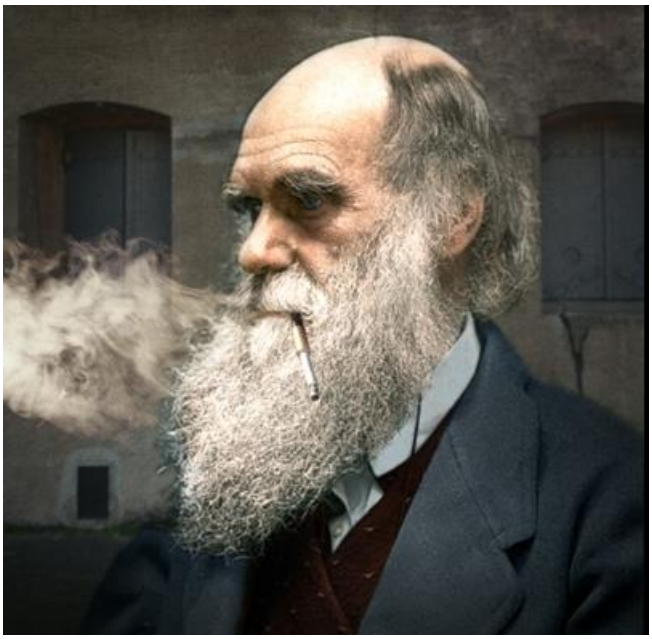


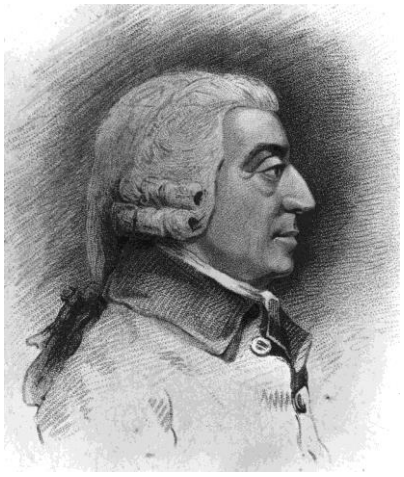

The Humanities and Social Sciences: Understanding the Human Role in Innovation

(July 8th, 2016)

Submitted to:
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Contents

Executive Overview

"Man is the measure of all things"
Protagoras (490-420 BC)

This paper is intended to stimulate a discussion about the idea of "human-centered innovation". Human-centered innovation means designing and implementing innovation programs to satisfy human needs (as consumers, patients, students, workers, and citizens, etc.).

It would reverse the polarity of innovation flows, from placing a priority on the "supply" of innovation, to a new emphasis on the human-centered "demand" for innovation. In doing so it would give priority to the social context supporting innovation, in addition to its technology base. While innovation does require an understanding of the natural world and how to develop a particular device, its application goes well beyond producing a technology, to include designing and building the conditions for a society to accept, adopt and use that technology to meet human needs.

This change in emphasis would acknowledge and put into practice the view that technology is simply a tool intended to serve humanity. It would place less emphasis on innovating things, and more emphasis on innovating social outcomes – in health, education, housing, inclusive economic growth, transportation, trade, and cleaner environmental sustainability, etc. In short, it would provide a framework of meaning and purpose, to encourage public support and investment in innovation activity. Such a made-in-Canada approach to innovation, would fit well with the current federal government's values of social inclusion and results-driven policy.

1. Purpose of the Report

The purpose of this Report is to help the Federation (Federation for the Humanities and Social Sciences) "better communicate the story of HSS scholarship throughout Universities Canada's Seizing Opportunities campaign and beyond". In order to achieve this objective, the Federation identified two guiding research questions for exploration:

A. Why is HSS important for innovation in Canada?
B. To what extent is there a gap or deficiency in Canadian investment in HSS R&D to support an effective innovation agenda?

In being guided by these questions, the Report was asked to examine the broader context of these questions, as noted below:

1. The role of HSS in innovation, which would examine a broader understanding of the concept of innovation performance that includes all activities involved in managing, designing, marketing and selling a product or service in global markets.
2. The rise of the service economy, which would emphasize the increasing importance of services in the Canadian economy and discuss the role of HSS research in supporting service activities.
3. The need for interdisciplinary research, particularly to address pressing social problems that go beyond straightforward technical solutions.
4. Innovation in public policy, with a focus on the role of HSS research in supporting the work of public institutions.
5. The different benefits of SHH and natural-science research.

2. Context for the Report

2.1 A New Federal Government

The election of a new majority federal Government in October, 2015, has ushered in a new open-ness and commitment to better public policy, including the development of "a new Innovation Agenda". In addition, it should be emphasized that this new innovation policy initiative is surrounded by and linked to many, many other major public policy reviews that were identified: in Ministerial Mandate letters; in commitments articulated in the Government's first Budget of April 2016; and in more recent policy announcements and consultation processes. The major commitments are extensive and are identified below:

Budget 2016: Policy Commitments

1. A commitment to a new Innovation Agenda
2. A commitment to a comprehensive review of federal support for fundamental science
3. A commitment to develop a national Cluster Mapping Portal
4. A commitment to develop a performance measurement framework for business accelerators and incubators
5. A commitment to a new trade and export strategy
6. A commitment to deepening trade relationships with large emerging markets, including China and India
7. A commitment to develop a pan-Canadian Framework on Clean Growth and Climate Change
8. A commitment to create a new Defence Strategy to deliver a modern, more agile,and better equipped military
9. A commitment to conduct a review of Canada's international assistance policy framework to refocus on the poorest and most vulnerable
10. A commitment to negotiate a new multi-year health acccord that will improve health care in Canada and boost health outcomes for all Canadians

11. A commitment of $8.4 Billion over 5 years to improve the socio-economic conditions of indigenous peoples
12. A commitment to develop a Social Innovation and Social Finance Strategy
13. A commitment to review the tax system to determine whether it works well for Canadians, with a view to eliminating poorly targeted and inefficient measures
14. To ensure that the Government delivers on its commitments, "a new results and delivery approach will be implemented that includes the establishment of the Cabinet Committee on Agenda, Results and Communications, chaired by the Prime Minister, and a Results Delivery Unit, housed in the Privy Council Office"

    Also: Dominic Barton heads a new Advisory Council on Economic Growth – will deliver a Sustainable Growth Strategy by December 31st, 2016

It should be noted that many of these major new policy initiatives are inter-related, and are particularly linked to the Innovation Agenda (e.g. a review of fundamental science, a new trade and export strategy, the transition to a low carbon economy and clean tech growth, a new Health Accord with Provinces/ Territories, and a new Economic Growth Strategy, etc.). Over the course of the summer, fall and winter, the results of these policy reviews and their recommendations will need to be synthesized and integrated for funding and implementation in Budget 2017 and beyond. **Common to all of these reviews for the new Government will be the human element – how will they support access to and sustain middle class jobs? In this regard, what role could HSS disciplines provide in helping to identify the key risks and opportunities in these complex ecosystems – science, innovation, trade, energy, health, environment and economic growth, around this common objective of strengthening social inclusion?**

2.2 An Inclusive Innovation Agenda

Regarding the scope and need for HSS knowledge to be engaged in improving the performance of Canada's Innovation Ecosystem – the opportunities are almost limitless. For example, Minister Bains identified 12 questions for public consultation about how to improve Canada's innovation performance (see Annex B for the full list of 12 questions). The examination of each one will need to draw upon extensive knowledge in areas of HSS disciplines. For example, consider just one question - #2 **"How do we work together to better equip our young people with the right skill sets for the economy of the future?"** What do we know about the economy of the future? What do we know about the changing nature of work? What do we know about the behaviours and attitudes of new generations and their expectations from work? How does this vary across cultures? What new skill sets will be needed in the workplace? What will be the role for experiential learning or work-

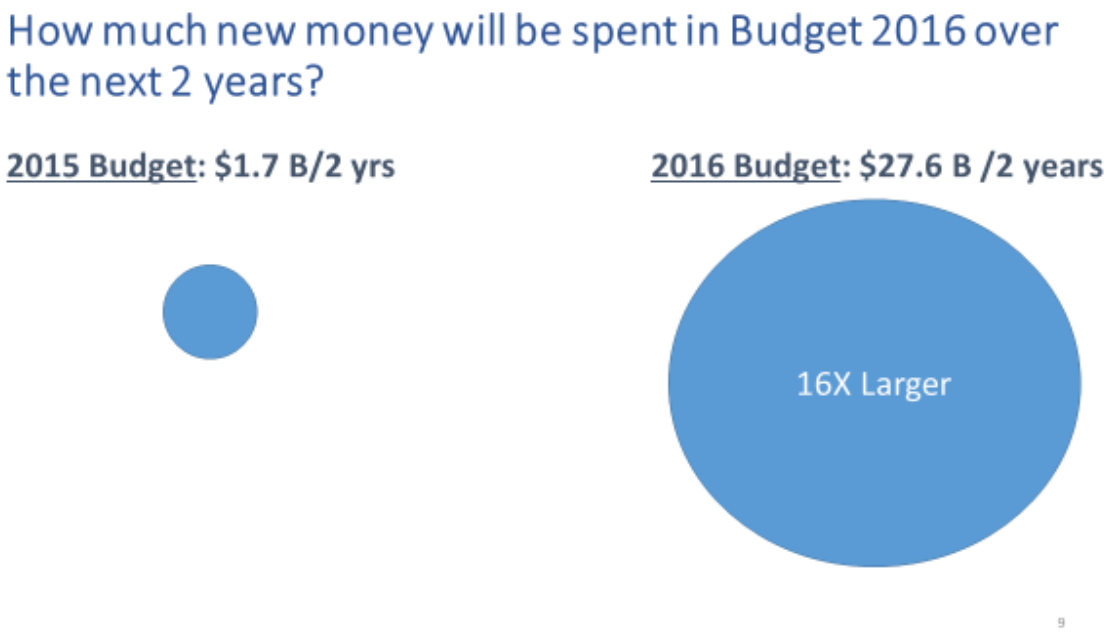
integrated learning in developing these skills? **The answers to these questions depends more on an understanding of the psychology of people than of the mechanics of a technology.**

To continue this discussion about the roles of HSS disciplines in contributing to a better understanding of these key questions – consider question #5 – **What is the right model for made-in-Canada innovation clusters led by business?** An innovation cluster is a geographic concentration, primarily in an urban environment, of interconnected businesses, suppliers, universities and colleges, risk capital providers, and supporting governmental institutes and programs (national, provincial, municipal), in a particular economic domain. In short, it is a dynamic social system of institutions, stakeholders and leaders sharing a collective objective to help local businesses thrive and grow in global markets. Again, HSS disciplines are central in understanding how to improve the performance of such regional social ecosystems.

