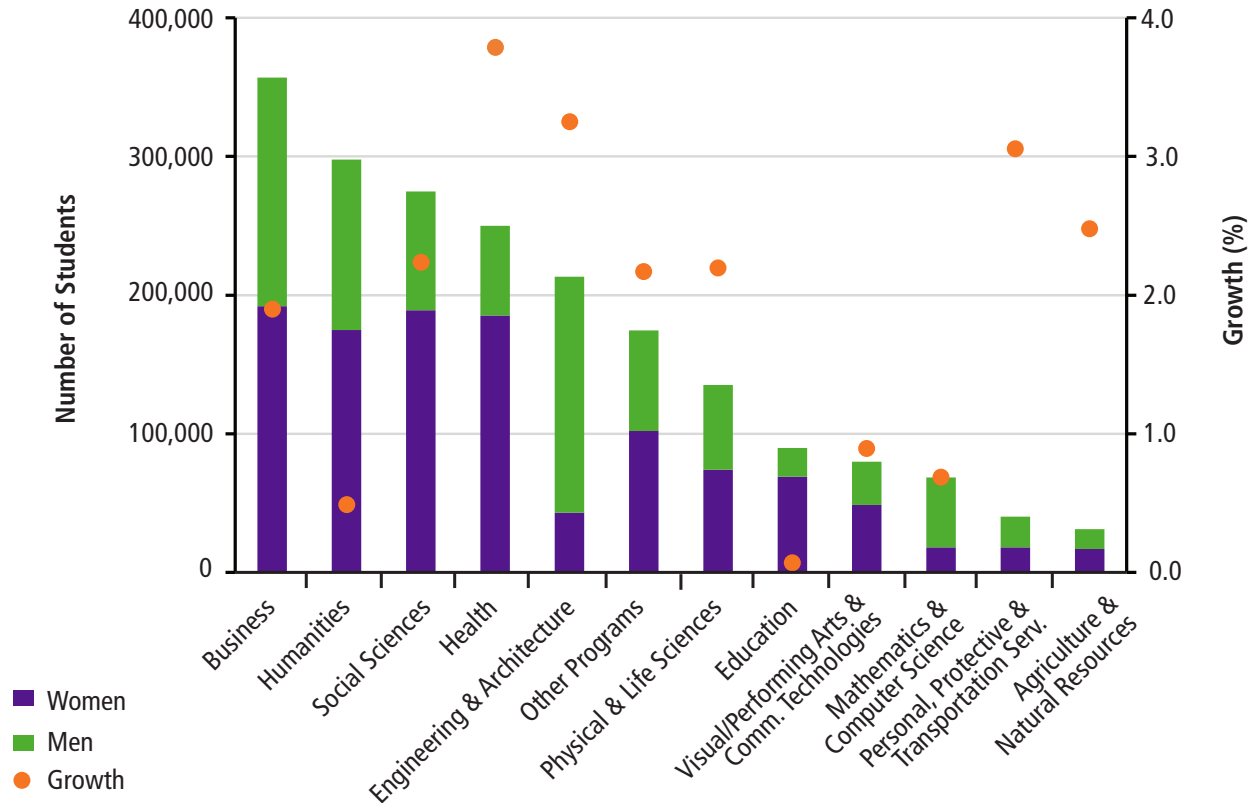
their first jobs designing products, researching markets, and interacting with diverse teammates and their managers. Yet, competency in innovation management is largely developed through experience. As they progress through their careers, eventually managing product teams or leading organizations, innovation managers can continue to improve their IMCs. Mid-career students can learn how to manage product portfolios, access capital, and partner with organizations to help implement their company’s vision. Finally, students in executive roles can update and refine their IMCs as they execute innovation strategies, access global markets, and build a vision for their company and industry.

Though the Panel acknowledges the unique twists and turns of each student’s career path, this report describes the courses, experiences, and programs available to students in three major career periods: early, middle, and executive. Education that is oriented around competencies, rather than knowledge or time spent in the classroom, can better integrate different learning opportunities (Frank *et al.*, 2010). Professional or accreditation bodies can define competencies for different career stages or roles. Training can then be adapted to pick up where students have left off in their education, or better prepare them for what is expected at the next career stage. Acquiring competencies across multiple career stages further encourages continuing education, as employees seek to constantly improve their abilities and employers clearly evaluate the abilities that employees can learn or develop during their tenure (Frank *et al.*, 2010).

## 1.3 EVIDENCE AND METHODS

Before running the expert workshop, the Panel undertook four main data collection exercises: 1) a literature review of innovation management and innovation management curricula; 2) a survey of courses, experiences, and programs offered at leading Canadian and international business schools and selected STEM (science, technology, engineering, and mathematics) departments, colleges, innovation intermediaries, and companies; 3) a survey of Canadian business school deans; and 4) interviews with management experts from around the world.

While innovation management is a growing field of study, little research has been published on how it is best taught. Specifically, the Panel found a paucity of literature on competency-based approaches to innovation management, perhaps due to the lack of consensus on



Data Source: StatCan, 2017

Figure 1.1

**Post-Secondary Enrolment, Growth, and Gender Representation by Field, 2016**

This figure plots 2016 post-secondary enrolment in Canada by field. The purple and green bars represent the number of women and men enrolled in each field while the orange dots plot the enrolment annual growth rate between 2007 and 2016.

who is actually considered to be an innovation manager (AACSB International, 2010). Another reason for the limited literature may be the lack of clarity on a number of terms related to innovation management such as *innovation*, *technology management*, and *entrepreneurship*. To address the lack of published research, the Panel drew on literature on innovation competencies and skills, technology management competencies, innovation management processes, and innovation capacity (see Table 1.1).

To help identify leading practices, the Panel conducted a survey of the curricula at 22 highly ranked business schools or schools that were suggested by workshop participants, deans, or management experts during report development. It also reviewed innovation management education and training offered in selected STEM departments, colleges, polytechnics, innovation intermediaries, and companies. The online survey of Canadian business school deans, which received 32 responses out of 62, asked for a catalogue of innovation management curricula (e.g., courses, learning experiences, joint programs) and reflections on leading

practices in Canada and globally. The standardized, open-ended interviews asked 11 Canadian and international experts about the theory and practice of innovation management as well as leading pedagogical practices. Methodological details for these evidence-gathering activities be found in the Appendix. Identifying leading practices is a work in progress; many activities, programs, courses, and experiences exist in Canada and internationally, and are rated highly by those who experience them. Formal evaluation, however, was beyond the scope of this assessment.

Together, these sources of information helped inform a two-day workshop held in Toronto in January 2018. The workshop brought together the Panel and 15 Canadian experts on innovation, drawn in almost equal parts from the academic and business worlds. Workshop participants reflected a diverse mix of disciplinary and sectoral expertise including innovation management and engineering as well as aerospace, energy, health, and software. As the practitioner perspective is often missing from the academic literature, this balance provided a more comprehensive and concrete

**Table 1.1**  
**Approaches Related to Innovation Management Competencies**

Approach	Dimensions	Source
Innovation Competencies	<ul style="list-style-type: none"> <li>• creativity</li> <li>• enterprising</li> <li>• integrating perspectives</li> <li>• forecasting</li> <li>• managing change</li> </ul>	Boyd and Goldenberg (2011)
Innovation Skills	<ul style="list-style-type: none"> <li>• implementation</li> <li>• relationship-building/communication</li> <li>• risk assessment/risk-taking</li> <li>• creativity/problem-solving/continuous improvement</li> </ul>	Grant (2014)
Technology Management Competencies	<ul style="list-style-type: none"> <li>• sales and marketing experience and expertise</li> <li>• organizational design and execution</li> <li>• product management</li> <li>• strategic finance</li> <li>• international market exposure and experience</li> </ul>	Lazaridis Institute (2016)
Innovation Management Process	<ul style="list-style-type: none"> <li>• inputs management</li> <li>• knowledge management</li> <li>• innovation strategy</li> <li>• organizational culture and structure</li> <li>• portfolio management</li> <li>• project management</li> <li>• commercialization</li> </ul>	Adams <i>et al.</i> (2006)
Innovation Capacity	<ul style="list-style-type: none"> <li>• knowledge and technology management capability</li> <li>• idea management capability</li> <li>• project development capability</li> <li>• commercialization capability</li> </ul>	Doroodian <i>et al.</i> (2014)

evidence base. The workshop used the Group Decision Support System (GDSS) platform and a facilitator to guide discussions. During four sessions, workshop participants began their discussions at small group tables (four to five people), brainstorming responses to the following questions: what competencies do managers of innovation need? how are innovation management competencies best taught? where are innovation management competencies best taught? and how can Canadian business schools and industry improve their IMC education and training? After each discussion, the facilitator grouped similar responses together and lead a plenary session with all workshop participants, refining responses and ultimately voting on which IMCs and leading practices were most important to highlight. While this process was not consensus-based, the ideas of all workshop participants were considered. The collective insights of workshop participants factored heavily in the Panel's final report.

#### 1.4 ORGANIZATION OF THE REPORT

The report is structured as follows. Chapter 2 defines and classifies the IMCs into five categories, reflecting on how they are used during a manager's career. Chapters 3 to 5 examine where and how innovation management is taught to students in the early, middle, and later stages of their careers. It combines the five sources of evidence — the workshop, literature review, curricula survey, deans' survey, and expert interviews — to identify leading courses, teaching practices, learning experiences, and programs. Chapter 6 presents the report's main findings and examines their implications for academic institutions, industry, and government.



# 2

## KEY FINDINGS

Five competencies are associated with high-performing innovation managers across many types of companies: finding opportunities, commercializing opportunities, managing diverse teams, leveraging innovation ecosystems, and leadership.

The relative emphasis of each IMC varies across an innovation manager's career. There is no hierarchy of competencies as each is reinforced and refined throughout a career.

Innovation and uncertainty are inseparable. Students benefit from courses and learning experiences that provide the necessary analytical tools and judgment capacity to manage uncertainty.

Competency-trained innovation managers excel at finding opportunities, whether through design thinking, R&D, or open innovation. They reward creativity, encourage experimentation, and tolerate failure.

Generating a continuous stream of commercial opportunities requires more than the ability to find opportunities. It requires managers trained in commercializing opportunities who can market, sell, finance, and supply new products, processes, and business models.

Building relationships is central to inclusive innovation. Managing diverse teams and leveraging innovation ecosystems help expand the pool of internal and external ideas, empowering and engaging people and institutions to innovate.

The most innovative companies have leaders who explore new opportunities while continuing to exploit past innovations. They create a shared corporate vision and innovation culture that supports company-wide innovation.

## 2 Innovation Management Competencies

Successful innovation depends, in part, on well-trained managers throughout an organization, from the C-suite to the shop floor. As a starting point for identifying IMCs, the Panel and workshop participants developed a profile of a competency-trained innovation manager featuring the knowledge, skills, and attitudes required to be successful.

### 2.1 PROFILE OF A COMPETENCY-TRAINED INNOVATION MANAGER

Competency-trained innovation managers create value for customers and users, generating greater incomes, wealth, and well-being. These effective managers have an innovation mindset and create cultures that reward creativity, tolerate failure, celebrate diversity, build relationships,

and embrace change. They develop a mental model of innovation that they systematically use, communicate, and reflect upon as they practice innovation management, and adopt leading theoretical and technical advances in this field. Competency-trained managers are able to innovate in management, developing new approaches such as Six Sigma, benchmarking, lean start-up, and agile management (Birkinshaw *et al.*, 2008).

Effective innovation managers possess, reflect on, and build on a variety of experiences (Manktelow & Birkinshaw, 2018). Central to these experiences is the acceptance of failure. Since most ideas fail in an innovation context, studying and reflecting on failure provides a deep pool of insight for managers. Learning from their own blunders, mistakes, and



miscalculations, and those of others, is the most effective way to understand failure. In fact, many workshop participants suggested that experiencing failure was almost a prerequisite for effective innovation management. Innovation managers need to know at what point to start again, to modify a design, or to completely abandon an idea. To do so, they must understand how to systematically manage ideas for commercial success.

Competency-trained innovation managers have domain expertise — the knowledge and skills related to a specific industry. Workshop participants noted that innovation must be considered within the context of the specific industry and culture in which it is being applied even though it may have arisen from something done in other industries. The domain informs the overall process of innovation management. For example, an innovation manager at a pharmaceutical company requires some knowledge of drug discovery and markets to support idea generation, experimental design, and problem solving. The knowledge needed is different than for a manager supporting the development and commercialization of new oil extraction technology, aerospace parts, or software. This expertise is best acquired through both industry experience and formal training, whether in management, STEM, or other disciplines. On their own, neither is sufficient expertise to manage innovation.

Although the ideal innovation manager does not exist, the Panel and workshop participants agreed that five IMCs are associated with high-performing innovation managers across many types of companies: finding opportunities, commercializing opportunities, managing diverse teams, leveraging innovation ecosystems, and leadership. As different industries and environments demand different knowledge, skills, and attitudes, the relative emphasis of each IMC varies across the career of an innovation manager, depending on their role, company, and industry. There is no hierarchy of competencies; each continues to be reinforced and refined well after completion of formal academic training. The remainder of this chapter outlines the knowledge, skills, and attitudes that make up each of the five IMCs.

## 2.2 FIVE INNOVATION MANAGEMENT COMPETENCIES

The Panel and workshop participants agreed that innovation — and thus the management of innovation — always occurs under conditions of uncertainty, when the likelihood of success or failure is indefinite or incalculable (Gans *et al.*, 2016; Maine & Seegopaul, 2016). All five IMCs are in some sense about managing uncertainty,

whether in developing a new product or leading corporate innovation strategy. Since uncertainty and innovation are inseparable, all innovation management students benefit from courses and learning experiences that provide the necessary analytical tools and judgment capacity to manage under uncertainty.

