The Economic Role and Influence of the Social Sciences and Humanities: A Conjecture

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Preface

This report was commissioned by the Corporate Performance, Evaluation and Audit Division of Social Sciences and Humanities Research Council of Canada (SSHRC). SSHRC is the federal agency that promotes and supports university-based research and training in the humanities and social sciences.

The purpose of the report is to stimulate further discussion and research on the economic importance of the social sciences and humanities. The opinions expressed herein are those of the author.

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SUMMARY

This essay explores the role and influence of the social sciences and humanities (SSH) on one aspect of society - the economy. The project has several objectives: develop a framework within which the economic role and influence of the SSH can be examined; stimulate a broader discussion of the economic role and influence of the SSH within the community of SSH scholars and researchers; to motivate additional academic research; and, contribute to increased awareness of the role that the SSH - and SSHRC - play in society at large and particularly in its economic life. Key findings are:

- The economy is the sum of the economic pursuits of individuals and groups operating in a particular social and cultural context. As such, SSH inputs and methods are extremely relevant.

- There is broad consensus that science and technology writ large are important to economic growth but little understanding of specific of the role of SSH.

- This study is about economic role and influence, not econometric "impact".

- Calls are growing to measure the return from government investment in research of all types. The SSH have inherent value to society and should not be primarily judged according to their economic impact. That said, it is important to understand their economic impact.

- The UK has recently abandoned its effort to develop a universal algorithm to calculate the economic impact of research, indicating the task is difficult.

- SSH research falls into 29 major disciplinary categories. At least 9 of these have strong links to the economy (Communications and Media Studies, Demography, Economics, Education, Geography, Industrial Relations, Management, Business and Administrative Studies, Urban and Regional Studies, and Law.

- An additional 11 disciplines have moderate links to the economy. A further 9 disciplines have indirect links.

- Of 46 possible areas of application of SSH research, 26 areas have direct relevance to the economy (e.g. Biotechnology, Management) and 30 have indirect relevance (e.g. Children and Youth, Global/Climate Change).

- Service industries now account for 69% of Canada's economic output, whereas good-producing industries account for 31%. Service industries rely primarily on SSH for their knowledge inputs while goods-producing industries primarily rely on STEM (science, technology, engineering, medicine). Both groups of industries draw on knowledge from the other sources.

- SSH-based industries account for about 76% of total employment, whereas STEM industries account for about 24%.

- Two-thirds of industries appear to rely primarily on SSH inputs vs. one-third on STEM inputs.

- There are many examples of high-profile companies (and government departments) that make heavy use of SSH inputs to their work or whose business is to produce SSH outputs: Thomson Corporation, Torstar Corporation, Cossette Communication Group, Cirque du Soleil, Canadian Western Bank, Manulife Financial Corporation, Stratford Festival, Industry Canada.

- Knowledge is the new "currency" of economic growth. Knowledge can arise either from SSH or from STEM. Research to date has focussed almost exclusively on knowledge from STEM.

- A number of inherently SSH-type processes (e.g. business strategies, management practices, intellectual property protection, organizational changes, improved communications) are essential if firms are to successfully apply knowledge.

- Knowledge can be codified, embodied or tacit. End-user organizations make us of all three types.

- Scientific research influences the economy by: generating concepts and ideas, training people, providing analytical tools, developing technology, or generating specific data and information. SSH and STEM research are equally capable of generating influence.

- Industries that rely primarily on SSH inputs account for $696.7 billion of annual GDP output. Industries that rely primarily on STEM inputs account for $431.4 billion of GDP.

- Notionally, among 18 industries: SSH knowledge has a high influence on 7 industry groupings, a moderate influence on 4 industries and a low influence on 7. The results for STEM are similar.

- By attributing a level of influence for SSH and STEM to each industry, we have inferred that SSH influences $389 billion of economic activity, close to the $400 billion influenced by STEM.

- There are substantial opportunities for additional research to understand in detail the economic role and influence of the social sciences and humanities.