Clearly, one could develop an entire HSS research program around this set of 12 innovation questions. **Perhaps the HSS community should propose the development and funding of such a research program over the next five years, to address the core issues raised by these 12 questions.** In this regard, it is unlikely that definitive answers to these questions will be found in the next 4 to 6 months.

2.3 Funding Constraints and the link to HSS research

It should be emphasized that there may not be a lot of new federal money available in the next several years for new investments to support improvements to Canada's innovation ecosystem, including for HSS research. In this regard, note that the size of Budget 2016, as illustrated in the schema below, is about 16 times larger than Budget 2015, likely limiting the scope for future incremental innovation investments. As a result, there will likely be more reliance on the re-allocation of innovation commitments within existing funding levels, or a focus on spending existing funding more effectively.



The magnitude of these new expenditures, in the context of declining global and domestic economic performance, suggest limited fiscal capacity for new public innovation investments.

Regarding new funds for HSS research, the Chart below identifies the 25 largest Budget expenditures over the next 2 years. Within this context the new Tri-Council funding is identified (in 30th position) at $190 M, and within this is contained the $32M for incremental HSS funding over two years, through SSHRC. There are two relevant observations from this ranking of the size of new Budget investments. **The first is the dominant focus of the new investments in community infrastructure and meeting the social needs of vulnerable groups in society, such as children, veterans, seniors, aboriginal Canadians, students, the unemployed, and refugees.** However, the second is the very limited new funding allocated to HSS research in relation to these predominantly social challenges ($16 M per year or $32 M over 2 years). In fact new spending on HSS research is just 0.1% of total spending of $27.6Billion. Does this make sense? **Perhaps more investment in HSS research and developing a deeper understanding of the nature of these societal problems at an earlier stage, would mean less need for such massive funding after these social problems reach an acute stage. Could the HSS community develop a funding agreement around "preventative" social research?**

The largest 25 Budget 2016 expenditures over 2 years:

Initiative	Cost ($M)	Initiative	Cost ($M)
1. Canada Child Benefit	9,880	14. On-reserve water and waste water	618
2. Support for Veterans	4,547	15. Extending EI benefits in affected regions	582
3. Middle Class tax cut	2,815	16. Expanding access to employment insurance	567
4. Public Transit infrastructure	2,548	17. First Nations housing	554
5. Social infrastructure	2,253	18. Treasury Board program integrity	500
6. Green infrastructure	1,804	19. Promote peace and security	391
7. Post Secondary infrastructure	1,750	20. First Nations schools	380
8. Single seniors- increase Guaranteed Income	1,147	21. Gas tax transfer	262
9. Pan-Canadian Climate Change projects	1,076	22. Increase Aid programs	256
10. Federal public infrastructure	959	23. First Nations community infrastructure	255
11. Reducing EI waiting period	957	24. Expand intake of Syrian refugees	240
12. Enhancing student grants	684	25. Genome Canada	237
13. First Nations education	670	30. Tri-Councils (including $32M for SSHRC over 2 yrs)	190

6

2.4 Conclusion

Budget 2016 encapsulated the context (see below) within which a new federal innovation strategy will be developed (as well as the opportunity for HSS research to contribute to that strategy over the longer term). In summary:

1. The Problem: Wages flat for 30 years
2. The Solution: Strengthen a vulnerable Middle Class
3. The Context: Global Growth Tepid
   Domestic Growth Falling
4. The Budget 2016 Strategy:
   1. Invest $27.6 B in Social Inclusion and Infrastructure today to quickly create 100,000 middle class jobs
   2. Invest in Innovation and Economic Growth tomorrow on the basis of recommendations being developed in a range policy reviews that include:
      i. A new Innovation Agenda
      ii. A review of Fundamental Science
      iii. A new Canadian Trade and Export Strategy
      iv. A new Framework on Climate Change and Clean Tech growth
      v. A new Health Accord
      vi. A new Sustainable Growth Strategy (the Dominic Barton Council)

In developing these policies, the demand for insight and recommendations based upon knowledge from the HSS disciplines is both broad and pervasive. This presents the HSS community with a remarkable opportunity to organize itself to contribute!

3. Methodology

The methodology that was pursued in developing this Report is summarized in Annex C.

4. Innovation and Economic Growth

In this section of the Report we examined the relationships among innovation, economic growth and HSS research, in order to discuss why HSS research is central to improving Canada's innovation performance.

4.1 What is innovation?

The most widespread definition of innovation, which has also been adopted by the federal Government, is sourced from the OECD "Oslo" Manual and states:

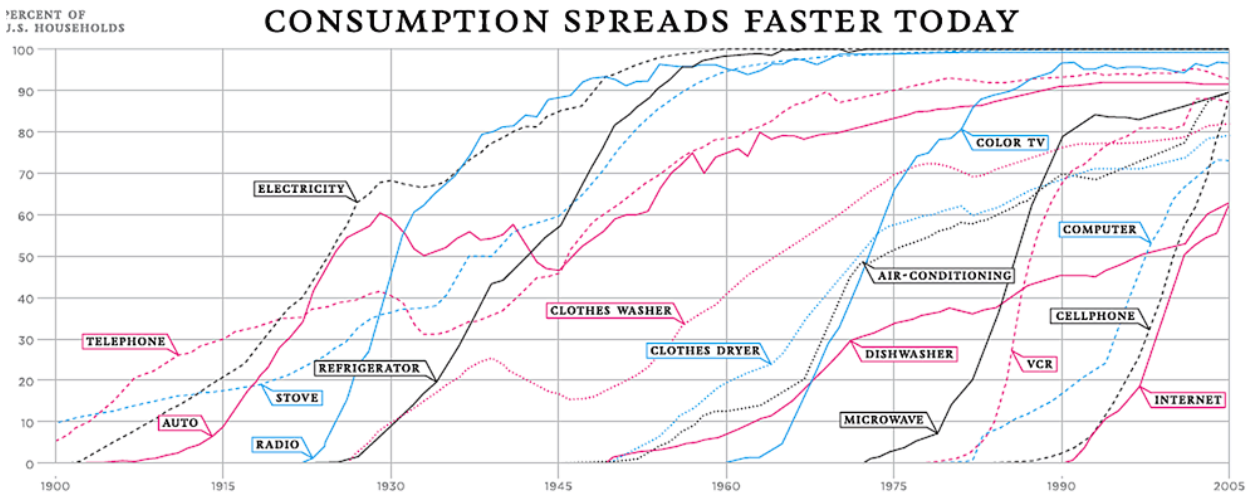
> "An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations."

From this definition about the scope of innovation activity there are several relevant observations for HSS disciplines:

1. Note that innovation activities go well beyond the manufacture of new products to also include other business activities that are central in getting a good or service to market, such as:
    - Improvement in business processes - e.g. just-in-time inventory, customer relations management (CRM), etc.
    - The development of new marketing methods – e.g. Shopify, Amazon, Netflix, etc.
    - The development of new organizational methods in business practices, workplace organization or external relations – e.g. Uber, AirBnB, crowdfunding, etc.

    Of particular relevance is the fact that improvements in these broader social aspects of innovation activity involve going beyond the development of a particular technological device, to a need for a better understanding of the human relationships within a business, between a business and its suppliers, and between a business and its customers.

2. It should also be noted from this definition, that innovation activity requires "implementation" in order to be complete. In other words, innovation requires acceptance and use of the innovative good or service in a society, and not just by a few people. In this context it is important to note that the diffusion of new knowledge/technology throughout a society, requires "social licence" from that society. It also requires from the innovator an understanding of the culture and values of that society in order to design and develop an effective innovation that will be broadly accepted and used. The changes in the rate of technology adoption are illustrated below:



Also note that as a technology is adopted widely (take for example the automobile) it can begin to transform other parts of a society – for example in the case of the automobile, facilitating the growth of suburbs, permitting access to jobs, supporting the growth of new industries – such as auto repair, filling stations, insurance, etc., making leisure travel and entertainment more accessible, facilitating interstate commerce, etc. **In summary, as technologies are introduced into an economy– these broader societal implications and likely changes in behaviour need to be anticipated and understood. This understanding of course is rooted in HSS disciplines.**

3. Even within the more dated and narrower understanding of innovation activity, centred on the development of a new or significantly improved product (physical good or service) economic activity has shifted dramatically over the past 70 years to a point where the service producing economy amounts to over 70% of economic activity, and the goods producing (manufacturing industries) component has shrunk to about 11%. Unfortunately, much of our thinking about both innovation and programs to support innovation are still driven by a focus on developing

new devices/tools. While an innovative manufacturing sector is an important component of economic activity, **it is now surrounded by the much larger service economy** – and this service economy now needs a deeper understanding (from HSS research) on how to best support innovation in service industries (e.g. finance, education, design, etc.), in order to strengthen their global competitiveness.

4. Finally, it should be noted that **innovation activity is not something that is new**. Arguably innovation activity can be seen simply as the history of the progress of civilization. For example, consider these two photographs which the consultant took at the Turkish Museum of Anatolian Civilizations in Ankara, Turkey in 2014.

   The first, from 8000 BC, shows a simple tool in the middle of the display case that illustrates the essence of innovation; the combination of separate things in a new way to create something of value – in this case the combining of 1) a stick with 2) a sharp rock bound by 3) animal hide, to form a new tool - an axe.

The second, from 1800 BC shows a tablet that contains a trade treaty between two tribes in Mesopotamia written in cuneiform script. What is interesting is that it is hand-held and exactly the size and shape of an I-Phone. However, unlike an I-Phone it is more innovative because it has two sides to display information (front and back). Finally, also note that it is wireless!