In many cases, as Gans *et al.* (2016) point out, the “only way to reduce uncertainty is through experimentation.” Managing innovation requires learning what experiments to run — whether technical or marketing — to test assumptions about new products, processes, marketing methods, or business models. It is both the art and the science of creatively testing assumptions. There is a science to innovation management: it is about reducing the error bars around assumptions. Most of the analytical tools available to manage under uncertainty, such as real options valuation, minimum viable product, cost benefit analysis, and advanced analytics (Friberg, 2015), can be taught to all innovation management students in classrooms throughout their educational careers.

However, as the Panel and workshop participants noted, analytical tools alone often kill disruptive innovation. Judgment capacity, which is more than just a gut feeling or guessing, is essential; it is based on a manager’s experience and knowledge (Drucker, 1985). In fact, experienced managers may use judgment to make decisions that are counter to the analytical results because of the uncertainty related to innovation (Munro & Edge, 2014). Judgment under uncertainty requires that managers are *agile*, evaluating a range of options, problem solving, and adapting as conditions change (Gans *et al.*, 2016). Effective innovation managers are also *sensemakers*, understanding their environments to “structure the unknown so as to be able to act in it” (Ancona, 2011). Sensemaking involves developing a “plausible understanding — a map — of a shifting world; testing this map with others through data collection, action, and conversation; and then refining, or abandoning, the map depending on how credible it is” (Ancona, 2011). As both agility and sensemaking develop over time, effective innovation management training provides students with active learning experiences throughout their careers.

### 2.2.1 Finding Opportunities

Innovation first involves identifying opportunities and then choosing the most effective methods to develop, refine, and acquire ideas that can be commercialized. Innovation management requires that managers are always looking for better ways to do things, using their own ideas or those of colleagues (CBOC, 2013). This may happen

within a company through design thinking or research and development (R&D), outside a company through collaborations and open innovation, or by the acquisition of other innovative companies.

Creative thinking is central to innovation, especially for the development of disruptive or radical innovation (Christensen, 1997; Gans, 2016). In addition to generating ideas themselves, managers must encourage staff and colleagues to propose new ideas, reward them for doing so, and demonstrate their trust in the ideas (CBOC, 2013). Through mentoring and coaching, open-minded managers can cultivate this attitude in others (CBOC, 2013). They can also use creativity development techniques with staff, such as brainstorming, lateral thinking, and mind mapping (Hidalgo & Albors, 2008). New ideas can be applied to innovation in product design and development or in the management itself (Birkinshaw *et al.*, 2008).

Innovative companies often use design thinking as a tool to start up and move forward the most promising ideas (Ignatius, 2015; Kolko, 2015). Design thinking helps companies simplify complex technological and business systems, and inform prototyping of products, assessment of risk and tolerance of failure, and development of empathetic relationships with users (Leonard & Rayport, 1997; IDEO, 2015). Incorporating the emotional reactions observed in users into the design of a product or service can improve its value proposition. Since not all ideas are successful, design thinking can help identify challenges and develop effective solutions to address them. Companies also conduct internal R&D to stimulate innovation, especially in the development of new technologies and related products and processes (CCA, 2018). R&D differs from design thinking in that it is based more on the scientific method, focuses more on research, and is a longer process (Maine *et al.*, 2014). Without R&D, ideas, inventions, and designs are less likely to become innovations, and companies are less likely to succeed.

Opportunities for innovation can also be sought outside the company: from customers or competitors, from other companies in a supply chain or global production network, or from an understanding of technological trends (Porter, 1998; Von Hippel, 2005). The importance of external sources of innovation has been underscored by the widely accepted concept of *open innovation*: “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of

innovation, respectively” (Chesbrough & Crowther, 2006). With open innovation, firms are as much managers of intellectual property (IP) as they are its creators due to the trend towards commercializing ideas that originate outside the company, often from users themselves (Baldwin & Von Hippel, 2011). By establishing methods to foster and support open in-house innovation, managers increase the likelihood of someone finding an innovative idea that can be pursued internally or acquired from an external source. Broadening the range of people involved in generating ideas through idea competitions, crowdsourcing, or innovation contests may also help reduce costs and improve the diversity and quality of the ideas.

### 2.2.2 Commercializing Opportunities

Innovation is about more than finding opportunities. It requires managers who can systematically manage new ideas and inventions for commercial success. Commercialization, the process that introduces new products or services to the market, takes into account marketing, sales, financing, and supply chain management. Industry stakeholders surveyed by the Lazaridis Institute (2016) identified marketing and sales as the most difficult competency to hire for in the Canadian technology market management pool. The Panel and workshop participants agreed that a competency-trained innovation manager must always be aware of market opportunities, especially in international markets.

Marketing encompasses market research, including advanced analytics; marketing techniques, including content and digital marketing; market sensing and empathy for users, especially awareness of the customer challenges to be solved; and needs identification, including advanced customer segmentation (Munro & Edge, 2014). Market awareness provides information about competitors and customers, which can be gathered and analyzed to create a picture of market realities. Information about the needs of users must be recent and high quality (Munro & Edge, 2014). At times, users may themselves be the source of innovation ideas (Von Hippel, 1986), but in emerging markets, for example, users may not articulate their needs at all.

Salesmanship is about more than selling products to consumers (Aronsson, 2004). The Panel noted that industrial customers are a significant market for Canadian-made innovations such as engineering equipment, aerospace parts, semiconductors, or software. These customers are often more responsive to price and design specifications than other consumers. Sales is considered a foundational component

of business in the technology sector because strength in this area is needed to grow and scale up companies (Lazaridis Institute, 2016). Interviewees in the Lazaridis Institute (2016) study stated that “the key to success is in understanding how to sell a business rather than a product, and how to correctly identify and sell a value proposition [developed as part of ideation] to a particular client.”

Many new ventures face the significant challenge of securing sufficient capital (CCA, 2013, 2018). The cost of commercializing an idea is often orders of magnitude more expensive than idea generation itself. In Canada, many firms secure early-stage seed capital from the federally led Industrial Research Assistance Program as well as from individual (angel) investors and venture capitalists. As product, process, and business models progress from proof-of-concept to demonstration to early commercialization when they face the so-called “valley of death,” financial capital is essential for converting the fruits of opportunity finding into commercial value (CCA, 2013, 2018).

Supply chain management includes the production and distribution decisions that determine how a product is made and how it reaches customers. Industry-specific knowledge is important for efficient supply chain management. In fast-paced technology industries such as software, products hit the market quickly (Lazaridis Institute, 2016). Capital-intensive sectors such as oil and gas extraction or advanced materials often move slowly because the risk and cost of failure are higher, and the invention is instigated upstream from the end-consumer (Leonard-Barton, 1995; CCA, 2015b; Maine & Seegopaul, 2016).

Successful commercialization requires moving an idea through and outside a company. Effective innovation managers need to build coalitions, develop plans, and motivate others. Timing is often essential. According to Maine and Thomas (2017), when a scientific breakthrough is made, the difference between success and failure in commercializing the new technology for the mass market may be the timing of certain strategic actions taken by the inventor, including publishing findings, filing patents, creating a company, and forming R&D alliances. Ultimately, for a competency-trained innovation manager, commercializing opportunities is about more than marketing and sales: it also includes finance, supply chains, and the relationships needed to manage these activities effectively.

### 2.2.3 Managing Diverse Teams

Innovation is best supported by the creation and management of diverse teams operating in a physically and psychologically safe environment. Team members must be able to express ideas and fail without fear of reprisal while retaining reasonable accountability through timeliness and transparency (Edmondson & Lei, 2014). Building and maintaining teams with diverse abilities and backgrounds fosters more and better ideas, if well managed. People with different identities (e.g., ethnicity, gender), education, work experiences, learning styles, and personalities bring different perspectives to a team (Page, 2017). Broadening a team’s perspectives, and creating an atmosphere in which team members can freely express their perspectives and ideas, may result in more or better innovation. However, if improperly managed, diverse teams may also be characterized by conflict, power dynamics, and bias (Bear & Woolley, 2011; Ellison & Mullin, 2014; Turban *et al.*, 2017).

The ability to communicate with professionals in other areas of expertise, as well as possessing a basic understanding of these areas, is important for successful innovation (Thursby *et al.*, 2009; AACSB International, 2010). Managers can create an environment that fosters collaboration and the sharing of ideas, skills, and knowledge without fear (Hidalgo & Albors, 2008). They can support collaboration by dedicating financial, human, and technical resources (e.g., allocating staff time to engage in non-operational, exploratory activities) (CBOC, 2013). Collaboration should occur across teams in an organization as well as within a team. The role of innovation managers extends beyond bringing together the right people; it is equally important for them to create a safe environment where people can express themselves, feel valued and supported, disagree, fail, and think creatively (Edmondson & Lei, 2014). Managers can model and encourage appropriate risk-taking and tolerance of mistakes, and use failure as an opportunity to learn (CBOC, 2013).

Since gender is embedded in a socially complex system, activities that appear to be neutral may be systemically biased in favour of one gender (Kaplan, 2017). Consider *pitching* where entrepreneurs present their ventures to potential investors. While effective in selecting some good ideas and companies, pitching is a highly gendered, “masculinized” process (Brooks *et al.*, 2014). As Kaplan (2017) explains, since pitching is seen as a typically male activity, men are likely to be viewed as inherently more successful at doing it. Even (or especially) if women “pitch like a man,” they

may still be seen as less competent. This gender bias may help explain why only 2% of venture capital currently goes to women in Silicon Valley (Kaplan, 2017). Similarly, stack ranking, a common management technique popularized by GE CEO Jack Welch in the 1980s, which requires managers across a company to rank their employees on a bell curve, may also produce gender inequality. This forced ranking may “conflate self confidence with competence and, because men are socialized to act more self-confidently... they are likely to get ranked higher in the stack” (Kaplan, 2017). To the extent these rankings correlate with promotion, gender bias may help explain the under-representation of women in management positions.

One way to think about diversity is as an innovation problem itself:

The fact that [innovation] is so difficult means that organizations put their best people on it and invest substantial resources in it; and the fact that it’s so difficult is what makes it so exciting for these smart people. In contrast, when people start talking about diversity and equality, and how hard those things are to achieve, most people get depressed or frustrated, rather than excited. What if, instead, we thought of diversity as an innovation problem — making this challenge as exciting as other innovation challenges?  
(Kaplan, 2017)

In fact, diversity and innovation often go hand-in-hand as diverse companies are more likely to outperform their peers (Thomas *et al.*, 2017). Companies without women on their board of directors have, on average, much worse performance than the average for their industry (Catalyst, 2016). However, the relationship between gender diversity and performance is not necessarily causal: it could be that the best companies just happen to hire a more diverse workforce and have more diverse boards. Therefore, it is not the diversity that causes their strong performance; instead, diversity and performance are two outcomes of “being a great company” (Kaplan, 2017). The Panel and workshop participants stressed that companies that proactively seek to employ a diverse workforce benefit from the resulting functional and intellectual diversity.

#### 2.2.4 Leveraging Innovation Ecosystems

Companies do not generally innovate in isolation. Their innovation depends not only on their internal management processes but also on leveraging the innovation ecosystem in which they operate for competitive advantage. Companies have relationships with other companies within their supply chains or global production networks, and with individuals,

public research institutes, universities, industry associations, and innovation support organizations. Moreover, they often choose to locate in regions where they can access talent in local academic institutions of higher education or local innovation networks that promote the exchange of knowledge. This set of relationships and organizations collectively defines an innovation ecosystem.

Understanding the context or system in which a company operates helps innovation managers identify and assess the suitability of potential partners. *Systems thinking* refers to a body of knowledge focused on the interrelationships between a system's constituent parts and how systems work over time and within the context of larger systems. The systems thinking approach contrasts with traditional analysis, which studies systems by breaking them down into their individual elements (Lessard, 2013). Gathering and analyzing data (e.g., information about markets, inputs) increases awareness of uncertainty, risks, and opportunities thereby improving decision-making.

Innovation managers leverage the resources of an innovation ecosystem by identifying potential partners, assessing their suitability, and creating trusting relationships. Building external relationships enables the inclusion of more diverse views, abilities, and ideas to complement those found within the company. This inclusion helps foster innovation within and outside the company. As discussed above, sensemaking helps identify and assess potential partners. It entails not only knowing the context of a situation, but also communicating it effectively to others (Ancona *et al.*, 2007). In the case of innovation ecosystems, sensemaking is more than just identifying good ideas and partners; it is also knowing when these partnerships would benefit from collaboration rather than acquisition (Schrage, 2014).

#### 2.2.5 Leadership

The Panel and workshop participants stressed the centrality of leadership to excellence in innovation management — from entrepreneurs thrust into leadership positions early in their career to senior executives with a wealth of leadership experience. Companies can do all the right things, such as invest in R&D, listen to customers, and build inclusive relationships, but still fall victim to a new technology or business model that was difficult to see coming. They are blindsided when they focus on their best, most profitable customers, and ignore other potential markets or customers seeking lower-cost products (Christensen, 1997; Gans, 2016). In contrast, the most successful companies have leaders who explore new opportunities while continuing to exploit past innovations and other assets (March, 1991). These *ambidextrous leaders* “exploit existing assets



and capabilities in mature businesses and, when needed, reconfigure these to develop new strengths” to avoid being made “irrelevant by changes in markets and technologies” (O’Reilly & Tushman, 2016). Leaders take responsibility for the creation of conditions that enable others to achieve shared purpose in the face of uncertainty (Ganz, 2010). Although leadership is an amorphous concept (Ancona, 2011), the Panel noted three capabilities that help innovation managers lead successful companies in a global innovation economy: visioning, change management, and culture creation.

*Visioning* involves “creating compelling images of the future... of what could be and, more important, what a leader wants the future to be” (Ancona *et al.*, 2007). However, developing a vision is a dynamic, collaborative process of articulating shared goals, which helps give employees a sense of meaning in their work:

Leaders who are skilled in this capability are able to get people excited about their view of the future while inviting others to help crystallize that image. If they realize other people aren’t joining in or buying into the vision, they don’t just turn up the volume; they engage in a dialogue about the reality they hope to produce. They use stories and metaphors to paint a vivid picture of what the vision will accomplish, even if they don’t have a comprehensive plan for getting there. They know that if the vision is credible and compelling enough, others will generate ideas to advance it.