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1.0 INTRODUCTION

> "*We live in complex and challenging times. Today's most pressing issues, whether economic, political, technological, or social, have crucial human dimensions that must be well understood if we are to respond effectively. The social sciences and humanities provide research-based knowledge about people - what motivates them, how they live and how they interact. It illuminates our understanding of the world we live in and our place in it. At SSHRC, we are committed to building and demonstrating the value of research in the social sciences and humanities as a contribution to Canada's continued prosperity, competitiveness and quality of life*."
>
> SSHRC president Dr. Chad Gaffield

This essay explores the role and influence of the social sciences and humanities (SSH) on one aspect of society - the economy. The project has several objectives. The first is to develop a framework within which the economic role and influence of the SSH can be examined, understood ... and even debated. A second objective is to stimulate a broader discussion of the economic role and influence of the SSH within the community of SSH scholars and researchers - and possibly further afield[1] - and to motivate additional academic research on the topic. And finally, the project is intended to contribute to increased awareness of the role that the SSH - and SSHRC - play in society at large and particularly in its economic life.

The policy environment for university research funding is changing. Calls are growing for all federal research funders to demonstrate their contributions, whether in terms of "impact", "value added" or "value for money". The government is asking all its funding agencies to report on how they are making a difference for the society and economy. Funding agencies need to tell their story.

Do the social sciences and humanities - and by extension research in SSH - influence the economy, and if so, what role do they play? Is it possible to quantify the influence? To answer these questions we need to give thought to the nature of the economy, the nature of the SSH, and the mechanisms through which they act on the economy. We also need to consider the particular role of academic SSH teaching and research.

[1] For example, within federal and provincial statistical agencies.

In his online posting (above), Dr. Gaffield points out that all areas of endeavour - *whether economic, political, technological, or social* - are human undertakings. As such they have individual, social (group, organizational) and cultural[2] dimensions. An economy is the sum (or result) of the economic pursuits of individuals and groups of individuals (companies, governments, etc.) that take place in a particular social and cultural context. In this regard, economic activity can be viewed as a specialized form of socio-cultural activity. Thus, it can be seen through macro- (economy-wide) and micro- (firm-level) economic lenses.

1.1 Innovation Paradigms and the Role of SSH

It is widely accepted that scientific research and development have economic consequences. As *Mobilizing Science and Technology to Canada's Advantage*, the government's 2006 science and technology (S&T) strategy, says:

> *Science and technology - and the innovations that it creates - is especially important for Canada at this point of our history. That's because we need to do more to increase our productivity ... Canada is not as productive as our most important trading partner and the world's benchmark economy, the United States, and the productivity gap is widening ... Scientific and technological innovations enable modern economies to improve their competitiveness and productivity, giving us the means to achieve an even higher standard of living and better quality of life.*

In the traditional linear model of innovation[3], scientists develop new understandings about the natural world and engineers translate scientific insights into new or improved technologies (e.g. biotechnology), products (e.g. drugs) or services (e.g. genetic testing). Manufacturing, marketing, distributing or providing goods and services that arise from research in the natural sciences, engineering or medicine/life sciences is the raîson d'ètre of many individual companies (e.g. Research in Motion, Apotex, Telus) and industries (e.g. information and communication technology, pharmaceuticals, telecommunication services). The current economic development paradigm, widely adopted by federal and provincial governments, attempts to enhance scientific research and leverage it into economic advantage for individuals, companies, industries ... and even nations.

So far, so good. Regardless of the preferred innovation model, there is broad consensus that science and technology underpin innovation and competitiveness. But what kinds of "science and technology"? Do public sector strategies include the social sciences and humanities, and if so how? Put otherwise, does the linear model of innovation (or other models) acknowledge the role and influence of the SSH? Is SSH activity even relevant to discussions about economic

[2]They take place within a particular system of meanings, norms and values.

[3]We do not ascribe to the linear model, preferring instead to see innovation as a more complicated process of interacting factors interacting in "innovation systems".

concerns such as productivity, competitiveness? How can the influence of SSH be conceptualized and measured?

Surprisingly, we are in virgin territory here. There is little in the published literature about the economic role and influence of the SSH. At best, there are legions of studies about the economic impact of the Arts in a particular community[4], but virtually nothing on the economic impact of the SSH more broadly. This is in contrast to a long tradition of research on the economic influence of research in the natural sciences, engineering and life sciences.

Perhaps the SSH are so ubiquitous that - like the air around us - we seldom stop to think about their importance. Perhaps the role and function of the SSH are not well enough understood and such thinking is premature.