So neither innovation nor its social context (in these examples a simple hand tool, and a trade treaty) are dependent upon modern-day activities. **Rather they are deeply rooted in responding to enduring human needs throughout our history.**

4.2 What is an Innovation Ecosystem?

An Innovation Ecosystem is the network of all stakeholder organizations in both the public and private sectors whose activities and interactions:

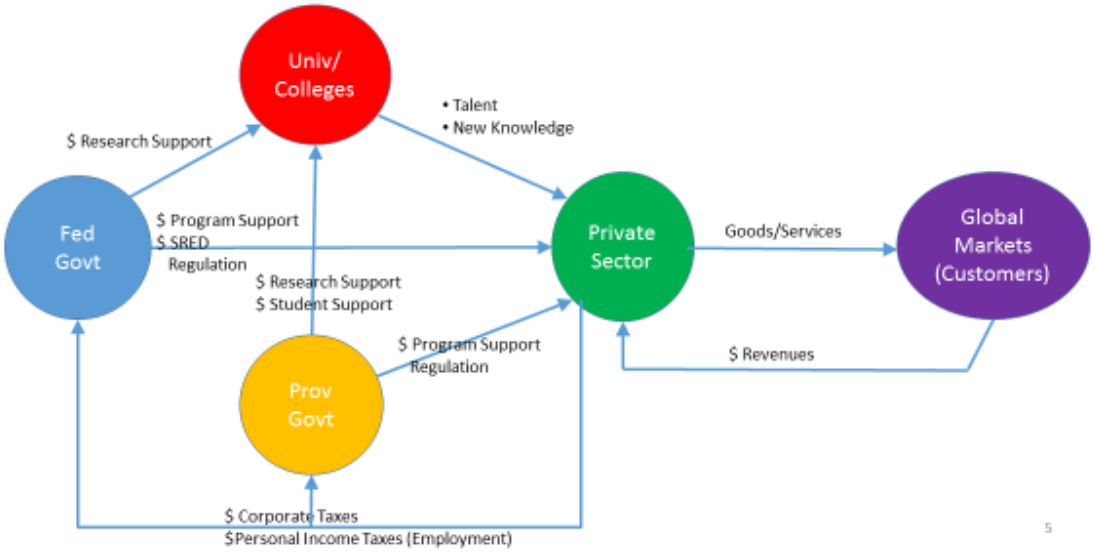
1. Create and disseminate new knowledge/technology, and
2. Support how businesses* incorporate that knowledge/technology into both existing and new products (either goods or services) for sale in domestic and global markets.

*Note that innovation activity can, of course, also be examined in relation to other institutions (Governments, Not-for-Profit organizations or Higher Education) and although these sectors of non-market innovation have not been examined nearly as much as business innovation, they will be discussed briefly in Section 10. However, the Government's Innovation Agenda centres on business innovation, in order to respond to the challenge of poor productivity performance and the need to grow Canada's middle class.

4.3 Who are the Primary Innovation Stakeholders?

There are five (5) key institutions and groups that combine to support an effective Innovation Ecosystem. They are noted in Figure 1 below (federal and provincial governments, universities and colleges, the private sector and global markets) and their key outputs are identified. For example, the key outputs of the Universities and Colleges are talented graduates, and new research-based knowledge.

Figure 1:Who are the key stakeholders in the Innovation Ecosystem?



Also note that the sustainability of the system is dependent upon a deep understanding of the values and needs of customers in global markets. The revenue feedback loops from customers permit the private sector to pay for talented employees and to invest in new innovation activity, as well as to pay taxes back to governments to help ensure the ecosystem is self-sustaining, including support for Higher Education research. **Also note that the five main stakeholder groups form a social network of interdependent or interrelated institutions, participants and leaders. As a result HSS disciplines are central to understanding how to improve the performance of an Innovation Ecosystem.**

4.4 Why is innovation important?

The Federal Economic Logic Chart, in Figure 1, is a useful way to explain the role of innovation in the economy. And it also helps to explain the role of HSS knowledge in contributing to improved economic performance. It is important to understand this logic chart if the HSS community want to influence the key federal decision-makers, particularly in Finance Canada. In summary, this chart reflects their language and perspective.

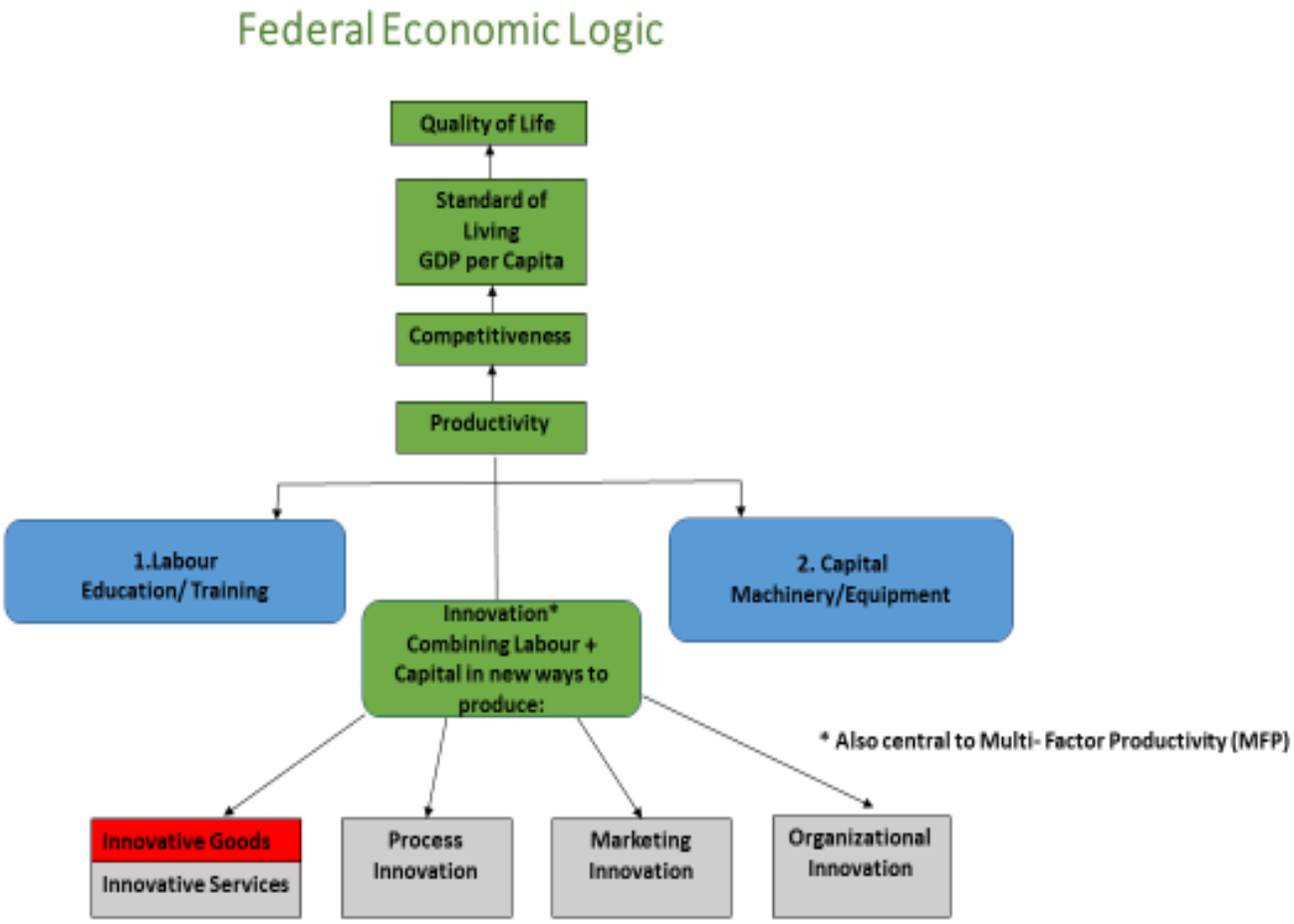
Beginning at the top of the logic diagram, governments are generally mandated to improve the Quality of Life of their Citizens. Improving the Quality of Life of a population requires investments whose sustained affordability depends on a country's Standard of Living (this is commonly measured as GDP per capita)*. This standard of living of a country is dependent upon how competitive its economy is in producing goods and services for global markets. In turn the long term competitiveness of an economy depends upon the productivity of its workforce. And the growth in its productivity depends upon three activities:

1. Public and private investments in Labour (participation rate/education/training),
2. Public and private investments in Physical Capital (the volume and quality of machinery and equipment) and
3. Public and private investments in Innovation (experimenting and managing different combinations of Labour and Physical Capital to create new goods, services, business processes, and business/marketing structures).

As a result these three categories of investment in productivity are the primary source of a country's competitiveness, standard of living and quality of life.

*The HSS community may wish to conduct research and build a consensus around better alternatives to measure a nation's standard of living.

Figure 2: Federal Economic Logic



Further, to grow an economy requires concentrating public and private investments in these three components: Labour, Physical Capital, and above all investing in Innovation – that is investing in new knowledge and skills on how to combine Labour and Capital in new ways to produce:

- New Goods + Services
- New Business Processes,
- New Marketing Methods
- New Organizational Forms

It is also interesting to note that innovation activity is a "managed" activity. It involves the discipline of how to integrate people and physical capital in new ways to produce new value for customers. As a result it requires a deep understanding of: customer needs in global markets that have different

cultures, norms and business practices; how to access these markets through complex distribution channels and value chains; how to develop the partnerships and alliances to permit this access; and how to manage a network of service, talent and component suppliers to produce the firm's innovative good or service that is capable of meeting the specific needs of customers in each of these global markets.

In summary, the process of innovation is an inherently human activity including developing and navigating a network of business relationships to build an innovative good or service and get it to a global customer to meet their needs. Within this broader social context, the development of an innovative device or good, for which new knowledge from the natural sciences is essential, is only one step in the long sequence of activities that is required for successful innovation to occur.