(Ancona *et al.*, 2007)

Innovation leaders in particular need to create a shared vision that unites employees in the pursuit of exploitation and exploration opportunities (O’Reilly & Tushman, 2016). Since they must evaluate and judge exploitation and exploration efforts differently, they will necessarily direct, challenge, and reward employees in a different manner. A shared vision allows a leader to strike the right strategic balance between these inherently conflicting efforts, and then cope with tensions that arise from the conflict between them without losing that balance.

The processes of creating and implementing an innovation in a company are equally challenging due to the complexity of innovation. Transforming a vision into action requires competency-based innovation leaders to drive *change management* and manage its inherent uncertainty. Only about 30% of change management programs succeed (Kotter, 1995; Ewenstein *et al.*, 2015). Change management permanently alters the patterns of employee behaviour as employees

adapt to change at their own pace and style (Hayes, 2014). It also enables the company to gain competitive advantage by effectively and efficiently implementing and adapting to market, regulatory, or other changes. To effectively manage change, innovation leaders must build trusting relationships with people within and outside of their organization (Dougherty, 2016), and balance advocacy for their own views with efforts to understand the views of others. This environment also supports processes required to identify, design, and implement the changes that will lead to the realization of a company’s vision (Ancona *et al.*, 2007).

As with visioning and change management, creating an *innovation culture* (i.e., a shared set of beliefs, assumptions, and norms) requires leaders who effectively communicate, manage conflict, and inspire employees. According to Dobni (2008), innovation culture is based on seven factors that span the entire organization: innovation propensity, organizational constituency, organizational learning, creativity and empowerment, market orientation, value orientation, and implementation context.

More specifically, leaders must make appropriate use of rewards, tolerate failure, and foster shared values such as openness to new ideas, creativity, change, continuous learning, autonomy, collaboration, flexibility, and informal communication. A company’s innovation culture is strongly correlated with its economic performance (Alvesson & Svingsson, 2015; Chatman & O’Reilly, 2016). A recent survey found that 78% of Fortune 1000 CEOs and CFOs view innovation culture as one of the top three factors affecting their firm’s value (Graham *et al.*, 2017) while Tellis *et al.* (2009) identified organizational culture as the strongest driver of radical innovation, ahead of government policy, labour, capital, and national culture.

## 2.3 CONCLUSION

Canada’s abundance of raw ideas and entrepreneurial spirit has produced world-leading research and thriving start-ups (CCA, 2018). However, improving Canada’s innovation performance requires producing managers who excel in more than simply finding opportunities. While some innovations are created by a spark of brilliance, the most successful global companies generate innovation in an established, regular manner. Canadian companies would benefit from a greater supply of innovation managers who, having mastered the five IMCs identified by the Panel, could deliver a continuous stream of commercial opportunities and build inclusive relationships inside and outside their companies.

Providing education and training in the five IMCs would help build the necessary capacity and expand the pool of Canadians who can push forward on a national vision for a more innovative Canada. However, these IMCs do not function in silos. Rather, they overlap, each dependent upon and mutually reinforcing the others. The competency-based approach adopted here is intended to begin a dialogue among business schools, companies, and other stakeholders that train and hire innovation managers. The conceptualization of the IMCs is the Panel's main contribution to the field of innovation management, and is a valuable and important way of rethinking innovation management education and training. Yet, as there are many different ways to conceptualize the IMCs, the five IMCs are not definitive. Rather they are more of a first take, which the Panel encourages others to refine and further develop.

The training of future innovation leaders can begin early in life. In elementary and secondary schools, creativity, communication, and collaboration can be taught alongside STEM skills. Encouraging students to experiment and take calculated risks can help prepare them for careers in innovation. However, as with other professional fields, most students are exposed to innovation management for the first time in universities and colleges. Chapter 3 considers the innovation management courses, teachers, learning experiences, and programs available to students early in their careers.



# 3

## KEY FINDINGS

Undergraduate business programs are a key leverage point for exposing more than 300,000 students each year to innovation management education, representing 20% of annual enrolment in Canada.

While innovation management is not often part of core business school curricula, the number of innovation management undergraduate courses offered in Canada have increased four-fold over the last decade.

Teachers with experience as innovators provide students with an understanding of how innovation works in practice, especially its associated challenges and failures. Whether as teachers, co-teachers, or guest lecturers, teacher-practitioners are a feature of leading courses in Canada and the United States.

Students benefit from innovation management education that reflects leading-edge theory and provides meaningful experiences such as entrepreneurial projects, flipped classrooms, innovation competitions, hackathons, work-integrated learning, and mentorship programs. Learning by doing is a feature of leading courses in Canada, the United States, and Europe.

Academic institutions can build an inclusive innovation culture by expanding access to innovation management education to all students. Collaborations with innovation intermediaries and companies expose these students to innovation management in practice.

The Panel identified three principles in educating and training early-career students:

- Joint courses and programs that expand access to the teachers, theory, learning experiences, and innovative culture housed in business schools to a greater number of students.
- Innovation management education that provides students with experiential learning opportunities.
- Effective teachers that expose students to leading-edge theory and meaningful experiences. Communities of practice among teachers, researchers, and practitioners that encourage innovation in curricula and diffusion of leading practices.

## 3 Early-Career Students

Business has been the most popular field of study in Canada for the last 15 years. In 2016, about 200,000 undergraduate and 120,000 college students were enrolled in business programs, accounting for about 20% of total post-secondary enrolment (StatCan, 2017). Even if only a fraction of these early-career students were to go on to manage innovation in their careers, this would still represent a significant leverage point for improving innovation management in Canada. Perhaps for this reason, the Canadian business school deans surveyed by the Panel ranked undergraduate programs ahead

of MBA and EMBA programs in importance for developing IMCs. Although undergraduate education cannot provide comprehensive training in all IMCs, it can offer foundational training in their concepts and theories, and experience in innovation through courses and extracurricular on-campus activities. This chapter examines programs and course offerings in business and STEM at the undergraduate level, as well as at colleges and polytechnics, and highlights some leading practices in teaching methods and learning experiences.

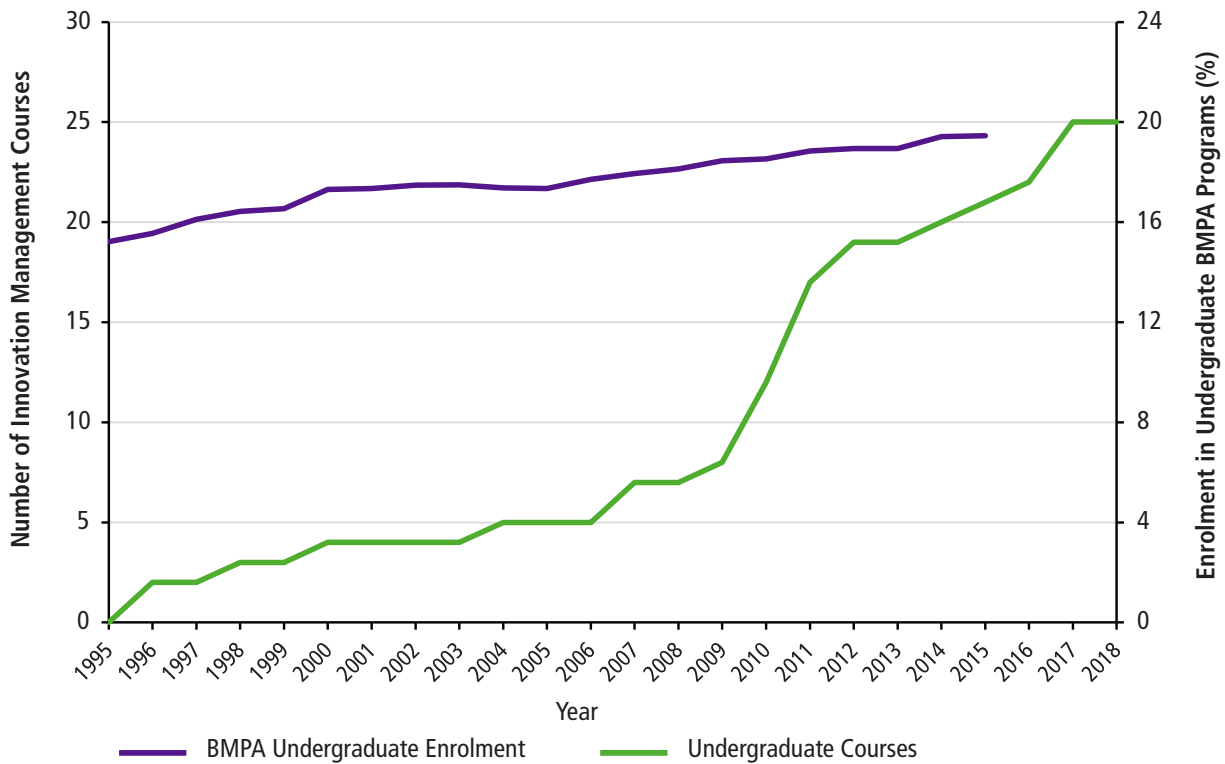
### 3.1 WHERE IMCs ARE LEARNED: PROGRAMS AND PLACES

#### 3.1.1 Bachelor of Commerce Programs

Bachelor of Commerce degrees provide foundational training in many general business competencies such as accounting, finance, and organizational behaviour. Designed for students with minimal business experience, they prepare students for their first jobs designing products, researching markets, and interacting with diverse teammates and their managers. While innovation is generally not a core course in these degrees, some innovation theory and practice are taught in courses such as entrepreneurship, marketing, strategy, and other related topics.

Undergraduate business education is on the rise in Canada. The proportion of undergraduate enrolment in BMPA (business, management, and public administration) programs has risen by nearly 4 percentage points in

the last two decades, and now makes up nearly 20% of Canadian undergraduate education (see Figure 3.1). Between 1997 and 2016, total enrolment almost doubled, with about 200,000 students enrolled in undergraduate BMPA programs by 2016 (StatCan, 2017). More recently, course offerings in innovation management have also expanded. While generally not part of core curriculum, the survey of business school deans found that innovation management undergraduate courses have increased four-fold in the past 10 years, with more than half of the 25 courses identified by deans established after 2009.<sup>1</sup> This rise, which reflects rising student and industry demand and interest in innovation, is promising. However, the Panel suggests that increasing access to innovation management education for undergraduate business students requires more than simply offering more courses. It must be accompanied by enhanced learning opportunities for students provided by teachers with more innovation experience and courses with more experiential focus.



Data Source: StatCan (2017) and data from the survey of Canadian business school deans

**Figure 3.1**  
**Innovation Management Courses and Enrolment in Undergraduate Business Programs, 1995–2018**

The survey of Canadian business school deans found that many undergraduate courses focused on innovation management (left axis) began in the past 10 years. Plotted alongside is the percentage of undergraduate enrolment in BMPA programs in Canada (right axis). As enrolment in undergraduate business programs has risen in the past 20 years, undergraduate innovation management courses have also emerged. Since the courses are self-reported by survey respondents, they are a representative rather than comprehensive sample.

<sup>1</sup> A comprehensive review of undergraduate business curricula was beyond the scope of this report. The courses identified by a large sample of Canadian business school deans, however, give some insight into innovation management course trends.

As discussed in Chapter 2, nearly all IMCs can be learned through a combination of theory and experience. Although comprehensive training is not achievable at the undergraduate level, theory-based education can begin in finding and commercializing opportunities. These reflect two halves of the innovation process — the exploratory phase of finding new ideas and the exploitative phase of commercializing the best ones. While students benefit from curricula that reflect leading-edge theory, the Panel and workshop participants stressed that the most effective way to learn these competencies is through practice. For example, all first-year undergraduates at Babson College (Wellesley, MA) are eligible to enrol in the year-long Foundations of Management and Entrepreneurship course. Taught by experienced industry professionals, the course provides small teams of students with \$3,000 to start a new business. Students learn innovation management fundamentals (e.g., design thinking, marketing) and how to put them into practice in their start-ups (Babson College, n.d.).

### 3.1.2 STEM Programs

Canada's STEM programs have helped produce one of the most skilled workforces in the world (CCA, 2015a, 2018). However, these programs rarely offer innovation-oriented courses. As workshop participants noted, undergraduate students in STEM departments often possess strong technical skills (e.g., design, programming) and domain expertise (e.g., aerospace, software), but lack business and management skills. As discussed in Chapter 2, failure, a common experience in innovation, is a prerequisite for effective future innovation management. Yet, for engineers, for example, failure is largely an unacceptable outcome in their projects. Although degree programs are often siloed (Billigin, 2013), STEM and other students benefit from access to leading-edge theory and meaningful experiences, especially failure. Some promising opportunities exist in engineering departments, such as through Western University's course on innovation and leadership in engineering. The undergraduate course is designed to develop skills in managing teams and leadership, all within the context of corporate entrepreneurship and innovation (Western University, n.d.). The University of New Brunswick's Faculty of Engineering also offers a one-year Master of Technology Management and Entrepreneurship designed for recent graduates of STEM programs to learn innovation skills (UNB, n.d.).

Certificates and other non-degree options can also increase access to innovation management education for non-business students. Simon Fraser University (SFU) offers the Charles Chang Certificate in Innovation and Entrepreneurship, which is run collaboratively by the Beedie School of Business and five other faculties: Applied Sciences; Communication, Art and Technology; Environment; Science; and Health Science. The short for-credit program teaches students innovation fundamentals in four courses,<sup>2</sup> allows them to explore additional courses in any of the faculties, and brings them together in a final capstone project-based course to work on a venture idea (Beedie School of Business, n.d.-b).