1.2 Economic Influence versus Economic Impact

Readers will note that we have purposely avoided the phrase "economic impact" (of the SSH). For the present, are concerning ourselves with the notion of "economic role and influence". Economic impact studies are econometric (quantitative) exercises that typically utilize input-output models of the economy to ascribe a quantified result to an investment or expenditure. Economic outputs are usually framed in terms of the marginal impact of an expenditure on the GDP output of the economy[5]. Impacts are normally ascribed to one of three categories: direct impacts, indirect impacts or induced impacts.

We do not feel that the state of the art is sufficiently advanced to engage in analyses of the economic impacts of the SSH at this time. For the present, we prefer to think in terms of role and influence. In time, we hope that other investigators will take up the challenge and attempt to develop more formal metrics for SSH investment, which could include economic impacts.

1.3 Measuring Research Returns

Calls are growing to measure the returns from public investment in research. In the UK, for example, there has been considerable discussion about measuring the economic impact of S&T. In 2006 the Department of Trade and Industry invited Mr Peter Warry, the Chair of the Particle Physics and Astronomy Research Council, to establish a group of experts drawn from academia, business, and the Research Councils to advise him on how the UK Research Councils could deliver - and demonstrate they are delivering - a major increase in the economic impact of their investments. The resulting "Warry Report" covered the activities of all 8 UK Research

[4]See, for example: Alberta Foundation for the Arts. The Economic Impact of the Arts in Alberta. Measuring the Value of the Arts. August 2005.

[5]i.e. "One dollar of expenditure on X yields an *n* dollar increase in GDP."

Councils[6]. In the context of improving the impact of knowledge transfer from funded research, the report touched on the economic potential of the social sciences and humanities. In reference to the Arts and Humanities Research Council, it said[7]:

> *For example AHRC research is of value to the creative industries, which now represent 8% of GDP and are growing at twice the rate of the economy as a whole ... In certain areas of the economy, especially the creative industries and financial services, innovation is increasingly driven by the interaction between technology and people. This can be seen in a range of businesses from broadcasting to computer games. This country's rich historical, literary, artistic and musical traditions (that) contribute to our competitive strengths in ways that may not have been fully recognised.*[8]

In the two years following the Warry Report the UK Research Councils attempted to develop a universal algorithm: *"... a formula to calculate the economic impact of the research projects that they fund"*. But as of the winter of 2008, the UK Research Councils *"have abandoned plans to develop a formula to calculate the economic impact of the research projects that they fund"*[9]. The councils effectively admitted defeat in the effort to develop a universal algorithm that would capture economic impacts: "*We want to get to the stage where we can say that with an investment of x we get a return of y,*" he said. But last week he[10] told Times Higher Education that there were so many variables that the councils had "given up" trying to find a formula. "*At this stage, the research councils don't believe that a quantitative assessment is possible,*" he said. "*Although we have been able to quantify economic impacts from a range of case studies, we don't believe we successfully generated a methodology to scale up to cover the entirety of our funding. We hoped to able to but in the end we weren't.*"

Thus, the UK Research Councils have been unable to develop a robust framework for measuring the economic impacts of scientific research - whether in the SSH or STEM. The linkages are too indirect and there are too many confounding variables.

Going as far as it did to acknowledge the economic influence of the SSH, the Warry Report did not focus special attention on them, and to this day this is no body of work on the economic role

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[6]These are the UK counterparts to CIHR, NSERC and SSHRC.

[7]Taken together, AHRC and its counterpart, ESRC (Economic and Social Research Council), would constitute SSHRC.

[8]Increasing the economic impact of Research Councils. Advice to the Director General of Science and Innovation, DTI from the Research Council Economic Impact Group. 14th July 2006. (http://www.grad.ac.uk/downloads/documents/Reports/National%20policy%20section/Warry%20report.pdf)

[9]Times Higher Education Supplement, 6 March 2008.

[10]Philip Esler, who is RCUK's "knowledge transfer champion" and chief executive of the Arts and Humanities Research Council.

of SSH. It could be axiomatic that one reason there is no such body of research is that the topic has not been of interest to the community of SSH scholars - the very community that would normally undertake this kind of study. One purpose of this essay is to stimulate such interest and research.