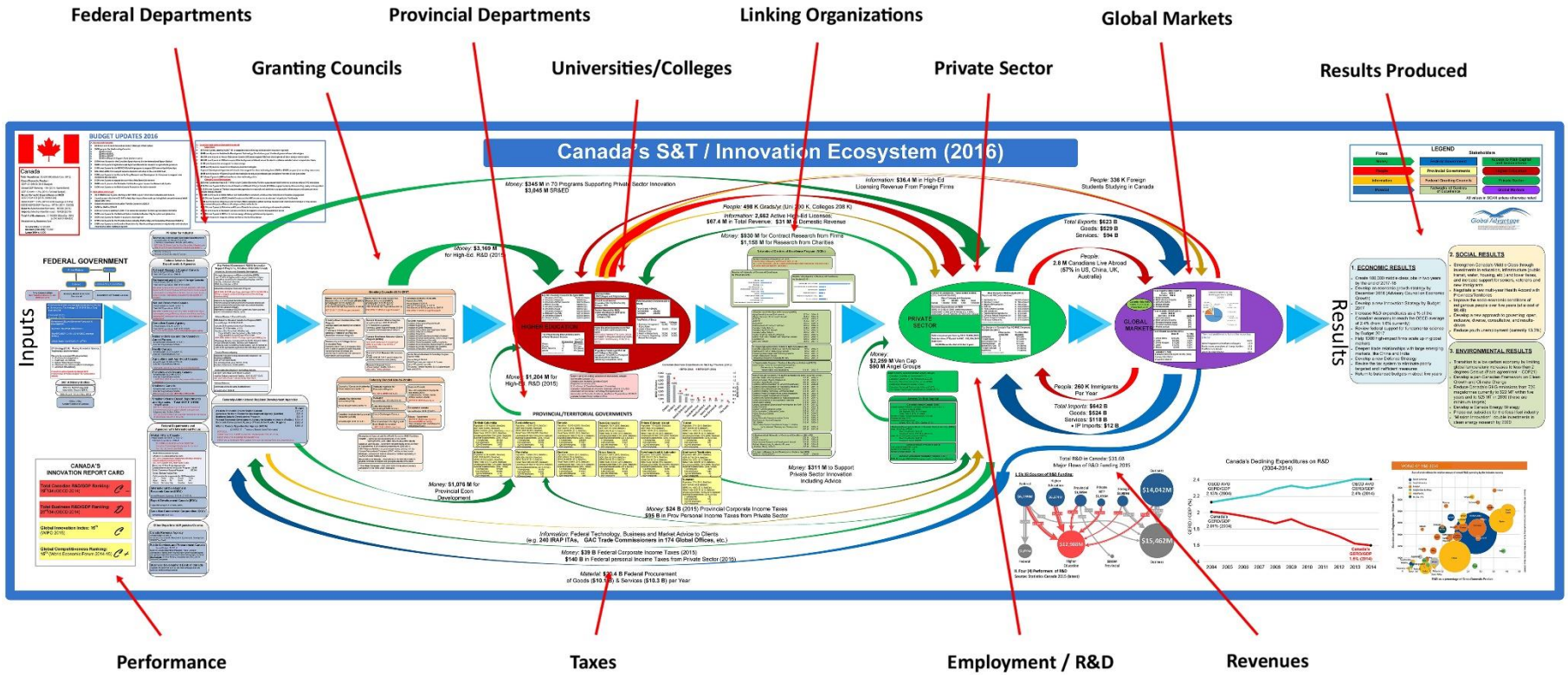
4.5 What does Canada's Innovation System Look like?

We will now turn from a general discussion of innovation, to a discussion of the key features of Canada's Innovation Ecosystem, its inadequate performance and the opportunities this presents for HSS research. Canada's Innovation Ecosystem (see Diagram 1 on page 17) consists of five major stakeholder groups and the relationships among them, as noted below.

I. The Innovation Stakeholders

Groups	Entities	Description of Function
1 + 2.Governments	1.Federal and 2.Provincial Departments, Agencies, Crown Corporations	**Governments** provide a variety of services and programs that support Higher Education and the Private Sector. These can be in the form of grants, contributions, loans, tax incentives, procurement, advisory services etc. Government is also responsible for providing the macroeconomic and regulatory environment within which innovation stakeholders operate.
3.Higher Education	Universities, Colleges Polytechnics	**The Higher Education sector** is responsible for educating talented graduates, creating new research knowledge and engaging with their communities.
4.Private Sector	Businesses, Associations, Networks	**The Private Sector** uses new knowledge for commercial purposes and benefits from talent to create value in both domestic and global markets. Businesses receive incentives and support from organizations throughout the ecosystem to increase their competitiveness and

		success. They can create well-paying jobs that help increase a country's standard of living and quality of life. The Private Sector also provides Risk capital (VenCap, Angel, etc.) to support SMEs with high growth potential.
5.Global Markets	Domestic and International Markets, Bodies, Agreements and Competitors	**Global markets** represent the domestic and global customers for innovative goods and services, as well as international organizations, bodies, and agreements that set the rules and standards for trade. Finally, global markets influence innovation through the presence of competitors, who also receive incentives and support from their own governments to expand into new markets.


Federal Departments
Provincial Departments
Linking Organizations
Global Markets
Granting Councils
Universities/Colleges
Private Sector
Results Produced
Canada's S&T / Innovation Ecosystem (2016)
Inputs
Results
Performance
Taxes
Employment / R&D
Revenues

II. The Flows between Stakeholders in the Ecosystem Map

The relationships among each of these five major innovation stakeholder groups are illustrated by the flows of 4 key things:

1. **People** (ex. highly qualified personnel, researchers, etc.)
2. **Money** (ex. grants, contributions, research expenditures, tax expenditures, risk capital, revenues from sales, etc.)
3. **Information** (ex. patents, licences, research results, market research, advice, etc.)
4. **Physical Material** (ex. machinery, equipment, resources, etc.)

The volume and quality of these four (4) flows among the stakeholder groups, impacts the overall performance of the innovation ecosystem. An examination of the adequacy of these flows is the key in identifying the strengths and weaknesses of any national ecosystem.

III. The Input-Output Structure of the Ecosystem Map

The Canada S&T/Innovation Ecosystem Map is intended to be read in a particular order, from left to right. For example, from A to E below:

A. **Governments** create the overall environment within which each group operates, and provide leadership in identifying the spending, tax support, and regulatory rules that underpin both the Higher Education and the Private Sector in the performance of the entire ecosystem;

B. **The Higher Education Sector** conducts over 40% of all Canadian research (basic and applied) which has the possibility of being commercialized, while also training highly qualified personnel (HQP) that are needed by companies (and other public institutions);

C. **The Private Sector** employs HQP to commercialize research and its own innovative ideas, operate the business, and enter new markets (domestically and internationally);

D. **Global Markets** represent both the customers and competition for innovative products and services created by Canada's Private Sector; and

E. **Results** are produced in the Innovation Ecosystem when Canadian firms sell their innovative products and services to customers in the domestic and global marketplace. As these products and services are purchased and used, they generate economic, social and environmental results.

The use of public money to develop a particular device or technology should be assessed against the economic, social or environmental results to be achieved, and that have been established by governments on behalf of their citizens. **Note that the identification and establishment of these results falls primarily within the purview of the HSS disciplines, and not the natural science disciplines.**

4.6 Commentary on the major link between HSS disciplines and the Innovation Ecosystem:

An Innovation Ecosystem is a complex social system of service relationships among individuals, networks and institutions in the Public, Private, Academic and Civic sectors. While each participant seeks to meet their individual objectives, they share an element of a common objective to improve the performance of the Innovation Ecosystem as a whole. The roles of innovation stakeholders are significantly interdependent, and therefore each needs to be generally aware of the behaviour of other stakeholders in order to successfully carry out their roles in contributing to the broader Ecosystem. They should also be sensitive to the fact that the Canadian Innovation Ecosystem is competing against the Ecosystems of other countries to attract global Talent, Knowledge, Technology, Money and Resources.

As a result, one of the key challenges for HSS research is – how do you redesign and improve the performance a social system (such as Canada's Innovation Ecosystem) while it is "live" and operating in a competitive environment?

4.7 Why is Canada's Innovation ecosystem performing poorly?

There are hundreds of papers and reports on the lacklustre performance of Canada's Innovation Ecosystem with even more recommendations on how to improve its results. The consultant has added his own views on these challenges as noted in Annex E.

The core concept underlying a majority of expert views is that "productivity" or the management of how organizations combine People and Capital in new ways (the primary component of multi-factor productivity) to produce new value for customers, is central to improved innovation performance.

Note that the core innovation challenge is "management", an HSS discipline, in order to improve innovation performance.

In short, HSS disciplines are central to deepening our understanding of human needs across languages and cultures, market segments, generations, and income and wealth differences etc., as well as an

understanding of how to mobilize and manage People and Capital resources in new ways to produce goods and services to satisfy those human needs.

5. Humanities and Social Sciences Research in Canada

This section of the Report will briefly examine the key features of the landscape of HSS research in Canada today including the volume, scope, and funding of HSS research, and the number of HSS research personnel and where they are employed.

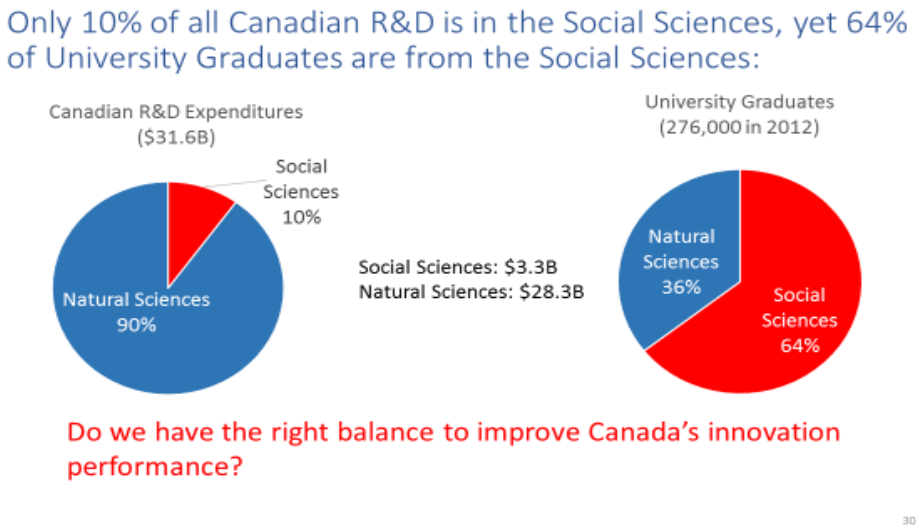
5.1 The Volume of HSS Research

According to the latest Stats Can data, only 10% of all Canadian R&D is in the HSS disciplines, amounting to $3,322M in 2015:

Science Type	2014 ($M)	2015 ($M)
Natural sciences and engineering, social sciences and humanities	31,825	31,604
Natural sciences and engineering	28,516	28,282
Social sciences and humanities	3,309	3,322

CANSIM Table 358-0001 Stats Can

Why is this? Are there more students studying Natural Sciences than Social Sciences? From the Stats Can data displayed below – this is not the case. In fact the reverse is true – there are more students graduating in HSS disciplines (64% of university graduates) than in Natural Science disciplines (36% of university graduates). Why then this apparent imbalance in funding research? Is it the case that HSS disciplines not do much research? Do they not do research as intensively as Natural Science disciplines? Is HSS research underfunded relative to Natural Science research? Is Natural Science research more costly than HSS research? What are the competing cost structures between Natural Science research and Social Science research (for example, one could imagine that Natural Science research may be more capital intensive than HSS research, conversely HSS research may have higher operating costs because of the need to do research in specific locations and geographies as opposed to a laboratory). All of these issues need to be investigated further.