### 3.1.3 Colleges and Polytechnics

With a long history of training innovators, colleges and polytechnics in Canada emphasize curricula that develop IMCs. Polytechnics in particular tend to have strong "alignment with industry and employer needs for skills and innovation outcomes" (Polytechnics Canada, 2018). Polytechnics and colleges can also specialize in particular applied research fields, making them more nimble and reactive to changes in Canadian industry (Luke, 2013). The training offered is often more timely and topical than that of many university programs, which tend to be more general with more formal degree program requirements (De Courcy & Marsh, 2018). Shorter diplomas, certificates, and other training programs are also available in addition to three- or four-year degree programs (Polytechnics Canada, n.d.).

Canadian colleges and polytechnics often focus more than universities on entrepreneurship and the development of experience through various work-integrated learning opportunities such as co-operative education, internships, and apprenticeships (Polytechnics Canada, 2018). By both training students in the theoretical foundations of entrepreneurship and facilitating on-campus entrepreneurial activity, colleges and polytechnics can foster IMCs in students. In recognition of this strength, the federal government allocated \$140 million over five years to colleges and polytechnics in *Budget 2018* to "increase support for collaborative innovation projects involving businesses, colleges and polytechnics" (GC, 2018). It also included more than 30 colleges in the 2018 announcement of federal funding for superclusters across Canada (CICan, 2018).

<sup>2</sup> The courses are: Introduction to Entrepreneurship and Innovation, Resourcing New Ventures, Foundations of Innovation, and Project Management (SFU, 2017).

### 3.2 HOW IMCs ARE LEARNED: LEADING PRACTICES

No matter the context in which students are first exposed to innovation management as a discipline, the Panel identified a number of leading ways to develop IMCs. The Panel and workshop participants emphasized the importance of a good learning environment, both with respect to the teachers and classroom environment and the overall culture of innovation. Supporting these leading practices does not fall only to educators. The entire innovation ecosystem can take action to improve innovation management education.

#### 3.2.1 Joint Programs and Collaborations

One way to expose non-business students to innovation management education is through joint programs. Joint programs bring students into courses they might not have otherwise entered, benefitting not only the interdisciplinary students themselves, but also their colleagues who gain exposure to different perspectives and expertise. The University of Toronto Scarborough offers a Management and Information Technology Bachelor of Business Administration degree that is described as “roughly equivalent to... a double-major in computer science and management” (UTSC, n.d.). The University of Calgary’s combined Bachelor of Science in Engineering and Bachelor of Commerce degree encourages teamwork, while exposing engineering students to important business-focused IMCs (e.g., commercializing opportunities) and allowing business students to participate in more science-focused components of the innovation ecosystem (University of Calgary, n.d.).

Innovation culture may also be developed through linkages with other institutions and with industry. These linkages increase students’ awareness of innovation ecosystems and provide opportunities to work with colleagues with different backgrounds, perspectives, and expertise. The Centre for Digital Media in Vancouver, BC is a unique organization that offers a four-way joint Master of Digital Media degree between four academic institutions (CDM, n.d.-c). The program takes a CBE approach, focusing on six competencies: teamwork, design process, self-awareness, time management, articulation, and information literacy. The training is also experience-based, with nearly two-thirds of coursework occurring through projects (CDM, n.d.-b). The program has a strong connection with industry partners, who participate in collaborative projects with students, provide guest lectures, and teach at the Centre (CDM, n.d.-a).

#### 3.2.2 Experiential Learning Opportunities

Experiential learning provides students with an opportunity to see innovation first hand. Early-career students can begin to practice innovation in academic institutions that deliver learning experiences in which students solve complex, multidisciplinary, real-world problems. They can also be exposed to the practice of innovation when they observe teachers and other role models innovating and building relationships within and outside academia, especially with industry. Access to innovation-specific experiences can help foster an innovation mindset in early-career students. On-campus innovation experiences, such as innovation competitions and hackathons, allow students to practice innovation in an environment that encourages experimentation, allows for failure, and fosters learning from experience. On-campus incubators and accelerators push students to find ideas, reflect on them, and develop a new product to fill a market gap. For example, the University of Waterloo’s Velocity offers an on-campus residency for students interested in entrepreneurship, a science-oriented lab space, and a discovery space that runs weekly workshops and provides coaching. It also runs innovation competitions, which can give students brief, intense experiences with hands-on innovation (Velocity, n.d.).

Undergraduates can also learn innovation management through work-integrated learning. One example of this is the Bridging Entrepreneurs to Students (BETS) program at University of Waterloo’s Conrad Business, Entrepreneurship and Technology Centre (University of Waterloo, n.d.). This program is a specialized entrepreneurship-focused co-op program that places first-year undergraduate engineering students in start-up companies for one semester. Students in this program learn and experience entrepreneurship, rotating through three five-week placements at local start-ups (University of Waterloo, n.d.). The existence of programs such as BETS emphasizes that experiential learning can occur at all stages, even in the first year of undergraduate studies. Shopify has a comparable work-integrated learning program where undergraduate computer science students receive some of their training at Shopify instead of on campus (Carleton University, 2016). These students graduate with work experience acquired over four years.

### 3.2.3 Effective Teachers and Experimental Curricula

Teachers inspire, mentor, and evaluate students, giving them crucial feedback on their work. Workshop participants observed that innovation management education succeeds when the right students are taught by the right teachers — teachers who focus on timely and topical material, are familiar with the theory *and* practice of innovation, and are incentivized to experiment and be creative. Experimentation can include the use of alternative assignments such as entrepreneurship projects or entirely different classroom styles such as flipped classrooms.

The survey of Canadian business school deans highlighted a lack of qualified faculty as a major barrier to developing innovation management education. Deans noted both the difficulty in recruiting and retaining faculty and in finding the appropriate expertise among existing faculty to offer innovation management courses. The Panel and workshop participants observed that this challenge stems both from the newness of the field and from the silos between teachers and practitioners of innovation management.

Good innovation management education is just in time and just on topic; it is up-to-date with current industry trends and approaches to innovation. Workshop participants

emphasized that the best teachers are familiar with the current theory and practice of innovation and tailor it to diverse students with different abilities, interests, and experiences. This combined expertise may also be achieved by engaging multiple teachers or inviting experienced innovators to guest lecture. Some schools, such as Babson College, where experience in entrepreneurship is a prerequisite to teaching it, have moved in this direction already (Noer, 2012). Experienced professionals can provide a wealth of insight and expertise that educators may lack. Workshop participants pointed out that teachers are rarely encouraged to develop hands-on experience. Recognizing that teachers are typically also responsible for conducting research, institutions can lean more on speciality teaching positions, adjunct professors, and co-teaching to support teachers in the classroom. Staff and resources dedicated to improving teaching, such as the MIT Sloan School of Management's Action Learning facility (Sloan School of Management, n.d.), can help teachers become more experimental and effective.

However, it is not always easy to innovate curricula. Canadian business school deans noted that changing curricula is a slow task, and it is difficult to find or retain innovative or experimental educators. To this end, all members of

Table 3.1

Examples of Leading Practices in Education and Training of Early-Career Students

Type	Name	Contribution to IMC Education
Undergraduate Business Course	Babson College's Foundations of Management and Entrepreneurship course	Mixes theory and practice: students learn entrepreneurship fundamentals and attempt their own entrepreneurship
Undergraduate Experiential Learning	Sloan School of Management's Action Learning Labs	Devotes staff and resources to encouraging and developing action learning within the business school
Undergraduate Certificate	Simon Fraser University's Charles Chang Certificate in Innovation and Entrepreneurship	Exposes non-business students to management training
Undergraduate STEM Course	Western University's Engineering Leadership courses	Provides IMC training to non-business undergraduate students
Interdisciplinary Course	University of Alberta's Innovation, Creativity and Entrepreneurship course	Exposes non-business students to management training
Work-Integrated Learning	University of Waterloo's Bridging Entrepreneurs to Students program	Gives first-year engineering students experience working for innovative start-up companies
Joint Programs Between Disciplines	University of Calgary's combined Bachelor of Science in Engineering and Bachelor of Commerce degree program	Exposes non-business students to management training
Joint Programs Between Institutions	Centre for Digital Media's Master of Digital Media degree	Offers a joint program between four different institutions, develops experience, fosters industry connections, and takes a competency-based approach
Community of Practice	European Commission's Knowledge Alliances	Brings schools and companies together to improve innovation education both in and out of higher education

Data Source: Panel, workshop participants, business school deans, and expert interviewees



Canada's innovation ecosystem can enable better teaching of innovation management. Academic institutions can support good teachers, industry can encourage experts to pour their expertise into training the next generation of managers, and governments can set up incentives for teaching and academic-industry partnerships. They have an opportunity to create systems that reward teachers who improve their curriculum and teaching skills. Developing a community of practice in teaching innovation management would allow teachers and practitioners alike to share and learn from each other to keep curricula relevant, experiment with teaching formats, and identify more learning opportunities for students to develop IMCs. For example, the European Union's Knowledge Alliances are examples of "transnational projects which bring higher education institutions and businesses together to... help strengthen Europe's capacity to innovate and support the modernisation of Europe's higher education systems" (EC, n.d.).

#### 3.2.4 Examples of Leading Practices

Table 3.1 highlights nine courses, experiences, and programs identified by the Panel, workshop participants, business school deans, and expert interviewees. Establishing communities of practice for teachers, researchers, and practitioners to share, implement, and expand on these and other leading practices will improve innovation management education and training.

### 3.3 CONCLUSION

The global economy's increasing reliance on innovation implies that future employees will need to understand — if not manage — some aspect of innovation in their careers. Academic institutions in Canada can expose more than 300,000 undergraduate and college students per year to innovation management theory and practice. Students in STEM programs would also benefit from access to the teachers, courses, and learning experiences housed in business schools. The growing need to expand access to innovation management education to all students is reflected in the recent growth of joint programs and cross-appointed faculty throughout academic institutions in Canada, the United States, and Europe.

Many undergraduate and college students may not be exposed to innovation management early in their careers. For some, their institutions do not offer this curricula, while for others, they choose not to take these courses. As they move into jobs, companies, and industries that focus on innovation, they will need more advanced, specialized training in innovation management. Chapter 4 considers options for students in the middle of their careers.



# 4

## KEY FINDINGS

Graduate business programs are a key leverage point to provide targeted and specialized training to more than 30,000 future innovation managers each year, representing 25% of annual enrolment in Canada.

While innovation management is not part of the core curriculum in most Canadian, U.S., and European MBA programs, the number of innovation management MBA courses offered in Canada have increased five-fold over the last decade.

Where offered, MBA elective courses in innovation management tend to focus on three of the five IMCs — finding opportunities, commercializing opportunities, and leveraging innovation ecosystems — with gaps in managing diverse teams and leadership.

The emergence of specialized innovation management programs reflects a growing demand from students for in-depth education that cannot be provided in MBA programs. Canadian business schools offer more specialized courses in innovation management than their U.S. counterparts.

Canadian business school deans ranked innovation intermediaries as the most important places for learning innovation management. Intermediaries provide students with access to collaborators, mentors, networks, and resources. When students take risks and fail, they learn from and reflect on this common feature of innovation.

The Panel identified three principles in educating and training mid-career students:

- Specialized graduate programs that target students planning to manage innovation in the next stage of their career with in-depth education that cannot be provided in more general MBA programs.
- Innovation management education that provides students with opportunities to take risks and allows for failures.
- Innovation intermediaries that contribute to innovation management training through mentoring and networking.

## 4 Mid-Career Students

Already working effectively in their fields, mid-career students are professionals who are beginning to manage others and are ready to build on what they learned as undergraduates and in their early-career experience. As entrepreneurs, product managers, or in other roles, they need to further develop all five IMCs. As discussed in Chapter 2, these competencies are more difficult to teach in classrooms, and require diverse experiences acquired

throughout one's career. This chapter considers MBA programs, specialized graduate programs, and innovation intermediaries as places where mid-career students can improve their innovation management competency. It then outlines leading practices in how IMCs are learned, highlighting the advantages of specialized programs and the value of mentorship and opportunities to take risks and learn from failure.

## 4.1 WHERE IMCs ARE LEARNED: PROGRAMS AND PLACES

### 4.1.1 MBA Programs

Martin and Milway (2007) suggest that Canadian companies have fewer MBA-qualified managers than in other countries. They argue that this is the underlying reason for Canada's deficiency in scaling innovative companies. Indeed, only three Canadian MBA programs cracked the top 100 in the *Financial Times* 2017 global ranking (Financial Times, 2017). This rationale, however, implies that MBA programs currently succeed at producing effective innovation managers and Canada merely needs more MBA graduates to address its deficiency. It contrasts with the critiques of others who argue that MBA programs do not actually develop effective managers (Mintzberg & Gosling, 2002; Hamel & Breen, 2007; Datar *et al.*, 2010; Mintzberg, 2017).

The Panel and workshop participants agreed that an MBA is an important credential in modern management education. MBA students have higher incomes and better rates of employment and promotion after graduation compared with many other students with graduate degrees (Zhao *et al.*, 2006). Because MBA programs do not require pre-existing business knowledge or prerequisite business courses, they attract students with diverse and specialized backgrounds and provide a foundation in general business management principles (Christensen & Nance, 2012). Foundational courses include accounting, entrepreneurship, finance, organizational behaviour, and strategy — but rarely innovation management.