1.4 Inherent Worth of SSH

At their best the SSH embody the highest achievements of humanity - its literature, art, laws, languages, history, social customs ... indeed its very identity. SSH researchers preserve and interpret human culture. Especially in an academic setting, they institutionalize humankind's capacity for social and cultural self-awareness and self-criticism. Not only that, they give us the tools[11] and concepts[12] to reflect on and interpret the past and present of our society and culture, and provide a window on its future. They stand between social awareness and "social amnesia" - the loss of historical and cultural perspective. Regardless of whether or not they have economic impacts, the social sciences and humanities, and scholarly research in these disciplines, have inherent value for society and are worthy of public support.

There will be some in the SSH community who feel that discussions of the economic role of the SSH somehow undermine the integrity and independence of the disciplines, and especially their essential critical function which, they would argue, is their very raîson d'ètre[13]. We respectfully disagree. We reject the argument that by engaging in research and discussion of their economic role and influence that the SSH community somehow loses its effectiveness in its social criticism role. We believe that SSH scholars can both be critics of the status quo and participants in it (as indeed most are).

Yet, while we firmly believe that most social science and humanities disciplines are directly or indirectly important to the economy, we do not agree that economic influence should be used as the sole - or even the most important - measure of their worth. The social sciences and humanities have merit in and of themselves and their ultimate worth must not be judged in economic terms alone. This said, it is equally important to understand what their economic role and influence is.

[11] For example, survey research is an important tool for business and government.

[12] Arguably, concepts that began as academic formulations - for example, "socialism" and "supply-side economics" have done much to change the fortunes of nations.

[13] That is, to act as independent critics of society and culture in all its manifestations.

2.0 SOCIAL SCIENCES AND HUMANITIES AND THE ECONOMY

In this chapter we will discuss the social sciences and humanities in terms of how their fields of study (disciplines) and their areas of application are relevant to the economy.

2.1 Economic Linkages of the SSH

SSHRC classifies the "universe" of social sciences and humanities into 29 major disciplinary categories - or fields of research - and numerous sub-categories. On the surface, it is not hard to discern that many of the main disciplines can have economic consequences (Table 1).

In our estimation, at least 8 SSH disciplines have clear and obvious ("Strong") links to the economy. For example, among the social science disciplines, studies in Management, Business and Administrative Studies are directly focussed on the economic activities of business enterprises[14]. Industrial Relations research similarly has a direct link to the economy in that it explores relations between employers and employees. Likewise, studies in Economics are obviously relevant to a wide range of economic affairs, from the micro- (firm-level) to the macro- (national, international) level.

Research in Demography and Geography influences economic activities as diverse as retail site location, building standards, housing investments, and private sector pension policy. Urban and Regional Studies-Environmental Studies are obviously relevant to private sector developers and urban planners

Among the Humanities disciplines, Law can claim the strongest apparent link to the economy. For example, corporate law, contracts law, product law, intellectual property

Table 1. Main SSHRC Disciplines

Social Sciences	Economy Linkage
1. Anthropology	I
2. Archaeology	I
3. Archival Science	M
4. Communications and Media Studies	S
5. Criminology	M
6. Demography	S
7. Economics	S
8. Education	S
9. Geography	S
10. Industrial Relations	S
11. Interdisciplinary Studies	M
12. Library and Information Science	M
13. Management, Business, Administrative Studies	S
14. Political Science	M
15. Psychology	M
16. Social Work	M
17. Sociology	M
18. Urban and Regional Studies, Environmental Studies	S
Humanities	
19. Classics, Classical & Dead Languages	I
20. History	I
21. Fine Arts	M
22. Folklore	I
23. Law	S
24. Linguistics	M
25. Literature, Modern Languages and	M
26. Mediaeval Studies	I
27. Philosophy	I
28. Religious Studies	I
29. Other	I
S=Strong; M= Moderate; I=Indirect;	

[14]They also relate directly to the activities of organizations in the private not-for-profit sector.

law, industrial relations law, international trade law, landlord and tenant law, and family law have daily economic consequences. One measure of relevance - total annual spending on legal services of these types - is undoubtedly in the billions of dollars[15].