To further explore this imbalance in funding between the natural sciences and engineering (90% of the funding) and the social sciences and humanities (10% of the funding), please see the "Parable of the Hockey Teams" at Annex B.

5.2 Federal Funding of HSS Research

How much support does the federal government provide for HSS research relative to Natural Science research? The following data is taken from the latest Stats Canada report.

- The federal government will fund $6,764 M in R&D in 2016-17 both inside and outside government. Of this amount $5,807 M or 86% is for natural science R&D, and $957 M, or 14% is for HSS R&D. Does this allocation make sense in relation to the federal government's priority on social inclusion?
    - Regarding federal support for R&D in the Higher Education Sector, this will total $2,915 M in 2016/17 allocated as follows: $2,318 M or 80% for the natural sciences, and $557 M for HSS or 20%.
    - Further, when one examines federal intramural funding for R&D, the apparent imbalance is even more striking. Of total federal intramural R&D of $2,582 M, almost 91% or $2,337 M is conducted in the natural science disciplines, and only $224 M or 9% is in the HSS disciplines.

Given the nature and magnitude of the social challenges facing Canadian society, particularly those identified for priority consideration by the new Federal Government (see section 3 regarding the

elderly, immigrants, aboriginals, children, students and veterans), the rationale underlying these investment differences and their impact should be examined and justified. In the consultant's own view – these allocations must be rebalanced to provide much more support for HSS research in government and academia.

5.3 The Scope and Quality of HSS Research

Regarding the scope and quality of Canadian HSS research, the CCA Report on "The State of Science and Technology in Canada 2012" noted that Canadian research activity was sound. In fact, with less than 0.5% of the world's population, Canada produces 4.1% of all scientific papers and nearly 5% of the most frequently cited papers. The Report concluded that Canada excelled in six research fields, three of which were in HSS disciplines. The six fields of strength were:

1 Clinical medicine
2 Historical studies (HSS discipline)
3 Information and Communication Technologies (ICT)
4 Physics and astronomy
5 Psychology and cognitive sciences (HSS discipline)
6 Visual and Performing Arts (HSS discipline)

These rankings and the key criteria to produce them are shown in the graphic below. The horizontal axis shows Canada's rank by Average Relative Citations. The vertical axis shows Canada's rank from a survey of top-cited international researchers. The size of the bubble is proportional to the number of papers produced in 2005 – 10. It would appear that HSS researchers perform well.

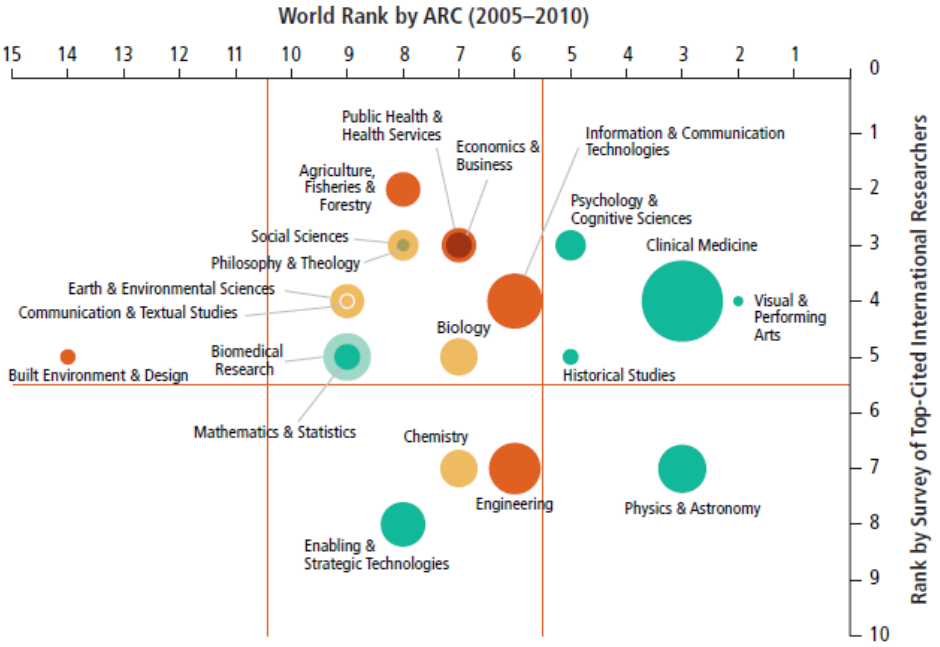


Figure 2. Survey Rank versus ARC Rank of 20 Fields

This figure shows Canada's rank in each field by Average Relative Citations (ARC) in the period 2005-2010 on the x-axis, and ranking in terms of the reputation of Canadian research in the survey of top-cited international researchers on the y-axis. The size of the bubble is proportional to the number of papers produced in 2005-2010. Bubbles are coloured according to whether Canada's share of world papers in that field increased (green), decreased (red), or remained approximately the same (yellow – defined as an increase or decrease of less than 0.2 per cent) compared with 1999-2004. ARC rank is out of the top 19 countries by total number of papers produced in that field of research.

As a result, a key question for further examination would be - **How could the knowledge that Canada has gained from these well-performing HSS disciplines, be used to strengthen Canada's innovation performance?** Note in this regard that the Council of Canadian Academies (CCA) is conducting a new Report on the State of Science and Technology in Canada – **should that Report include a specific examination of the links between S&T research in all disciplines and Canada's innovation performance?**

5.4 The Number and Employment of HSS research graduates

Stats Can data identify 226,620 personnel engaged in R&D throughout Canada in 2013. Of this amount, they identify 191,420 research personnel or 84% in the natural sciences sector, and 35,200 research personnel or 16% in the HSS sector. The further allocation of these research personnel is displayed below:

Table 358-0159 [1]
Personnel engaged in research and development, by performing sector, occupational category and type of science annual (number)

The data below is a part of CANSIM table 358-0159.

Selected items
Geography = Canada
Occupational category = Total personnel

Performing sector	Type of science	2012	2013
footnotes			
Total performing sector	**Total sciences**	231,230	226,620
	Natural sciences and engineering	197,100	191,420
	Social sciences and humanities	34,130	35,200
Federal government	**Total sciences**	16,290	15,480
	Natural sciences and engineering	14,910	14,060
	Social sciences and humanities	1,380	1,420
Provincial government [3]	**Total sciences**	2,780	2,630
	Natural sciences and engineering	2,250	2,080
	Social sciences and humanities	530	550
Business enterprise	**Total sciences**	139,460	132,330

Performing sector	Type of science	2012	2013
	Natural sciences and engineering	139,460	132,330
Higher education	**Total sciences**	71,320	74,730
	Natural sciences and engineering	39,100	41,500
	Social sciences and humanities	32,210	33,230
Private non-profit [4]	**Total sciences**	1,390	1,450
	Natural sciences and engineering	1,390	1,450
	Social sciences and humanities	0	0

Source: Statistics Canada. *Table 358-0159 - Personnel engaged in research and development, by performing sector, occupational category and type of science, annual (number),* CANSIM Date modified: 2016-01-12

The Stats Can data reveal some remarkable insights that should require further examination. Of the total HSS research personnel identified – **some 35,200 or 94% are working in the Higher Education sector, but only 4% in the federal government, only 1.6% in provincial governments and 0% are shown as working in either the non-profit sector or in the private sector**.

Clearly these results do not make sense for these latter two sectors. The Federation or SSHRC may wish to pursue an understanding of these data results, which may reflect a fundamental methodological challenge.

In addition, the results for the research personnel operating in the federal government appears to be puzzling. **Of the 15,480 research personnel in the Federal Government, 14,060 or 91% are shown to have disciplines in the natural sciences area and only 1,420 or 9% are shown to have disciplines in the HSS areas**. Again this allocation of research personnel between the two disciplines appears odd and is

worth a deeper examination, particularly given the government's focus on developing a more inclusive society that provides stronger support for vulnerable Canadians.

6. Innovation in the Service Economy

6.1 The service sector now accounts for the majority of the Canadian economy.

Canada's economy – like other industrialized economies – has been undergoing a gradual, long-term structural shift away from the agriculture and manufacturing sectors and towards services. In 1911, about 1/3rd of working Canadians were employed in services. However, today, the service industries account for more than 70% of Canada's GDP (**Figure 4**) and 3 out of every 4 jobs. Services also account for an increasingly large share of Canada's exports (~15%). Economists predict the service sector will continue to grow in importance and size relative to manufacturing in the coming decades. But despite this growth in service industries, most policy support for innovation in OECD countries remains more targeted towards technological and product-based innovation in the manufacturing sector than the service sector.