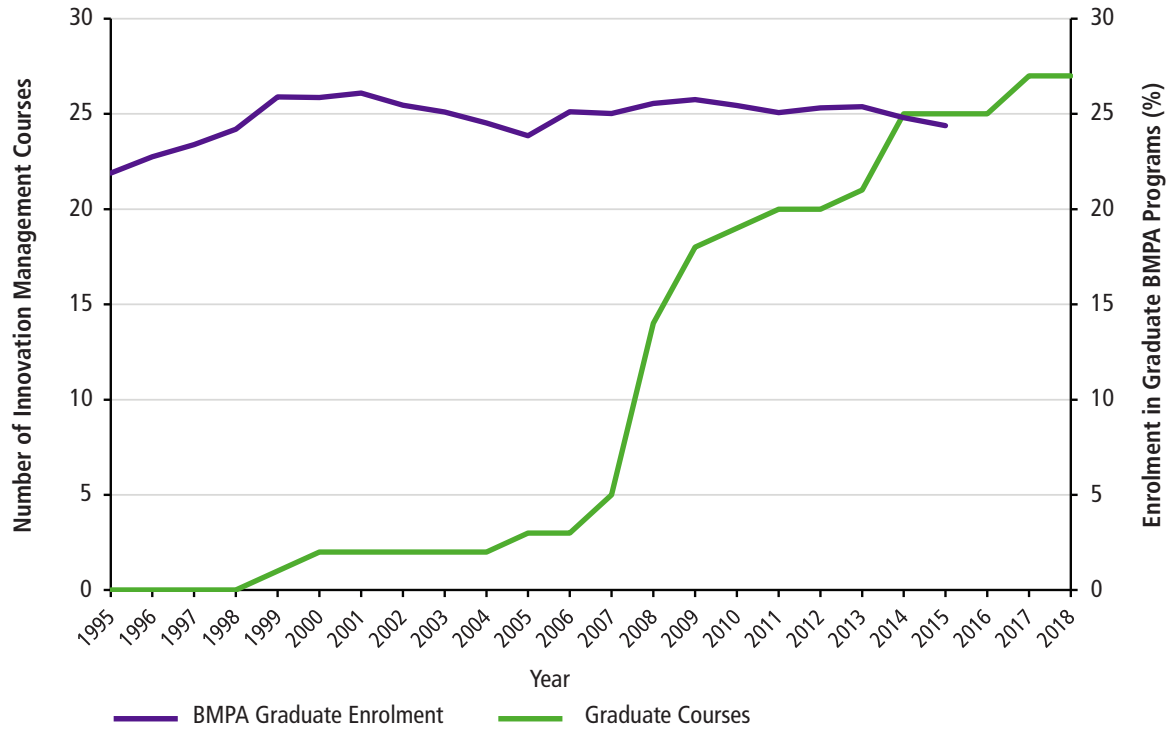
MBA programs continue to be a dominant choice for management training in Canada. From 1997 to 2016, enrolment in Canadian programs more than doubled to over 30,000 students per year, although the proportion of graduate students in these programs remained steady over the period (see Figure 4.1). However, the past 20 years have seen a steep increase in innovation management curricula. Most of the 27 MBA courses teaching innovation management, as identified by the business school deans, were created in the past 10 years. As noted in Chapter 1, the rise in course offerings may reflect the growing demand for innovation skills across the economy as a result of technological innovation. Moreover, the sharp increase since 2008 may reflect a need to rethink curricula following the global financial crisis.

The Panel conducted a survey of the curricula at highly ranked business schools in Canada and abroad (see Appendix). Half of the 22 business schools surveyed offered innovation courses as electives or as part of a separate

concentration of courses. Of these, 6 of 15 Canadian and 6 of 8 international MBA programs had such courses. While some MBA programs included core courses in entrepreneurship, only the Harvard Business School offered an innovation course as part of its core curriculum. The reason that innovation management is not part of the core curriculum in most Canadian, U.S., and European MBA programs is perhaps that innovation is already a theme in other MBA courses or it is seen as a niche topic that is not relevant for all MBA students. Innovation courses at the MBA level tend to emphasize opportunity finding (e.g., design thinking, IP); commercializing opportunities (e.g., marketing, supply chain management); and leveraging innovation ecosystems (e.g., innovation theories, global trends in innovation).

The courses identified by the Panel are similar to those found in Kars-Unluoglu's recent (2016) survey of innovation courses. This study developed a list of the top 50 business schools worldwide, of which 20 responded to the investigation. The resulting sample included schools from the United States (n=15), United Kingdom (n=2), Singapore, Australia, and Switzerland (n=1 each). None of the Canadian schools in the list of 50 replied. In contrast to the Panel's survey, which looked at publicly available information for course offerings (i.e., information on business school websites), Kars-Unluoglu's survey directly contacted instructors to request syllabi. The Panel examined the data from Kars-Unluoglu's curriculum survey, which included topics and details of innovation courses. The Panel, in applying their framework of the five IMCs to the data, found support for the Panel's claim that curricula generally focuses on the IMCs of finding opportunities, commercializing opportunities, and leveraging innovation ecosystems.

The Panel's survey of 22 business schools in Canada and abroad found the median MBA student to be 29 years old with 5 years of business experience. Some have suggested that MBA students' lack of managerial experience makes them poorly equipped to learn management competencies (Mintzberg, 2004). In contrast, the Panel and workshop participants posited that this simply reflects the need for MBA programs to supplement teaching of theoretical knowledge and analytical tools with more opportunities to gain experience in innovation management. For example, the Innovation Teams course, offered jointly by MIT's School of Engineering and Sloan School of Management, creates multidisciplinary teams of students who work on campus-based innovations over the course of a semester. Much of the classwork is practical, involving innovation work itself or presentations and discussions related to team projects (Perez-Breva, 2018).



Data Sources: StatCan (2017) and data from the survey of Canadian business school deans

Figure 4.1

#### Innovation Management Courses and Enrolment in Graduate Business Programs, 1995–2018

The survey of Canadian business school deans found that many graduate courses focused on innovation management (left axis) were created in the past 10 years (similar to the trend in undergraduate courses). Plotted alongside is the percentage of graduate enrolment in BIPA programs in Canada (right axis). As graduate business programs have expanded in the past 20 years, graduate innovation management courses have also emerged. Since the courses are self-reported by survey respondents, they are a representative rather than comprehensive sample.

Innovation can be fostered outside of the classroom in many different ways through formal training and hands-on experience. Rotman DesignWorks, a studio that fosters business design competencies in MBA students, defines *business design* as a “human-centred approach to innovation” that brings together empathy, prototyping, and strategy (Rotman School of Management, n.d.-b). It offers students a wide variety of learning experiences, and facilitates business design courses and even an MBA specialization in the topic. It also runs boot camps, workshops, sprints, and case competitions to give students hands-on experience. Connections with industry are developed through career coaching, guest speakers, and other networking opportunities (Rotman School of Management, n.d.-a).

#### 4.1.2 Specialized Graduate Programs

Innovation management is a growing area of academic and professional expertise (Tidd & Bessant, 2013; Dodgson *et al.*, 2014). Specialized masters and other professional programs emphasizing innovation target students in specific fields or at specific stages of their careers. These

programs are often aimed at mid-career students with basic innovation experience and who may not otherwise enrol in a conventional business school program (e.g., Bachelor of Commerce, MBA). Some specialized MBA programs, as well as other master’s programs, are offered full-time to students with a few years of experience while other part-time programs target students with more experience, including domain expertise (see Table 4.1). The Panel and workshop participants agreed that the emergence of specialized innovation management programs reflects a growing demand from students for in-depth education that cannot be provided in more general MBA programs.

#### Specialized MBA Programs

Many specialized full-time programs target a similar group of students as typical MBA programs, requiring zero to four years of professional experience, and have a similar structure to MBA programs. Of the five Canadian schools that offer specialized MBAs, two programs were highlighted by workshop participants as being especially effective: the SFU Beedie Management of Technology MBA and the

**Table 4.1**  
**Specialized Graduate Programs at Canadian Universities**

Specialized MBA Programs	
Carleton University	Technology Innovation Management
Ryerson University	Management of Technology & Innovation
Simon Fraser University	Management of Technology
University of Toronto Mississauga	Master of Management of Innovation
University of Waterloo	Master of Business, Entrepreneurship, and Technology
Specialized Master's Programs	
HEC Montréal	MSc in Entrepreneurship, Intrapreneurship, and Innovation
Queen's University	Master of Entrepreneurship and Innovation
Ryerson University	Management of Technology and Innovation Professional Master's Diploma
Simon Fraser University	Invention to Innovation program
University of Waterloo	Graduate Diploma in Business and Entrepreneurship

Data Source: Panel, workshop participants, business school deans, and expert interviewees

Ryerson University Ted Rogers MBA in Management of Technology & Innovation. Both include courses offering frameworks and skills for building an innovation culture, managing under uncertainty, new product development, and technology portfolio management (Beedie School of Business, n.d.-a; Ryerson University, n.d.).

### Specialized Master's and Other Programs

Beyond specialized education for relatively inexperienced students, some postgraduate programs target experienced professionals or others with domain expertise. These programs are often shorter than MBAs (one year or less), completed on a part-time basis (i.e., designed for full-time professionals), and focused on particular topics, such as innovation or entrepreneurship. As in MBA programs, admission is not restricted to students with prior business education, and may be open to those with backgrounds in health, science, or engineering. These programs may lead to certificates, diplomas, or master's degrees, and include courses that count towards a future MBA degree.

More Canadian than international schools offer these programs (5 out of 15 schools versus 1 out of 8, respectively). International schools primarily offered MBA programs or academic master's or doctoral programs in management. This difference can be interpreted to mean that some Canadian business schools are making more effort to improve training of innovation managers than international programs. However, it can also mean that leading international schools are choosing not to offer such programs because their other graduate programs adequately cover these topics; therefore, their popularity in Canada may reflect a weakness in Canada's MBA programs. In some countries (particularly in Europe), this gap in education

may be filled by comparable innovation management training in master of science degree programs. Several interviewees identified leading programs at Babson College, Imperial College Business School, and Rotterdam School of Management that teach cutting-edge theory as well as provide experiential learning opportunities (new venture creation, summer project, and internship, respectively) (Babson College, 2018; ICBS, 2018; Rotterdam School of Management, 2018).

Indeed, some schools in Canada have begun to offer specialized master's programs such as HEC Montréal's MSc in Entrepreneurship, Intrapreneurship, and Innovation (HEC Montréal, n.d.). There is an opportunity for business schools to customize content for specific students, going deeper into the training of specific IMCs. Students typically take the same set of required courses as in an MBA, but many electives are tailored to focus on innovation (e.g., Marketing and Selling the New Venture at Smith School of Business' Master of Management Innovation and Entrepreneurship at Queen's University (Smith School of Business, n.d.)). As well, many courses are only offered by these specialized programs and are not included in MBA, EMBA, or other programs. For instance, the Sobey School of Business' Master of Technology Entrepreneurship and Innovation at Saint Mary's University offers courses such as Innovation Processes and Management and Entrepreneurial Marketing, which are not available through its MBA or EMBA programs (SMU, 2017).

### 4.1.3 Innovation Intermediaries

For Canadian business school deans, the most important places for learning innovation management are innovation intermediaries, which are “organizations or groups within organizations that work to enable innovation, either directly by enabling the innovativeness of one or more firms, or indirectly by enhancing the innovative capacity of regions, nations, or sectors” (Dalziel, 2010). There are many different types of innovation intermediaries, including incubators, accelerators, and labs, as well as organizations that fund and coordinate hands-on innovation experience. While they may not always offer formal innovation training, they provide students with experience in innovation and entrepreneurship. They also provide the time, space, and resources for innovation that students may not find in academic programs (Lalkaka, 2002).

Other key innovation intermediaries include not-for-profit organizations that support inexperienced innovators. While some of these programs, such as Venture for Canada, match recent graduates or other entrepreneurs with start-up companies (Venture for Canada, n.d.), others, such as Next 36 (Next Canada, n.d.), offer business mentoring as well as formal training through leading post-secondary institutions. These programs are comparable to co-operative education, where companies get access to new talent while new entrepreneurs gain invaluable hands-on experience in innovation.

## 4.2 HOW IMCs ARE LEARNED: LEADING PRACTICES

Mid-career students have the appetite, insight, and experience for deeper training in innovation management, either through specialized programs that target training at students’ needs or through innovation experience itself, which provides room for taking risks and learning from failures. Students can participate in these learning experiences in academic institutions or through innovation intermediaries. Ideally, a combination of these places and experiences is needed to ensure an innovation ecosystem that capitalizes on all of Canada’s managerial potential.

### 4.2.1 Specialized Training Programs Tailored to the Needs of Students

Specialized programs, in contrast to generalist Bachelor of Commerce or MBA programs, target specific competencies related to innovation management — and teach the right material to the right students at the right time. Students in these programs are likely to have similar interests in innovation, which can foster collaboration and mutual understanding. Specialized programs, by their very nature,

tend to have lower enrolment and smaller class sizes than conventional MBA programs. This helps facilitate more communication among students and between students and teachers.

The Invention to Innovation program offered by the Beedie School of Business exemplifies programming that is tailored to the needs of its students. A part-time graduate certificate program in science and technology commercialization, it is designed for scientists and engineers enrolled in a Vancouver-based master’s or PhD program or to recent PhD alumni. The program teaches students the “frameworks, perspective and techniques needed to contribute to new product development and commercialization” (Beedie School of Business, n.d.-c). Short programs can also provide specialized extracurricular training in particular IMCs. HEC Montréal, in collaboration with the University of Barcelona and Freie Universität Berlin, runs a hands-on and immersive two-week summer school program that builds familiarity with creativity, creative practices, and management of creativity and innovation (Mosaic Creativity & Innovation Hub, 2016).

Specialized training can also happen outside the classroom at on-campus learning hubs or innovation intermediaries. The Self-Development Laboratory at the University of Toronto’s Rotman School of Management offers personalized training to students, including in the communication and interpersonal skills important for teamwork and leadership. Training is based on students’ individual challenges and needs as identified through reflection on their experiences (Moldoveanu & MacKinnon, 2016). At innovation intermediary Communitech in Waterloo, a three-week Tech Sales Apprenticeship program provides students with a mix of theory and experience in specific aspects of commercialization. Students learn from experienced salespeople about key topics such as territory planning, lead generation, and negotiating, and spend five days with local tech companies learning through experience (Communitech, n.d.).