Another group of 11 disciplines has (we would argue) a positive ("Moderate") but more indirect link to economic affairs. Research in Criminology can influence insurance rates or sentencing guidelines for convicted offenders. Political Science (often termed Political Economy) is concerned with the interaction of political behaviour and economic behaviour. To the degree that the performance of the economy rests on the quality of the school and university/college systems, research in Education can lead to improvements in the supply of human capital[16]. Research in Sociology and Social work can help companies to manage their human resources. Communications and Media Studies are relevant to fields as diverse as telecommunication investment strategies, broadcasting policy, copyright/digital rights, and the secondary school curriculum[17]. Fine Art - in particular design[18] - makes an important contribution in such diverse business sectors as Advertising and Cultural Industries and Manufacturing: for example, the fast-growing video game industry fuses software development with visual arts and design. In the world of manufacturing, product design is integral to successful new product development. Research in Psychology - for example human factors research - applies to fields as diverse as aerospace, transportation, and nuclear power plant operations. Research in fields such as Library and Information Science and Archival Science can yield benefits for web searching, data mining, and firm-level knowledge transfer/knowledge management systems.

Then, there is a group of 9 disciplines where links to the economy may be "Indirect", or at first glance, downright obscure. Among the social sciences, for instance, Anthropology and Archaeology initially appear to be disconnected from the economy. But even these seemingly arcane disciplines can have direct economic linkages. For one thing, anthropology and archaeology lie at the heart of many museum collections and exhibits; and, museums are a large business in Canada, annually attracting millions of domestic and foreign visitors[19]. Anthropology

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[15]Total spending on Legal, accounting, tax preparation and bookkeeping services combined was $13.1 billion in 2006.

[16]For example, Canada has a long-standing "deficit" in experienced business managers. Management, Business and Administrative Studies are social science disciplines.

[17]c.f. Media Studies

[18]For example; industrial design, fashion design, architectural design, web design.

[19]According to the Department of Canadian Heritage, across the country there are approximately 2,500 heritage institutions including museums, historic sites, archives, exhibition centres, planetariums, observatories, aquariums, zoos, botanical gardens, arboretums and conservatories. Among them they employ 25,500 paid staff. Six percent have annual budgets in excess of $1 million, 32% have budgets between $100,000 and $1 million and approximately 62 percent have annual operating budgets of less than $100,000. On average, 40 percent of their revenue is earned from a variety of sources including admissions, sales, and memberships. Source: Towards a New Museum Policy. Discussion Guide. Ottawa. 2005.

and Archaeology can also come into play in land development; for example, when development is proposed for heritage sites or traditional native lands.

Similarly, many humanities disciplines seem at first glance to be only loosely connected to the economy. But on close examination, a number of these can also have important economic impacts. History and Folklore often form the seed of business ventures in: the $2.5 billion radio and television industry, $2.7 billion motion picture and sound industry, $2.9 billion advertising industry, or $9.4 billion publishing industry. Likewise for the Classics, Classical and Dead Languages, Mediaeval Studies, and Religious Studies. Another humanities discipline, Linguistics, underpins Canada's large translation industry, as well as the rapidly growing machine translation industry. Even philosophy can have substantial economic impacts, as for example, when applied to the growing fields of corporate governance or healthcare bioethics.

This is all to say that far from being disconnected from the everyday economy, experience suggests that the social sciences and humanities form an integral part of it.

2.2 Economic Relevance of Applied SSH

The social sciences and humanities have economic relevance when they are applied in the economy and society. (What elements of SSH research and how they are applied are discussed in chapters 5 and 7). For each of the 39 SSHRC disciplines described above, there can be one or more "areas of application" for the research being conducted (Table 2). For example, research in Demography can be applied to Agriculture (e.g. employment projections for the farm labour force), Transportation (e.g. regional demand for new road construction), Science and Technology (e.g. changing supply of HQP), or immigration policy (immigration quotas). Alternately, research in Management, Business and Administrative Studies can be applied to fields as diverse as Financial and Monetary Systems, and Law and Justice.

SSHRC asks its community to indicate 46 possible areas of application for their research, ranging from Agriculture to Youth (Table 2). In our estimation, at least half of these - specifically 26 application areas - are directly related to the economy. For example, research in the social sciences and humanities can have a direct impact on the economy when it is applied to activity in Agriculture, Biotechnology, Communication, Economic, regional and industrial development, Employment and labour, Energy and natural resources, Environment and sustainability, Financial and monetary systems, Fisheries, Forestry and Sylviculture, Globalization, Housing, Immigration or Information Technologies.