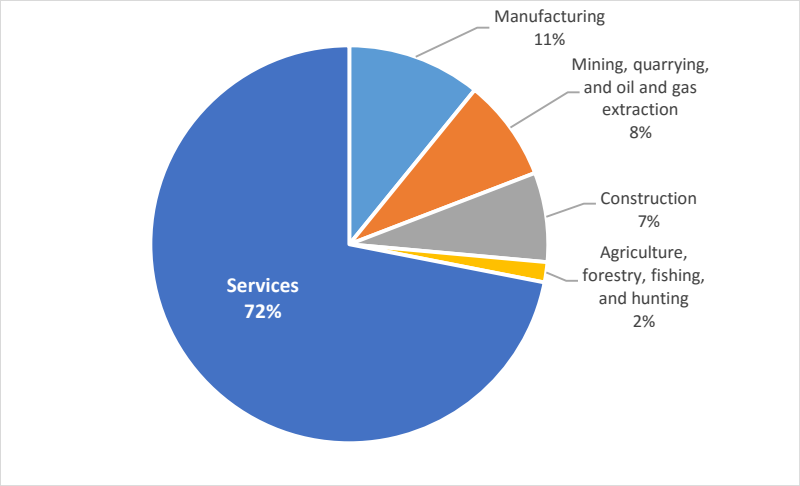


Figure 4 Canadian GDP by Sector, 2014 (Source: Statistics Canada)

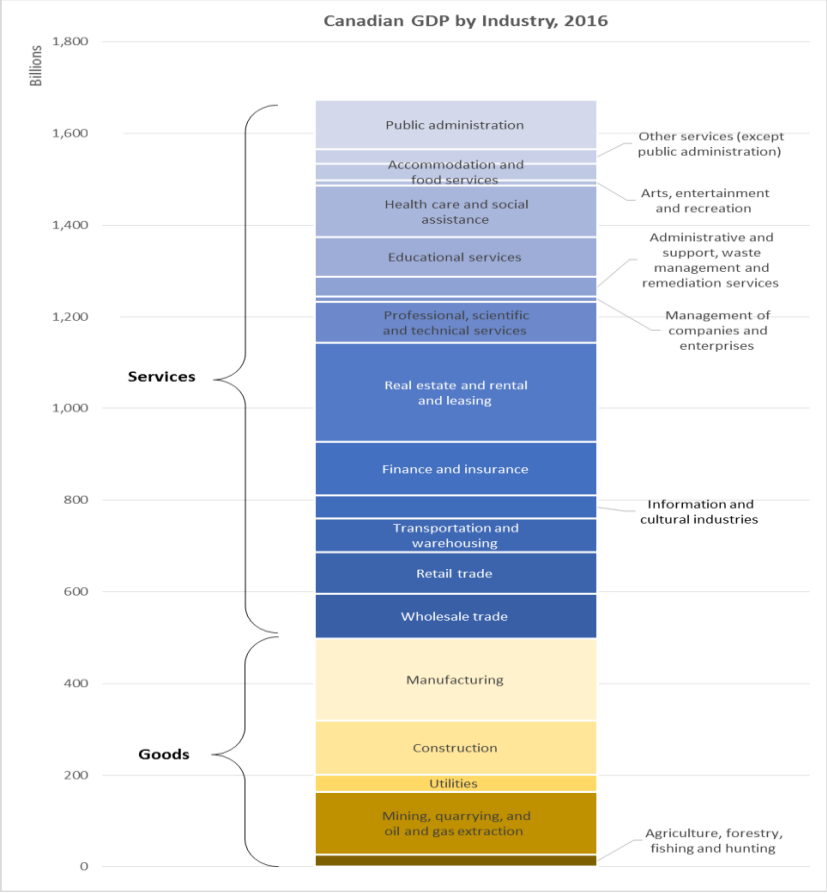
6.2. Innovation in the service sector requires 'soft' analytical, business, and communication skills

Effective innovation activity goes well beyond *technological* innovation. For example, innovation activity is an important means to increase efficiency and productivity in the service sector as well as in the manufacturing sector. As noted earlier, according to the OECD, innovation activity is broad-based and includes product innovation, process innovation, marketing innovation, and organizational innovation. In this regard, OECD research has found that innovation in the service sector tends to be non-technical and results from small incremental changes in processes and procedures not requiring much formal R&D

(OECD, 2005 Promoting Innovation in Servies). Canadian innovation surveys have also found that service sector firms are often as innovative as their counterparts in the manufacturing sector (SIBS 2009 & 2012).

Canadian service industries involve a diverse range of jobs, business skills and abilities, including both high-tech and knowledge-intensive jobs, as well as low-skill, labour-intensive jobs (see Figure 2 below that identifies 16 categories of service industries and employment - ranging from finance and insurance, through health care and education, to accommodation and food services). As a result, the skills-profiles for service workers are diverse. All four (4) types of innovation (as noted above per the OECD definition) require multiple and complementary skill sets. For example, the OECD has noted that many skills are implicated in the capacity for innovation, **including "basic skills such as reading and writing, academic skills, technical skills, generic skills such as problem solving and 'soft' skills such as multicultural openness and leadership" (OECD, 2011 Skills for Innovation and Research).** Again, most of these skills can derive from training in the HSS disciplines. The next section will explore this idea further.

Figure 4. Canadian GDP by Industry, 2016. (Source: Statistics Canada - CANSIM Table 3279-0031)



6.3 Training in the social sciences and the humanities can develop the core cognitive, business, and communication skills needed to support innovation in the economy

Fundamental cognitive skills are versatile and increasingly viewed by economists as critical to meeting most labour-market needs in the 21st century. Such skills are not tied to mastering a specific domain of knowledge, but are developed through practice and training in disciplines requiring critical thinking, analytical discipline, creativity and originality, and skill in communication. In this regard, education in the social sciences and humanities has the capacity to develop these skills through both foundational and discipline-specific educational programming. Foundational skills such as literacy and critical thinking are cultivated through training in the social sciences and humanities. Education in the social sciences and humanities also contributes to the development of **collaborative skills** when team work and cooperative learning are a priority in a collaborative and inter-dependent economy. Education in the social sciences and humanities also develops skills and knowledge that are widely applicable and conducive to supporting innovation – **such as business and financial skills, and knowledge and understanding of economics, government and regulation, and law.** Education in the social sciences and humanities therefore complements education in the natural sciences and engineering by providing alternative means to develop core cognitive competencies, and by providing training in disciplines and fields that directly support innovation.

Note that science and technology skills are only a prerequisite for some types of innovation – namely technological innovation. However cognitive, analytical, and communication skills developed through training in the social sciences and humanities (as in the natural sciences and engineering) are necessary to support all types of innovation – both that occurring in the service sector as well as that occurring in high-tech goods producing industries.

7. The Need for Interdisciplinary Research to Address Complex Social Problems (including both HSS and Natural Sciences Research)

7.1 The Federal Policy Agenda

Governments today are faced with a broad range of complex public policy challenges. For example, as noted earlier, Canada's Federal Government has undertaken to simultaneously:

- Develop a new Innovation Agenda
- Review support for Fundamental Science

- Transition to a low carbon economy and manage climate change
- Strengthen and grow Canada's middle class
- Negotiate a new Health Accord
- Increase support for aboriginal communities
- Develop a new trade and export strategy
- Strengthen Canada's Immigration system

Any one of these public policy challenges will involve hundreds of stakeholders from all parts of society, including different levels of government (federal, provincial/territorial, municipal), different industry and business sectors, different higher education institutions and interests (universities, polytechnics, colleges), different civic and social organizations, and different segments of an interested public. To find effective new solutions across such a wide diversity of stakeholder groups requires combining knowledge and evidence from diverse disciplines in both the HSS and natural science disciplines, in order to be effective. It also involves a deep understanding of how to engage all parts of society in a collective decision-making process in order to ensure widespread acceptance of the decisions ultimately taken. **The knowledge to permit these collaborative processes to be effective falls within the domain of the HSS disciplines. How could the HSS community engage its disciplines to improve these policy consultation processes to permit better decisions for the benefit of all Canadians?**

7.2 Better decision-making in public policy

In summary, to make better decisions in these complex public policy issues a broad array of knowledge needs to be understood, structured and organized for decision-makers. That broad societal context is generally the purview of the HSS disciplines. **While it includes an understanding of the natural world and how to develop a particular device or technology, it goes well beyond developing a technology, to designing and building the conditions for a society to accept, adopt and use that technology.**

To illustrate this system complexity, let's consider one example. Thomas Edison is renowned for his discovery of a thing - the electric light bulb. But this bulb was the last component of an entirely new electric lighting industry he designed.

> "Thomas Edison grasped the systemic nature of technological transformation a century ago when he introduced the electric light bulb. He realized that the technology he envisioned—no matter how innovative—couldn't by itself sweep aside the kerosene-based lighting industry. **Instead of asking how he could solve the technical problem of inventing a light bulb, Edison asked how he could get consumers to switch from kerosene to electricity.** He understood that despite the many advantages of electric light, it would replace kerosene only if it had its own, economically competitive network.
>
> So, while scores of people worldwide worked on inventing a light bulb, **Edison conceived a fully operational system. His technical platform included generators, meters, transmission lines, and substations, and he mapped out both how they would interact technically and how they would combine in a profitable business.**
>
> But an innovative business model wasn't enough to bring this revolutionary technological system to market. Edison also needed to test it out in a friendly foothold market, and he needed a leg up from favorable government policy. Accordingly, for his first small-scale trial, he chose close-packed Lower Manhattan, which was filled with Wall Street firms eager to be on the technological cutting edge, whose employees worked long into the night.
>
> It was not coincidental that these were the very people who could fund its expansion. And he used his public standing to acquire regulatory support—for example, to get the needed permits despite opposition from the lamplighters' union."

In summary, Edison needed a broad array of societal knowledge (and not just a knowledge of high resistant filaments for his light bulb) in order to dismantle the kerosene-based lighting industry and replace it with the electric lighting industry.

In a similar fashion, and selecting just one real example from the Government priorities as noted above - the transition from oil to a low carbon economy – this challenge will clearly require the development and adoption of a complete range of new cleaner and more efficient technologies (including for example, electric cars or self-driving vehicles, or drone delivered mail). But, of course, any technology must be accepted or used within a society in order for its benefits to be produced. **Therefore "social licence" must be obtained before an innovation can become effective** (think here of the concerns raised in some countries to the sale of genetically modified foods).