### 4.2.2 Opportunities for Risk-Taking and Failure

Innovation is a process built on experimentation, uncertainty, and, often, failure. As such, the culture and learning environment of classes should encourage students to take risks, fail, and learn from those failures. However, experience often comes through innovation intermediaries or on-the-job experience rather than through academic programs. One exception is Stanford University’s Lean Launchpad, a 10-week practical entrepreneurship course that facilitates experimentation with innovation (Peña, 2014; Blank *et al.*, 2017). The group work and experiential learning allow students to learn from each other and reflect



on their experience. Students watch pre-recorded lectures before classes, which focus on student presentations and discussions of their experiences (Blank *et al.*, 2017), and the course requires students to conduct 100 interviews with customers and experts. This approach teaches students about consumer needs (Peña, 2014) and builds understanding of the innovation ecosystem. Working in innovation labs also gives participants the opportunity to experiment, take risks, and learn from the results since they are places where “unconventional, often risky, thinking is encouraged... [f]ailure is embraced; [and] prototypes that do not ‘work’ are part of the process to finding those with potential” (Torjman, 2012).

#### 4.2.3 Mentorship and Networking

Mentorship opportunities offered at innovation intermediaries help students to take risks and to fail. Innovation intermediaries often rely on experienced innovators and experts to train and guide participants. As workshop participants noted, mentorship is much more personalized than traditional education: it can be the just-in-time, just-on-topic training that participants need to develop their IMCs. At the Creative Destruction Lab (CDL) at the University of Toronto, experienced innovators select promising business ideas, investing their own resources and acting as mentors to aspiring entrepreneurs (Siu, 2017). CDL, which has now expanded beyond Toronto to Montréal, Halifax, Vancouver, and Calgary, also provides support through its technical advisors and by including current MBA students in the management of innovative businesses (CDL, n.d.-b).

Innovation intermediaries often bring together participants and mentors from different backgrounds and expertise. Campus-based intermediaries facilitate collaboration across disciplines by attracting participants from different departments and programs, or even from outside of the institution itself. Although campus-based, CDL accepts off-campus entrepreneurs and relies on industry mentors and advisors (CDL, n.d.-a). This approach allows students

to learn aspects of managing diverse teams including understanding their value and how to collaborate in cross-disciplinary team environments. Off-campus intermediaries can be more inclusive than campus-based programs because they can open their doors to participants with diverse qualifications, identities, and experiences. For instance, at Volta Labs enrolment or previous qualifications are not required: “[a]nyone can show up with a laptop and an idea to work, learn and network seven days a week” (Volta, n.d.-a). Working with diverse audiences also requires diverse programming. Volta offers up to 15 different programs for resident companies and a similar number of experiences to community members (Volta, n.d.-b). For example, Volta’s Women Taking Over the World with Tech program is open to all women working in tech, not solely entrepreneurs, and, by its targeted nature, can support and provide more relevant opportunities to women (Volta, n.d.-c). This inclusive approach can help participants with diverse opinions and expertise to understand the broader innovation ecosystem in which they operate.

Some programs, such as the Canada School of Innovation, provide opportunities for developing networks alongside innovation management training. A venture of Canada’s Research and Technology Organizations in collaboration with the University of Alberta (Canada School of Innovation, n.d.), the School delivers intensive experiential training programs for developing innovation management skills including foresight and ideation, innovation strategy, program and project management, market evaluation, sales and marketing, IP management, and communication. These skills are taught through a combination of theory, case studies, and targeted problems.

#### 4.2.4 Examples of Leading Practices

Table 4.2 highlights 13 courses, experiences, and programs highlighted by the Panel, workshop participants, business school deans and expert interviews as examples of leading practices in innovation management education and training for mid-career students.



Table 4.2

## Examples of Leading Practices in Education and Training of Mid-Career Students

Type	Name	Contribution to IMC Education
MBA Core Course	Harvard Business School's The Entrepreneurial Manager course	Teaches an innovation-focused course in the core curriculum
MBA Elective Course	Sloan School of Management's Innovation Teams course	Gives students experience in commercialization and working in diverse teams
Specialized MBAs	Ted Rogers School of Management's MBA in Management of Technology and Innovation Beedie School of Business' Management of Technology MBA	Develops IMCs in targeted MBA programs
Specialized MSc Programs	HEC Montréal's MSc in Entrepreneurship, Intrapreneurship, and Innovation Imperial College Business School's MSc Innovation, Entrepreneurship & Management program	Provides targeted academic education in innovation management
Specialized Graduate Program with Exclusive Courses	Innovation Processes and Management and Entrepreneurial Marketing courses in the Sobey School of Business' Master of Technology Entrepreneurship and Innovation program	Provides specialized training in IMCs that is not available in typical MBA or EMBA programs
Innovation Intermediary Training	Creative Destruction Lab	Offers mentorship by experienced innovators
Innovation Intermediary Training	Volta Labs	Provides a range of courses and learning opportunities for different audiences
Innovation Intermediary Training	Communtech Tech Sales Apprenticeship program	Mixes theory and experience in targeted IMC training
Targeted Graduate Certificate	Beedie School of Business' Invention to Innovation program	Teaches IMCs to non-business students
Targeted Extracurricular Training	HEC Montreal's Mosaic's Summer School on Management of Creativity	Provides short, targeted IMC training to students and professionals alike
On-Campus Training Hub/Organization	Rotman School of Management's Self-Development Lab	Trains small groups in communicative and interactional skills in a tailored fashion
On-Campus Training Hub/Organization	Rotman School of Management's DesignWorks	Teaches business design skills through multiple formal and informal learning opportunities
Experience-Based Graduate Course	Stanford University's Lean Launchpad course	Offers practical experience in developing innovations in a team

Data Source: Panel, workshop participants, business school deans, and expert interviewees

### 4.3 CONCLUSION

Innovation management will be increasingly synonymous with management in the future. Business schools can teach all MBA students the basics of the five IMCs and better prepare them to manage in an increasingly innovation-driven economy. Specialized MBAs and master's programs allow business schools to teach the right material to the right students at the right time. Striking the right balance between MBA core and elective courses and specialized programs will depend on the needs of students and the expertise of faculty members in each business school.

Not all managers of innovation will attend business school programs. For those who are unable to access or uninterested in graduate training, innovation intermediaries provide alternative opportunities for peer learning, networking, and mentorship, empowering more people with diverse skills, backgrounds, and perspectives. Innovation managers at all stages in their career experiment together, share resources, and learn from each other's failure. However, as students move into leadership roles, they will again need more advanced, specialized training in innovation management. Chapter 5 describes some of the opportunities for executive students.

# 5

## KEY FINDINGS

Executive students would benefit from expanded access to innovation management education in competencies such as leadership but also in more specialized areas of particular national weakness such as scaling.

Innovation management is not part of the core curriculum in most Canadian, U.S., and European EMBA programs. Canadian business schools offer fewer executive courses in innovation management than their U.S. counterparts.

Companies can actively develop IMCs in employees through mentorship, workshops, and courses. This on-the-job training can be complemented with more formal innovation management education provided by academic institutions or innovation intermediaries.

Excellence in innovation management requires lifelong learning, refining and reinforcing competencies throughout a career. Lifelong learning ensures that managers constantly strengthen their IMCs and keeps them up-to-date on current trends in innovation.

The Panel identified three principles in educating and training executive students:

- Specialized training in how to scale high-tech companies.
- Innovation management education that provides students opportunities to reflect on their experiences.
- Laddered courses and programs in business schools that encourage students to supplement on-the-job training with more formal innovation management education.

## 5 Executive Students

Business executives are well positioned to improve innovation management in Canadian companies. While some entrepreneurs become executives overnight, most executives have a wealth of experience, particularly in management roles in their industry. Given their roles and degree of influence, such students can immediately put into practice what they learn in business schools or other educational settings. Students in executive roles can update and refine their IMCs as they execute innovation strategies, access global markets, and build a vision for their company and industry. This chapter explores how executive courses and programs at business schools and training offered by companies help executives improve their IMCs. It highlights leading practices related to specialized training, opportunities for reflection, and lifelong learning.

### 5.1 WHERE IMCs ARE LEARNED: PROGRAMS AND PLACES

#### 5.1.1 EMBA Programs and Executive Education

Executives and other experienced managers enter business schools primarily through EMBA degree programs and one-off executive education courses, with many executive education courses counting towards EMBA degrees. While executive courses typically focus on a single topic and last a few days, MBAs are part-time, one- or two-year programs comprised of foundational courses (e.g., finance, strategy) as well as more specialized electives. Business schools often tailor executive education to specific audiences through customized courses that, for example, managers of a single company can attend together.

Executives are usually seeking to augment their experience with deeper theoretical knowledge, to strengthen their network, and to learn from the practices of others (Crotty & Soule, 1997). The Panel and workshop participants agreed that business schools are a natural place to teach executives, and that management professors and other innovation scholars are the most appropriate teachers of the latest tools, techniques, and thinking in innovation management. For example, the Creativity and Innovation course in Concordia University's John Molson EMBA trains executives in finding and commercializing opportunities (Concordia University, n.d.). Programs such as the Lazaridis Institute's Executive Master's in Technology Management are well-suited for executive IMC training in that they provide training in design thinking, market awareness, and leveraging networks, as well as one-on-one leadership coaching (Lazaridis Institute, n.d.-b).

The survey of EMBA and executive education curricula at 22 business schools (the same group reviewed for the MBA programs)<sup>3</sup> revealed that Canadian EMBA programs appear to have fewer innovation and innovation management courses compared with their international counterparts. Only half of the Canadian programs (5 of 10), but all 6 international programs, offered innovation courses (including innovation management courses).<sup>4</sup> Canadian EMBA programs included 6 innovation-related courses compared with 13 courses offered abroad.<sup>5</sup> Similarly, most international schools offer innovation courses among their executive education courses but only two Canadian schools offered explicitly focused innovation management courses: York University's Certificate in Strategic Leadership and Innovation and the University of British Columbia's Strategy and Innovation course.

### 5.1.2 Companies and Professional Associations

Although some executives may have received a comprehensive education in innovation management at business schools and innovation intermediaries, many learn on the job. Business school deans identified the critical role

of the private sector in improving innovation management in Canada. Companies can build an innovation culture by making innovation a part of normal business processes, including measuring, benchmarking, and establishing objectives for improving product, process, organizational, and strategic innovation. Companies can also offer on-the-job training, professional development opportunities, and mentorship programs to develop IMCs. W.L. Gore & Associates, whose innovation culture has been widely lauded (Tambe, 2013), is a prime example of employee mentorship where "everyone has a sponsor, even the CEO" (Fister Gale, 2015). Training can also occur in more formal and deliberate ways. Shopify, for instance, has its own Talent Acceleration team that coaches its managers (Hoyt, 2015) and runs internal workshops to train new managers. The training covers fundamentals of management to high-level leadership and may include one-on-one targeted training (Hoyt, 2015).

Companies can also engage with academic institutions and business schools to develop customized executive education programs. For example, upon filling 600 new innovation-focused roles in 2009, IBM engaged with Imperial College Business School to create a program to specifically foster employee openness and creativity — with the result that IBM "has enhanced its capability to foster radical innovation that is led by its clients" (ICBS, n.d.).

Professional associations offer professional development opportunities to develop IMCs. For example, the Product Development and Management Association's (PDMA) New Product Development Professional certification program<sup>6</sup> provides training in strategy; portfolio management; new product process; organization, teams, and culture; tools and metrics; market research; and life cycle management (PDMA, 2017a). Similarly, the Global Innovation Management Institute's (GIMI) Innovation Certification Program features four levels based on innovation competencies developed with input from more than 200 Fortune 500 companies (GIMI, 2015a, 2015b).

3 EMBA programs are less common than MBA programs. From the 22 schools surveyed, the Panel identified 10 Canadian and 6 international EMBA programs. These included the Stanford LEAD Certificate in Corporate Innovation and the Harvard Program for Leadership Development, which have functionally replaced EMBA programs at their respective institutions. Executive education courses may be taught by business schools or by their host institution. Both were reviewed in this case.

4 Canadian programs with innovation or innovation management courses were Rotman EMBA, Alberta Haskayne EMBA, Kellogg-Schulich EMBA, Beedie EMBA, and DeGroote EMBA. International programs were Stanford LEAD Certificate, Sloan EMBA, Harvard PLD, INSEAD EMBA, Judge EMBA, and Wharton EMBA.

5 One Canadian EMBA (Beedie) offered two relevant courses. Among international programs, the Stanford Lead Certificate offered four, the Sloan EMBA three, Wharton and Judge two each, and the INSEAD and Harvard programs one each.

6 To gain the certification, applicants must have prior education (high school diploma or university degree) and two to five years' experience related to new product development, and they must pass a certification exam (PDMA, 2017b).

## 5.2 HOW IMCs ARE LEARNED: LEADING PRACTICES

Executives, given their extensive experience and ability to affect company-wide innovation, are a unique group of innovation management students. They can develop IMCs by reflecting on previous experiences and learning from the experiences of others, as well as by constantly improving their innovation management through lifelong learning opportunities. While companies have a major role to play in the professional development of managers, all actors in the innovation ecosystem can develop learning experiences for executives of all types that include reflection on experience.

### 5.2.1 Specialized Training in Scaling High-Tech Companies

Some evidence suggests that Canadian innovation managers struggle to build, grow, and scale companies, especially in high-tech industries (Lazaridis Institute, 2016; CCA, 2018). Programs that address scaling, a critical point in a company's growth (Sutton & Hayagreeva, 2014), could therefore improve innovation management in Canada. The Lazaridis Scale-Up program brings founders and CEOs of 10 technology companies together with students in an accelerator-type environment where they receive one-on-one mentorship and training based on individual company needs (Lazaridis Institute, n.d.-a). Therefore, the teaching focuses on timely and topical information that helps management address immediate challenges in scaling. Similar programs exist at academic institutions abroad. For example, Harvard Business School's short executive education course, *Launching New Ventures*, is updated annually; however, it is not customized to students' needs (HBS, n.d.). Six schools in Norway run a three-month, collaborative and customized training program in scaling up companies, featuring industry mentors and academic leaders in innovation and entrepreneurship (BI Norwegian Business School, n.d.).