In short, it is an integrated system of both technical and social knowledge that needs to be understood and applied in order to solve these complex public policy challenges.

7.3 The function of research

Given that the function of research is "to increase the stock of knowledge" then a key question for public policy is…**what new research-based knowledge do Canadians need in order to manage current or emerging problems facing groups within our society?**

Note that such a research investigation begins with the human or societal result in mind. The reasoning process is then as follows:

1. What do Canadians need?
2. What kinds of new knowledge are required in order to develop the goods and services that can satisfy that need?
3. How can that new knowledge be best acquired (e.g. buy it, license it, conduct R&D in Canada, etc.)?
4. How will the areas of new research-based knowledge be integrated with existing knowledge in order to produce the new goods and services that Canadians need?

In this regard, note again that the HSS disciplines are central to developing a deeper understanding of the scope and depth of "human needs", which then motivate the research process to discover the new knowledge to help satisfy those needs.

7.4 Industry 4.0 and the future nature of work

Klaus Schwab, the founder and Executive Chairman of the World Economic Forum, wrote a commentary about the future nature of work. (*The Fourth Industrial Revolution: what it means, how to respond*) as background to stimulate discussion among world leaders at Davos. It has significant implications for the role of HSS research.

Schwab noted that "The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres."

In describing this integration of these different spheres of technology – the physical, digital and biological - he concluded that, "We stand on the brink of a technological revolution that will fundamentally alter the way we live, work, and relate to one another. In its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before. We do not yet know just how it will unfold, but one thing is clear: the response to it must be integrated and comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society."

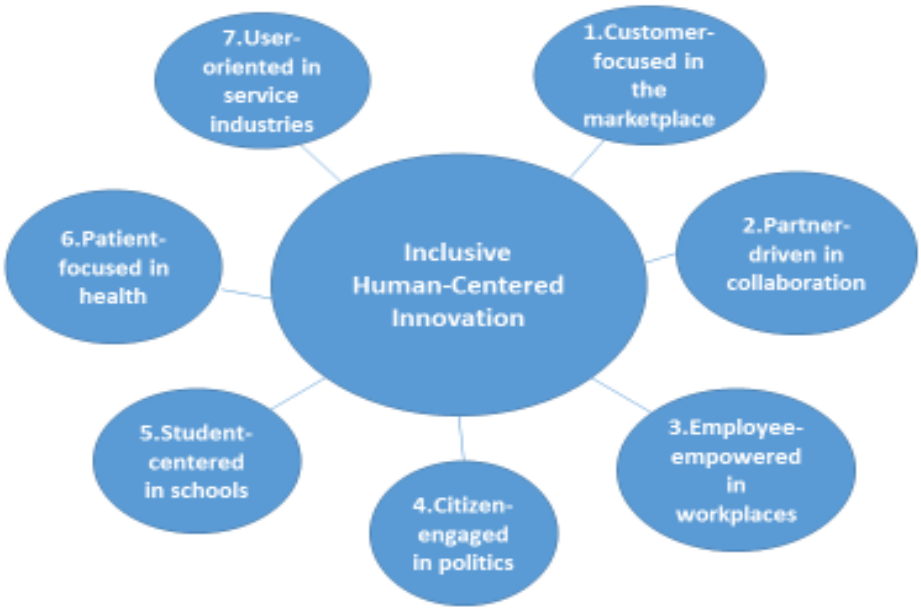
What role will the HSS disciplines play in helping nations navigate the risks and opportunities that will emerge from the application of these rapidly emerging technologies? Is there a program of HSS research that Canada should fund in order to prepare for the implications of the dissemination of these technologies?

Schwab noted that the revolution could see the displacement of workers by machines so that as talent more than capital becomes the critical factor of production – that labour mobility may be increasingly segmented into low skill/low pay and high skill/high pay segments, which could lead to an increase in social tensions. In conclusion, he noted:

> **"In the end, it all comes down to people and values. We need to shape a future that works for all of us by putting people first and empowering them.** In its most pessimistic, dehumanized form, the Fourth Industrial Revolution may indeed have the potential to "robotize" humanity and thus to deprive us of our heart and soul. But as a complement to the best parts of human nature—creativity, empathy, stewardship—it can also lift humanity into a new collective and moral consciousness based on a shared sense of destiny. It is incumbent on us all to make sure the latter prevails."

To me, Schwab makes a sound argument for reminding ourselves that **technology is a tool intended to serve humanity**. This is also the same argument for considering a different emphasis on public support for innovation activity – one that places priority on what I would call **"inclusive human-centred innovation"**. The basic applications of this concept are outlined below.

Inclusive Human-Centered Innovation: Identifying and Meeting People's Needs



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Inclusive human-centered innovation would reverse the polarity of innovation flow, from placing a priority on the "supply" of innovation, to a renewed emphasis on the "demand" for innovation. It would restructure the programs for innovation support and investment around this change in flow. It would change the emphasis **from technology solutions to human-centered solutions**. For example:

1. Innovation goals would be established in reference to meeting human needs (not by innovation inputs such as R&D rankings or the size of Venture Capital pools, etc.)
2. Innovation activity would be supported with public funding only if it reflects Canadian values, such as inclusiveness of outcomes,
3. Innovation results would be measured by the extent to which the innovations satisfy a specific Canadian "need" (for better health, safety, transportation, education, employment, aboriginal housing, cleaner technologies, etc.)

By recognizing that technology is not an end in itself, but rather only a means to assist in satisfying human needs, we can begin to rebalance Canada's innovation ecosystem from a dominant focus on producing individual things to a focus on innovating entire social ecosystems such as in health, clean energy, inclusive innovation, trade, and economic growth.

8. Innovation in the Public Sector

The primary focus of innovation discussions has centered on business innovation. This is because it is the business sector that produces goods and services for sale in both domestic and global markets, thereby generating the revenue to pay for good middle class jobs, and to support further risky investments in research and other innovation activities. Further, the corporate and personal taxes from these activities form the key revenue base to support the public services that Canadians enjoy, including publicly funded research in universities and colleges.

But the practice of innovation can be applied in other work environments, including Governments, Higher Education, and Civil Society. Each of these three sectors also provide goods and services to other consumers – although not primarily with the objective of producing a profit.

However, as noted in the following two paragraphs from the OECD Oslo Manual (page 16) much less is known about innovation activity in the non-market-oriented economy.

Scope of the OECD, Oslo Manual – Sector Coverage

> "27. Innovation can occur in any sector of the economy, including government services such as health or education. The Manual's guidelines, however, are essentially designed to deal with innovations in the business enterprise sector alone. This includes manufacturing, primary industries and the services sector.
>
> 28. Innovation is also important for the public sector. However, less is known about innovation processes in non-market-oriented sectors. Much work remains to be done to study innovation and develop a framework for the collection of innovation data in the public sector. Such work could form the basis for a separate manual."

Because of its causal link to improving national productivity, and generating the revenue to support a full range of government services including social programs, most governments have focused attention on understanding innovation in the business sector. As a result, much more research is needed to

understand how to innovate in both government institutions and in civic or social institution, including social innovation itself. Clearly there is a central role for HSS disciplines in accelerating this deeper understanding. **Could the HSS community or SSHRC consider developing and seeking funding from the federal government for a program of research to explore these social applications?**

8.1 How could one innovate in the Public Sector?

In principle, innovation in the Public Sector should not be much different from innovation in the Private Sector. Why is this?

The main reason is that the ingredients for innovation are the same in the two cases. Each institution involves managers working with labour and capital resources to provide goods and services to customers (citizens). The innovation challenge is broadly similar - how to experiment and combine people and capital in different ways to generate more value for the customers they serve. However, there are of course contextual differences between the two sectors – for example, in the incentive and organizational structures, cultures, degree of openness to competitive pressures and access to funding sources. (As one example of this difference - in the case of the Private Sector, the customers pay directly for the good and services they receive, but in the case of the Public Sector, payments are normally made indirectly by Citizens through their taxes).

8.2 Public Sector Innovation in Practice

Most governments try to improve the services they deliver to their citizens. In this regard, the new federal government is no exception and intends to improve the services it delivers in several key areas, including as already noted in Section 2.1, its support for innovation, fundamental science, trade and economic growth, to cite just a few examples. To achieve these objectives it is being innovative in its approach. For example, it is adopting a new approach to accountability by issuing public mandate letters for each Minister. Further it has established a separate Cabinet Committee (on “Results”) reporting to the Prime Minister and a corresponding deliverology and results unit in the Privy Council Office to monitor and report on federal investments, targets, metrics and results delivered. Further, results units have also been established in many federal departments and agencies to assist in this government-wide innovation. This focus on measuring and reporting on public policy “results” has been developed in other jurisdictions, particularly under the Blair Government in the UK, as well as in the Ontario Government. The design and implementation of a new “deliverology” system is a good example of an “adopted” innovation that is then integrated into the federal context of this

Government, and the specific values it has identified as priorities and it promotes. The consultant believes these human values of inclusiveness, diversity, tolerance, and equity will be reflected in the "results" expected from the Government's emerging policy agenda, including a new Innovation Agenda. **But how will these values, such as inclusiveness, be measured? Should Canada's HSS community develop a research program to address this need?**

Another public sector innovation will be the creation of a Chief Science Officer in the federal government and a corresponding departmental structure to support a higher value being placed on scientific knowledge and evidence-based decision-making. Within this context, the inclusion of HSS knowledge and disciplines will be a key component in achieving better public decisions from better evidence. **The HSS community should develop a strategy to communicate how it can contribute to improving the HSS evidence that will be needed to support federal public policy decisions.**

Finally, as a third example of public sector innovation, the Government is reinforcing its support for "innovation hubs" and the application of behavioural economics in departments and agencies to encourage a culture of experimentation in service delivery (e.g. developing small experiments to improve service delivery by incorporating feedback from service recipients, adjusting services accordingly, and then scaling up the service delivery). It is too soon to judge the effectiveness of these innovative initiatives – but their support is commendable in broadening the scope for innovation in the public sector. And again, HSS disciplines, is this case for example, the application of "behavioural economics", will be central to learning how to design and build better public services.

9. Recommendations to Enhance Support for HSS Research

The following five sets of recommendations are suggested for consideration – as ways to enhance support for HSS research.

1. Core Concept. Develop a campaign to communicate the importance of "human-centered innovation", as a way to improve the declining performance of Canada's innovation ecosystem.
2. Innovation Policy. Consider developing a long-term program of HSS research to:
    - Explore the underlying core issues raised by Minister Bains 12 innovation questions
    - Develop the economic, social and environmental "results" that should be expected from an effective innovation ecosystem

- Deepen our understanding of human needs across cultures and languages, market segments, generations, ethnic groups, political systems, and income and wealth differences, in order to better shape innovation programming
- Assess global best practices in how a society accepts and responds to the adoption and diffusion of new technologies and effectively manages their risks and opportunities

3. Current Innovation Practices. Work with Government Departments to:
    - Understand why Stats Canada data identifies no social scientists as working in the Private Sector and Non-Profit sectors, and the implications of this practice
    - Understand why social science research is specifically excluded from SR&ED eligibility, and the impact this has on innovation performance
    - Understand why inside the federal government, only 9% of all research personnel are identified as having disciplines in the HSS area (91% are identified as having natural science disciplines) particularly in relation to the overwhelming array of social challenges the Government is examining (e.g. new social programs for the elderly, veterans, aboriginal communities, climate change adaptation, students, unemployed, etc.)
4. Broader Public Policy. Consider developing a long-term program of HSS research to explore:
    - The idea of "preventative" HSS research to anticipate emerging societal problems at an earlier stage, before they reach an acute stage requiring massive government investment
    - The appropriate role that HSS research – and the evidence it produces – could play in contributing to all public policy, in the context of the federal government's renewed emphasis on evidence-based decision-making and the creation of a Chief Science Officer function
    - How to innovate in government, academia and civic (not-for-profit) institutions
5. Programming and Management.
    - Increase overall federal funding for HSS research (both intramural and extramural) to approach a balance with natural science research
    - Increase the number of Networks of Centres of Excellence centred specifically on HSS disciplines
    - Establish new Research Chairs in Sales, Marketing, Business Models, and Global Trade

- Change federal procurement to provide more support for HSS proposals
- Develop better knowledge mobilization and management processes for HSS research in order to communicate the results more effectively to key audiences
- Develop and fund a new SSHRC program targeting the link between emerging disruptive technologies and the future nature of work, and the likely impact on Canadian society

Annex A: Definitions

1. **The Humanities and Social Sciences**
   Although definitions can vary across scholarly institutions and groups, generally the humanities are those disciplines that investigate the human condition, using primarily analytical, critical, or speculative methods. The humanities include (but are not limited to) ancient and modern languages, literature, history, philosophy, religion, and visual and performing arts, such as music and theatre.
   Closely related to the humanities, the social sciences are fields of study that may involve more empirical methods to consider society and human behaviour including (but not limited to) anthropology, archaeology, criminology, economics, education, linguistics, political science, and international relations, sociology, geography, law and psychology. *(www.ideas.ca/about/cfhss/)*
2. **Natural Sciences**
   The sciences collectively that are involved in the study of the physical world and its phenomena, including biology, physics, chemistry, and geology, but excluding social sciences, abstract or theoretical sciences, such as mathematics, and applied sciences. *(Collins English Dictionary)*
3. **Research and Development**
   Research and development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications. *(OECD "Oslo" Manual)*
4. **Innovation**
   - An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.
   - The minimum requirement for an innovation is that the product, process, marketing method or organizational method must be new (or significantly improved) to the firm. *(OECD "Oslo" Manual)*
5. **Innovation Ecosystem**
   An Innovation Ecosystem is the network of all stakeholder organizations in both the public and private sectors whose activities and interactions:
   3. Create and disseminate new knowledge/technology, and
   4. Support how businesses incorporate that knowledge/technology into both existing and new products for sale in domestic and global markets.
6. **The Service Economy**
   An economy based on providing services rather than manufacturing or producing goods. *(Cambridge Business English Dictionary)*
7. **Research Impact**
   Research impact refers to the influence scholarly and creative enquiry has upon wider society, intended as well as unintended, immediate as well as protracted. It includes the influence such research has upon future researchers within the discipline as well as in other disciplines and on public policy, quality of life, social cohesion, business innovation, the environment, artistic and

creative practices, commercial and economic activity, administrative and institutional development, and political and cultural understanding. *(The Impacts of Humanities and Social Science Research - Working paper, Oct 2014 – Federation for HSS)*

8. **Workplace Integrated Learning**

   The term "work-integrated learning" broadly refers to educational programs that incorporate a workplace-based component but are also connected to classroom learning or an individual's program of study. Although the term "work-integrated learning" is not used universally across all types of post-secondary level programs that include a work-based or practice-based component, the term has been adopted by universities around the globe to identify programs that add a practical employment-based learning component to school-based learning. *(Higher Education Strategy Associates Intelligence Brief 5, Work Integrated Learning and Career-Ready Students: Examining the Evidence, Kramer + Usher, Nov 2011)*

Annex B: The Twelve Questions for the Innovation Agenda

1. What does it take for Canada to be known globally as the best country in attracting and developing diverse, high-end talent?
2. How do we work together to better equip our young people with the right skill sets for the economy of the future?
3. How can colleges play a larger role in the innovation ecosystem?
4. As innovation is about people and businesses, how can we increase the demand for science, technology, engineering and math graduates?
5. What is the right model for made-in-Canada innovation clusters led by businesses?
6. What are the barriers to greater participation by Canadian companies in North American and global supply chains?
7. How can Canada better support the scale-up of innovative companies into the next generation of billion-dollar global players?
8. Are there market-based approaches to encourage wider adoption of clean technologies by the private sector?
9. What's the future of digital infrastructure? Do we need to transition Canada there faster? Who are the partners?
10. What are innovative ways to develop stronger digital skills among Canadians?
11. How can regulations be designed and used to drive innovation across key sectors?
12. What new approaches could be explored to improve government services to businesses? Who are the partners?

Annex C: Methodology

The approach that was taken to examine the link between HSS research and innovation was as follows:

1. A literature review was undertaken of all the latest publications about Canadian research, innovation and commercialization performance, including:
    - ISED – STIC Report
    - OECD – the latest Reports on Innovation and Knowledge Transfer
    - Universities Canada and U-15 Reports and Submissions
    - NSERC Reports and Strategy documents
    - SSHRC Reports and Strategy documents
    - IRPP Report – Canada's Innovation Conundrum
    - The Canada US Business Council Report on Canadian Innovation
2. The consultation documents released by Minister Bains, Duncan, Chaggers and Joly on the Innovation Agenda and the Review of Fundamental Science.
3. An examination and analysis of all Stats Canada data on:
    - Higher Education Research
    - Research Personnel
    - Private Sector Research
    - Federal and Provincial support for Higher Education Research
4. An examination of all recent Council of Canadian Academies Reports on:
    - S&T (2012)
    - Industrial R&D (2013)
    - Culture + Innovation (2014)
    - STEM Skills and Canada's Economic Productivity (2015)
    - Paradox Lost (2013)
5. An assessment of Budget 2016 commitments and all Mandate letters
6. A review of recent articles and publications on Canada's Research and Innovation performance
7. A review of feedback on the Report Outline by designated "readers"
8. A review of feedback on the first Draft of the Report by designated "readers"

Annex D: The Parable of Two Hockey Teams

Imagine two Canadian hockey coaches who have each been given $100 M dollars and asked to build the world's best hockey team.

The first coach (of the Better "Things" Team) divides his money into two piles: a 90% pile ($90M) and a 10% pile ($10M).

- He then spends this $90M pile on researching and improving new hockey things such as better skate blades, better composite hockey sticks, better shoulder pads, more durable plastic mouth guards, better cushioned helmets, etc.
- But he only spends 10% on researching and improving the performance of his players.

The second coach (of the Better "People" Team) also divides his money into two piles: a 90% ($90M) pile and a 10% ($10M) pile. But the coach then takes a different approach.

- He then spends the $90 M pile on researching and improving the performance of his people and how they interact as a team – he gets the best assistant coaches, he gets and trains the best players – improving their individual strength, coordination and speed. He leases the best practice facilities to train his team. He organizes competitions with the best global teams. He videotapes his team's games and conducts team meetings to provide feedback on individual and team performance. He uses sports psychologists and physiotherapists to work with his players, etc.
- He spends his 10% pile ($10M) on researching and buying the best available equipment for his players.

Which of the two teams will likely perform better?

Does the answer relate to how the coaches have allocated their investments between improving "things" as opposed to improving "people"?

If so, then why does Canada spend 90% of its research funding of $31.6 B per year on researching how to understand and improve "things" (the natural sciences) as opposed to only 10% on how to understand and improve "people" (the social sciences)? This raises two strategic questions for further consideration:

1. In order to become one of the best teams in the world at innovation, "a global centre of innovation", have we got the right balance between conducting research to better understand "things" versus conducting research to better understand "people"?
2. Is the current 90-10 split between investments in natural sciences research vs social science research, the best allocation in order to meet the needs of Canadians? What is the evidence?

Annex E: Views of Consultant on Challenges to Canada's Innovation Ecosystem performance

1. Continuing decline in Innovation/R&D funding ("A decade of darkness").
2. No national innovation objectives ("What are we building?")
3. No industry "sectoral" strategies - (Cleantech, ICT, Life Sciences, etc.)
4. Inadequate understanding of structure of the Private Sector (75% of firms have only 4 employees, Services Sector 70% of the economy and increasing, etc.)
5. Too narrow a focus on R&D, including SR&ED – "Innovation Activity" is 4 to 6 times broader than just improving products, and includes improving business processes, structures and access to markets.
6. University Commercialization – a red herring (focus on producing outstanding graduates and researchers)
7. Inadequate understanding that innovation activity and innovation ecosystems need to be managed, therefore need innovation targets, metrics, feedback and adjustments.
8. Little effective Federal coordination …or Federal-Provincial coordination
9. Inadequate data on innovation performance
    - Stats Can (termination of key data sets)
    - SIBS Survey (excludes 87% of businesses)
    - CCA – did not survey the Private Sector
10. Little support for SMEs to access global markets – a "Sustainable" Innovation Strategy must be an Export Strategy!