### 5.2.2 Opportunities to Reflect on Student Experiences

Teachers can make use of executives' experience by encouraging them to reflect on their past successes and failures as innovation managers. Reflection is "developed when students are taught to think more deeply about what they have learned, learn more about themselves, and engage in critical inquiry that can change their current beliefs and assumptions" (Inamdar & Roldan, 2013). Reflection gives students the opportunity to merge their experience with theories learned in the classroom (Mintzberg & Gosling, 2002), which both grounds the theory in reality and builds up the practical understanding of concepts. Reflection can be fostered through group discussions, where students

collectively learn from their experiences and identify biases and blind spots in their thinking (Mintzberg & Gosling, 2002). For example, the International Master's Program for Managers at McGill University regularly balances classroom education with group discussions and peer mentorship. Students are encouraged to bring their real business challenges to the discussion and to take lessons and suggestions back to their businesses. This helps students build connections and fosters an understanding of the larger innovation ecosystem (IMPMP, n.d.).

Teachers of executives excel when they are aware of their students' learning context and the experience they bring to the table, and know when to facilitate reflection on student experience. Teachers can support reflection by creating opportunities for group discussions. For instance, flipped classrooms devote class time to student discussions and reflection on theory-based lecture material that students viewed individually before coming to class (Saunders, 2017).

### 5.2.3 Lifelong Learning

Excellence in innovation management requires lifelong learning. The days of attending university early in one's life and then "spending" that knowledge for the next 35 years in one's career (or careers) are over. Globalization, automation, and artificial intelligence will have a transformative impact on the employment landscape over the coming years, ranging from significant job creation to job displacement, and from heightened labour productivity to widening skills gaps. In many industries and countries, the most in-demand occupations or specialties of today did not even exist a decade ago. According to Friedman (2016), "[w]hen you have an accelerated pace of change, the single most competitive advantage is to be a lifelong learner." There are many examples where companies have recognized the importance of lifelong learning. AT&T partnered with online platform Udacity to acquire the means to update the skills of its workforce. It offers employees roughly \$8,000 per year to take courses on topics like web page design or big data analytics. As John Donovan, AT&T chief strategy officer states, one "can be a lifetime employee if you are ready to be a lifelong learner" (Friedman, 2016).

Education should help managers stay informed and relevant in the global innovation ecosystem. This includes teaching general knowledge on management techniques and approaches as well as more technical knowledge on emerging topics such as financial technology and artificial intelligence. As with early- and mid-career education, executive students need a variety of training opportunities that suit their expertise, experience, and career stage: mentorship, workshops, executive education, EMBA programs, etc.

Academic institutions can encourage lifelong learning. While many schools offer education programs to students at different career stages (Bachelor of Commerce, MBA, EMBA, executive education), the ability to bridge these options can be a significant advantage. When courses or programs are "laddered," where each standalone course serves as a prerequisite for the next course in sequence, students can supplement on-the-job training with more formal education. For instance, many of the courses in the Invention to Innovation certificate at Beedie School of Business for non-business graduate students cover the prerequisites for the Beedie Management of Technology MBA (Beedie School of Business, n.d.-c). Workshop participants identified laddering as a way for business

schools to attract more students, particularly those who may not have applied for a major degree program such as an MBA or EMBA. Students are incentivized to take laddered courses and programs because they are relevant prerequisites for multiple programs. They also serve as testing grounds for students to determine their level of interest in the topic and their willingness to learn more.

#### 5.2.4 Examples of Leading Practices

Table 5.1 highlights 11 courses, experiences, and programs highlighted by the Panel, workshop participants, business school deans, and expert interviewees as examples of leading practices in innovation management education and training suited to executives.

**Table 5.1**  
**Examples of Leading Practices in Education and Training of Executive Students**

Type	Name	Contribution to IMC Education
Targeted Education Course	Harvard Business School's Launching New Ventures course	Provides targeted training in IMCs
Targeted Education Program	Lazaridis Institute's Executive Master's in Technology Management	Provides targeted training in leadership and other IMCs
Targeted Education Program	Lazaridis Institute's Scale-Up Program	Provides targeted and tailored mentorship and training in scaling
Tailored Education Program	MIT REAP Norway University Consortium's Accelerator Scale-Up Program	Provides collaborative and customized training in IMCs from both academics and practitioners
Company-Based Training Approach	Shopify's Talent Acceleration team	Uses workshops and mentorship in on-the-job training for low- and high-level management skills
Professional Certification	PDMA's New Product Development Professional certification	Provides targeted professional development training in IMCs
Professional Certification	GIMI's Innovation Certification Program	Provides targeted professional development training in IMCs
Company-Initiated Tailored Education Course	Imperial College Business School's Delivering Innovation in Practice customized course for IBM	Teaches IBM staff how to foster innovation in a tailored executive education course
Reflection-Oriented Executive Education Program	International Masters Program for Managers	Emphasizes reflection and learning from peers
On-the-Job Lifelong Learning	AT&T and Udacity educational partnership	Updates staff skills through on-the-job training courses
Laddered Programs	Beedie School of Business' laddering of its Invention to Innovation certificate and its Management of Technology MBA	Provides a steady, easy way to continually gain more IMC training over a career

Data Source: Panel, workshop participants, business school deans, and expert interviewees

### 5.3 CONCLUSION

Executives are best positioned to improve innovation management across Canada. To compete in the global innovation economy, Canadian companies simply cannot wait for early- and mid-career students to acquire IMCs. Expanding the course offerings and learning experiences to current executives will help produce innovation leaders who can drive creativity, disrupt markets, promote diversity, think globally, scale companies, and ultimately enhance the innovation ecosystem both within and outside their companies.

Today's executives can also be valuable role models for the next generation of innovation managers in Canada. They can help their employees acquire innovation management

competence through on-the-job training and by providing resources for external educational opportunities. Executives can co-teach or guest lecture in undergraduate and graduate classrooms and mentor start-ups and scale-ups through innovation intermediaries and professional networks. A virtuous cycle of innovation leaders mentoring students who themselves become mentors will help produce generations of Canadians who can lead innovative companies at the forefront of the global economy.



# 6

## 6 Conclusion

Canada has an abundance of raw ideas, talented people, and entrepreneurial spirit. While research is world-class and technology start-ups are thriving, few companies grow and mature in Canada. This cycle — invent and sell, invent and sell — allows other countries to capture much of the economic and social benefits of Canadian-invented products, processes, marketing methods, and business models. Escaping this cycle will be aided by more effective innovation managers who can systematically manage ideas for commercial success and motivate others to reimagine innovation in Canada.

In this report, the Panel focused on two broad questions: what skills are needed to manage innovation and where and how these are best taught. Reflecting on the available evidence, the Panel highlighted 33 leading practices and reached seven conclusions about innovation management education and training in Canada.

### 6.1 CONCLUSIONS

**Five competencies are associated with high-performing innovation managers across many types of companies: finding opportunities, commercializing opportunities, managing diverse teams, leveraging innovation ecosystems, and leadership.**

Successful innovation depends, in part, on having well-trained managers throughout an organization, from the C-suite to the shop floor. The Panel adopted a competency-based education approach because it prepares students for practical work rather than only teaching them knowledge. The conceptualization of the IMCs is the Panel's main contribution to the field of innovation management, and is a valuable and important way of rethinking innovation management education and training. As different industries and environments may demand different knowledge, skills,

and attitudes, the relative emphasis of each IMC varies across an innovation manager's career depending on their role, company, and industry. There is no hierarchy of competencies as each continues to be reinforced and refined well after completion of formal academic training. The competency-based approach adopted by the Panel is intended to begin a dialogue among business schools, companies, and other stakeholders that educate and train innovation managers. As there are many different ways to conceptualize the IMCs, the five IMCs are not definitive. Rather they are more of a first take, which the Panel encourages others to refine and further develop.

Managers educated and trained in the IMCs have the potential to create value for customers and users, generating greater incomes, wealth, and well-being. Whether in developing a new product or leading corporate innovation strategy, managers need to be agile sensemakers, evaluating a range of options, solving problems, and adapting as conditions change. Competency-trained innovation managers find opportunities, whether through design thinking, R&D, or open innovation, and reward creativity, encourage experimentation, and tolerate failure. However, generating a continuous stream of commercial opportunities entails more than just finding opportunities. It requires managers trained in commercializing opportunities, who can market, sell, finance, and supply new products, processes, and business models. Building relationships is central to inclusive innovation. Managing diverse teams and leveraging innovation ecosystems help expand the pool of internal and external ideas, empowering and engaging people and institutions to innovate. Above all else, innovative companies need leaders who explore new opportunities while continuing to exploit existing innovations. They create a shared corporate vision and innovation culture that supports company-wide innovation.

**Offering more innovation management courses can better prepare Canadian MBAs to manage in an increasingly innovation-driven economy. Joint programs are a leading practice for expanding access to innovation management education to students outside of business schools.**

Innovation management will be indistinguishable from management in the future. Business graduate programs in Canada, with an annual enrolment of more than 30,000 students, provide an opportunity for business schools to foster IMCs in Canada's future managers. While some MBA programs offer courses in entrepreneurship, virtually no Canadian or U.S. schools offer innovation management courses as part of their core curriculum. However, the number of innovation management MBA elective courses offered in Canada have increased five-fold over the last decade, tending to focus on three of the five IMCs — finding opportunities, commercializing opportunities, and leveraging innovation ecosystems — with gaps in managing diverse teams and leadership. Ultimately, business schools have an opportunity to teach all MBA students the basics of the five IMCs. Striking the right balance between core and elective course offerings will depend on needs of students and expertise of faculty members in each business school.

The global economy's increasing reliance on innovation implies that future employees will need to understand — if not manage — some aspect of innovation in their careers. Representing 20% of annual enrolment in Canada, undergraduate and college business programs are a key leverage point for exposing more than 300,000 students each year to innovation management education. While innovation management is not often part of core business school curricula, the number of innovation management undergraduate courses offered in Canada have increased four-fold over the last decade. However, expanding the courses and learning experiences offered to STEM and other interested students will increase the likelihood that future Canadian innovation managers are equipped with the competencies needed to effectively manage innovation. Joint courses and programs expand access to the teachers, theory, learning experiences, and innovative culture housed in business schools to a greater number of students. Academic institutions can build an inclusive innovation culture by expanding access to innovation management education to all students, increasing the likelihood that Canadians will be able to manage innovation more effectively.

**Specialized programs are a leading practice for providing in-depth innovation management education to mid-career students and focused training scaling high-tech companies to executives.**

Innovation management is a sophisticated, growing area of academic and professional expertise. The emergence of specialized innovation management programs may also reflect an increasing demand from students for in-depth education that cannot be provided in MBA programs. Specialized MBAs and master's programs allow business schools to teach the right material to the right students at the right time. Program content can be more tailored and timely, and go into more depth on innovation topics than in a broader program; directed to students who are specifically interested in innovation and in developing IMCs; and customized to the expertise and needs of students entering the program. Canadian schools lag their international comparators in executive training in innovation and innovation management. EMBA can provide executives with targeted, personalized education that reflects their diverse needs, experiences, and education levels. The Panel and workshop participants agreed that current and future Canadian executives would benefit from more specialized training in how to scale high-tech companies. However, expanding executive student access to innovation management education in all five IMCs would help produce innovation leaders in Canada today who drive creativity, promote diversity, disrupt markets, think globally, scale companies, and ultimately enhance the innovation ecosystem both within and outside their companies.

**Leading practices are not widely recognized in innovation management because it is a nascent field with silos of expertise. Innovation management education could be improved by developing communities of practice for teachers, researchers, and practitioners to share, implement, and expand leading practices.**

No single curriculum will or can satisfy all needs for the development of the next generation of innovation managers. The catalogue of formats, styles, methods, approaches, and platforms is growing and innovating — which is a positive development. Identifying leading practices is a work in progress; many activities, programs, courses, and experiences exist in Canada and internationally, and are rated highly by those who experience them. Formal evaluation of leading practices, however, was beyond the scope of this assessment.

Sharing best practices among teachers, administrators, and others involved in curriculum design is the most effective way to develop high-quality innovation management courses, learning experiences, and programs. Community members build trusted relationships with other educators and share their unique knowledge and experience of innovation management. Including innovation management researchers and practitioners in the community helps align teaching practices with leading theoretical and industrial advances. A community of practice also encourages innovative curricula by expanding collective knowledge, identifying gaps in program offerings, and suggesting novel solutions.

**Leading innovation management courses and programs provide students with active learning experiences as well as opportunities for risk-taking, failure, and reflection.**

While educational institutions teach many of the competencies with a particular focus on foundational and theoretical learning, increasingly it is recognized that innovation management learning benefits considerably through experiences in safe environments that encourage experimentation and allow for failure. Active learning beyond classrooms includes entrepreneurial projects, flipped classrooms, innovation competitions, hackathons, work-integrated learning, and mentorship programs. Innovation management education succeeds when the students are taught by teachers who encourage risk-taking and tolerate quick, intelligent failure. Teachers should be encouraged to gain experience as innovators and invite innovators into classrooms to describe and reflect on their experiences. Students of innovation management learn from these second-hand experiences by applying theory and engaging in reflective exercises. Establishing linkages between business schools, STEM departments, other academic institutions, innovation intermediaries, and industry builds an off-campus innovation culture that allows students to see the larger innovation ecosystem at work and build relationships with colleagues and mentors across disciplines.

**Teacher-practitioners, innovation intermediaries, and lifelong learning are leading practices for effective innovation management education and training throughout the innovation ecosystem and across a student's career.**

Teachers with experience as innovators can provide students with an understanding of how innovation works in practice, especially its associated challenges and failures. Whether as solo teachers, co-teachers, or guest lecturers, these teacher-practitioners may become role models or mentors for students. Innovation management education is more valuable to students when it reflects leading-edge

theory and provides meaningful experiences. Incentivizing teachers to experiment in course content and delivery will result in innovation in innovation management curricula. However, not all managers of innovation will attend business school programs. For those who are unable to access or uninterested in graduate training, innovation intermediaries provide alternative opportunities for peer learning, networking, and mentorship, empowering more people with diverse skills, backgrounds, and perspectives. Innovation managers at all stages in their career experiment together, share resources, and learn from each other's failures. Innovation intermediaries are excellent places for students to experience and manage innovation. Excellence in innovation management requires lifelong learning, refining and reinforcing competencies throughout a career. Lifelong learning ensures that managers constantly strengthen their IMCs and keeps them up-to-date on current trends in innovation. By laddering courses and programs, business schools can encourage students to supplement on-the-job training with more formal innovation management education.

**Inclusive innovation can underpin both the theory and practice of innovation management, empowering diverse people and institutions to innovate.**

Inclusive innovation is the result of people with diverse backgrounds and perspectives interacting via fair practices to expand the pool of ideas and opportunities for commercialization. Academic institutions can develop new courses and learning opportunities, making inclusive innovation an explicit goal of in the design of pedagogy. Collaboration throughout the ecosystem among academic institutions, innovation intermediaries, and companies as well with social entrepreneurs and marginalized groups will create a culture of tolerance towards risk, celebrating failure and experimentation, while finding ways to both include, empower, and reward the many and diverse not just the few. There is an opportunity to develop a uniquely Canadian model of inclusive innovation management education.

## 6.2 IMPLICATIONS AND OPPORTUNITIES

### 6.2.1 Business Schools and Other Academic Institutions

Business schools and other academic institutions have an opportunity to support the development of Canada's innovation managers by training a larger number of more diverse students. Developing collaborative programs between business schools and engineering and science departments or across Canadian universities and colleges would increase the number of students exposed to high-quality innovation management education. In addition, exposing students to

IMCs earlier in their education and in more disciplines, increasing focused just-in-time training, and developing an accreditation process have the potential to support the development of IMCs across all academic institutions.

### 6.2.2 Industry

Companies can establish a robust innovation culture and provide employees with professional development opportunities. They can better articulate and communicate the required IMCs and focus their recruitment efforts accordingly. This may require a willingness to strike a balance between a candidate's credentials and experience. Through internal (e.g., mentorship, internal courses) and external (e.g., just-in-time programs offered by academic institutions) training in IMCs, companies can demonstrate their commitment to talent development by allocating relatively more time and resources to develop IMCs. Companies can also enable more inclusive innovation cultures, which create potential interactions among diverse ideas, employees, and others in the innovation ecosystem.

### 6.2.3 Governments

Governments have the opportunity to further foster the development of IMCs in Canada by establishing policy and funding programs that support innovation management education and training within innovation ecosystems, such as the recently announced superclusters program. The government can also fund IMC training initiatives that involve partnerships between academic institutions and industry. Workshop participants articulated their support for government programs that help industry to establish long-term training opportunities (e.g., Mitacs fellowships, Natural Sciences and Engineering Research Council (NSERC) CREATE grants) and access a pipeline of technical talent. They also identified as an opportunity industry-academia exchanges involving students, faculty, managers, and executives, who research, innovate, mentor, and reflect while working in a different sector.

## 6.3 FINAL REFLECTIONS

With about 350,000 undergraduate and graduate students enrolled in business programs in Canada, these schools are well positioned to offer more innovation management courses and experiential learning, drawing from the

leading practices identified by the experts involved in this report. Undergraduate, MBA, and executive students can acquire IMCs throughout their careers, blending theory, experience, and reflection as they learn to find and commercialize opportunities, manage diversity, leverage innovation ecosystems, and eventually lead innovative companies. Yet, it takes an ecosystem to develop excellent innovation managers. STEM departments, colleges, innovation intermediaries, companies, and governments can all participate in innovation management training, collaborating with each other and business schools to provide relevant opportunities. In a world with many divides, intolerance, and haves and have nots, this is a chance for Canada to both spearhead a new moment of innovation and to do so in a more inclusive and Canadian way. Canada can leverage its inclusive social environment as a source of competitive advantage in the global innovation economy, serving as a model for other countries.

The Panel recognizes that scaling and growing companies in Canada is an urgent national priority. This challenge extends beyond those companies that innovate or those business schools that teach innovation. It requires a cultural shift across academic institutions, governments, and citizens to celebrate and revere innovators alongside leaders in other fields. One step in addressing this priority is to endorse and support a vision of strengthened competencies in innovation management. More widespread education and training in the five IMCs identified by the Panel would help in creating the necessary capacity and expanding the pool of Canadians who can push forward on this national agenda. This goes well beyond isolated courses or learning experiences; it requires integration of full-fledged programs across the innovation ecosystem using the common language and approach of IMCs. Stakeholders in all sectors and jurisdictions can coordinate and align their collective efforts to support, develop and deliver experientially based inclusive innovation education programs taking into account the framework set out in the Panel's report.



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## Appendix

### Appendix: Details of Evidence-Gathering

To supplement the findings of the workshop and literature review, the Panel gathered three additional sources of evidence: a survey of courses, experiences, and programs offered at leading Canadian and international business schools; a survey of deans of Canadian business schools; and interviews with 11 management experts.

#### CURRICULA SURVEY

Between April 2017 and March 2018, the Panel conducted a survey of the curricula at 22 selected business schools that were either highly ranked in Canada or abroad, as per the 2016 *Financial Times* and 2017 *Maclean's* rankings (Maclean's, 2016; Financial Times, 2017), or that were suggested by workshop participants, deans, or management experts during report development. The goal of the survey was not to rank Canadian business schools vis-à-vis their international counterparts, but rather to highlight examples of leading international practices.

The survey primarily focused on graduate programs: MBAs, specialized postgraduate programs (e.g. certificates, diplomas), EMBA's, and executive education. For each, programs that used the term *innovation* or *innovation management* were the focus. Other programming outside of business schools was also briefly reviewed, including from STEM departments, colleges and polytechnics, and innovation intermediaries.

This survey used a non-random sample of schools, and therefore was not exhaustive. As only publicly available information shown on business school websites about course offerings and course descriptions was collected this may not reflect the actual curriculum experienced by students. As well, schools display different information for their programs from course titles or program themes to entire course descriptions or syllabi.

The list of school curricula examined is as follows:

#### Canada:

- Carleton University and Sprott School of Business (Ottawa, ON)
- Dalhousie University and Rowe School of Business (Halifax, NS)
- McGill University and Desautels Faculty of Management (Montréal, QC)
- McMaster University and DeGroote School of Business (Hamilton, ON)
- Queen's University and Smith School of Business (Kingston, ON)
- Ryerson University and Ted Rogers School of Management (Toronto, ON)
- Saint Mary's University and Sobey School of Business (Halifax, NS)
- Simon Fraser University and Beedie School of Business (Burnaby, BC)
- University of Alberta and Alberta School of Business (Edmonton, AB)
- University of British Columbia and Sauder School of Business (Vancouver, BC)
- University of Calgary and Haskayne School of Business (Calgary, AB)
- University of Toronto and Rotman School of Management (Toronto, ON)
- University of Waterloo and Conrad Business, Entrepreneurship and Technology Centre (Waterloo, ON)
- Western University and Ivey Business School (London, ON)
- York University and Schulich School of Business (Toronto, ON)



**International:**

- Babson College and F.W. Olin Graduate School of Business (Wellesley, MA)
- Harvard University and Harvard Business School (Cambridge, MA)
- INSEAD (Fontainebleau, France)
- London Business School (London, United Kingdom)
- Massachusetts Institute of Technology and Sloan School of Management (Cambridge, MA)
- University of Cambridge and Judge Business School (Cambridge, United Kingdom)
- University of Pennsylvania and The Wharton School (Philadelphia, PA)
- Stanford University and Stanford Graduate School of Business (Stanford, CA)

**SURVEY OF CANADIAN BUSINESS SCHOOL DEANS**

The Panel conducted an online survey of Canadian business school deans to understand their perspectives on innovation management education in light of their role in business curricula. The survey was administered in fall 2017 via an online survey platform, and sent to all 62 members of the Canadian Federation of Business School Deans. It asked deans to catalogue their innovation management curricula (e.g., courses, learning experiences, joint programs) and reflect on leading practices in business schools and elsewhere (e.g., innovation intermediaries, industry). The response rate was 52% (i.e., 32 of 62 deans). See Box A.1 for the survey questions.

**Box A.1****Survey of Canadian Business School Deans**

- 1. Does your business school offer an innovation management curriculum?**
  - Yes
  - No
  - I don't know
  - Prefer not to disclose
- 2. If yes, please list any courses in which innovation management is taught.**
  - Course title
  - Level (undergraduate, graduate, MBA, EMBA, executive education, etc.)
  - Teaching methods used (lectures, case studies, practicums, internships, etc.)
  - Year the course began
  - Approximate annual enrolment
- 3. Does your business school offer other learning experiences related to innovation management (e.g., internships, practicums, case competitions)?**
  - Yes
  - No
  - I don't know
  - Prefer not to disclose
- 4. If yes, please provide a brief description (or website link) of other learning experience related to innovation management (e.g., internships, practicums, case competitions) that your business school offers.**
- 5. Does your business school offer innovation management courses or other learning experiences jointly with other academic departments, institutions, or industry?**
  - Yes
  - No
  - I don't know
  - Prefer not to disclose
- 6. If yes, please provide a brief description of innovation management courses or other learning experiences offered jointly with other academic departments, institutions, or industry. Or, provide a website link, if applicable.**
- 7. Please highlight up to three examples of leading innovation management curriculum that you are aware of at other institutions.**
  - Institution
  - Course or learning experience
  - Why is it leading?

*continued on next page*

**8. What are the barriers to adopting leading innovation management curriculum at your business school?**

**9. In your opinion, how important (very, moderately, slightly, not at all, no opinion) are the following institutions generally in developing innovation management skills?**

- Business schools (undergraduate/graduate programs)
- Business schools (MBA programs)
- Business schools (EMBA programs, executive education)
- STEM (Science, technology, engineering, and mathematics) departments
- Other university departments
- Colleges and polytechnics
- Accelerators and incubators
- Companies

**10. In your opinion, what are the top three business schools (or other institutions) for teaching innovation management? Please explain why.**

**11. In your opinion, what is needed to improve innovation management in Canada?**

**12. Do you have any other comments or feedback?**

### INTERVIEWS WITH MANAGEMENT EXPERTS

The Panel conducted brief, standardized, open-ended interviews with experts in the field of innovation management. The following set of questions guided the discussions:

- What distinguishes innovation management from management?
- What skills are needed to effectively manage innovation?
- What Innovation Management courses are being taught at your institution?
- What is taught in your IM courses? What are the top 3-5 most important elements to teach in IM?
- Which faculty members are teaching IM courses at your institution? Which students are taught?
- What other work is being done at your institution (in your department or in other faculties) to teach or foster innovation management skills?
- At which other institutions is innovation taught well? Please provide examples.

The following individuals were interviewed in 2017 and 2018:

- Sylvie Albert (Faculty of Business and Economics, University of Winnipeg, Winnipeg, MB)
- Julian Birkinshaw (London Business School, London, United Kingdom)
- Elicia Maine (Beedie School of Business, Simon Fraser University, Vancouver, BC)
- Henry Mintzberg, O.C., O.Q., FRSC (Desautels Faculty of Management, McGill University, Montréal, QC)
- Steven Murphy (University of Ontario Institute of Technology, Toronto, ON)
- Fiona Murray (Sloan School of Management, MIT, Cambridge, MA)
- Charles O'Reilly (Stanford Graduate School of Business, Stanford University, Stanford, CA)
- Scott Stern (Sloan School of Management, MIT, Cambridge, MA)
- Peter Todd (HEC Paris, Paris, France)
- Dietmar Theis (Technische Universität München, Munich, Germany)
- Michael Tushman (Harvard Business School, Harvard University, Cambridge, MA)



## Council of Canadian Academies' Reports of Interest

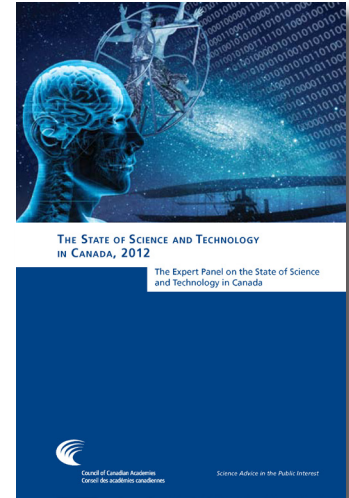
The assessment reports listed below are accessible through the CCA's website ([www.scienceadvice.ca](http://www.scienceadvice.ca)):



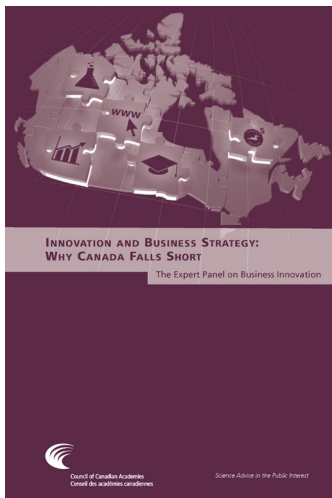
**Competing in a Global Innovation Economy: The Current State of R&D in Canada**  
(2018)



**Preliminary Data Update on Canadian Research Performance and International Reputation**  
(2016)



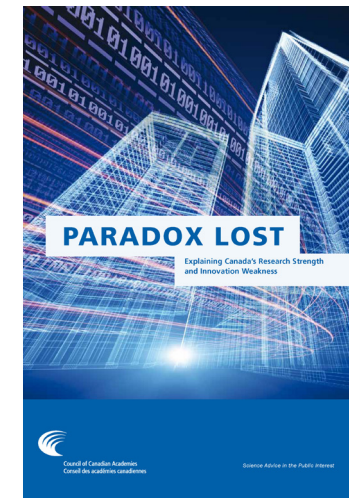
**The State of Science and Technology in Canada, 2012**  
(2012)



**Innovation and Business Strategy: Why Canada Falls Short**  
(2009)



**Innovation Impacts: Measurement and Assessment**  
(2013)



**Paradox Lost: Explaining Canada's Research Strength and Innovation Weakness**  
(2013)

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