Table 2. Economic Relevance of the SSHRC Areas of Application			
Area of Application	**Relevance**		**Relevance**
Agriculture	D	Children and youth	I
Arts and culture	D	Children	I
Biotechnology	D	Education	I
Communication	D	Elderly	I
Economic, regional and industrial development	D	Ethics	I
Economic and Regional Development	D	Family	I
Employment and labour	D	Gender Issues	I
Energy and natural resources	D	Global/Climate Change	I
Environment and Sustainability	D	Health	I
Financial and Monetary Systems	D	Indigenous peoples	I
Fisheries	D	Literacy	I
Forestry, Sylviculture	D	Mental Health	I
Globalization	D	Multiculturalism and ethnic studies	I
Housing	D	Politics and government	I
Immigration	D	Post-Secondary Education, Research	I
Information Technologies	D	Poverty	I
Innovation, Industrial and Technological Development	D	Social development and welfare	I
International relations, development, trade	D	Violence	I
Law and justice	D	Women	I
Leisure, recreation and tourism	D	Youth	I
Management	D		
Northern development	D		
Population studies	D		
Productivity	D		
Science and technology	D		
Transportation	D		
D = Directly Relevant; I = Indirectly Relevant			

In many other application areas, for instance, Children, Education, Elderly, Family, Gender Issues, Global/Climate Change, Health, or Indigenous peoples, SSH research can have indirect economic consequences. For example, research on early childhood can lead to improvements in educational performance and decreased social spending, for example, on health problems, delinquency or criminal activity. The preceding table gives one perspective on the relevance of each of the SSHRC areas of application to the economy.

3.0 THE ECONOMY - AN SSH PERSPECTIVE

The following section discusses the structure and output of the Canadian economy from the perspective of the social sciences and humanities. It considers major industry groupings as "receptors" for SSH knowledge. It also examines parts of the economy that are "traded" and those that are not.

3.1 Structure of the Economy

Canada's economy produced goods and services valued at nearly $1.2 trillion in 2006 (Table 3). Industries that produced goods were responsible for $375.5 billion of output (31.4% of the total) while industries that produced services accounted for $818.9 billion of output (68.6% of the total).

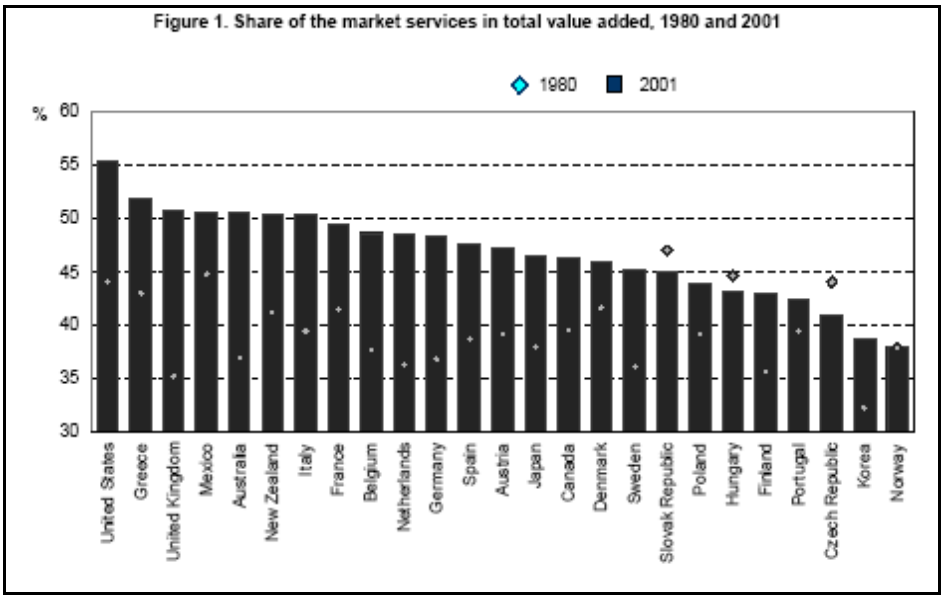
Based on the GDP output figures, it is evident that the modern economy is primarily service-based. It is dominated by industries that produce intangible services rather than tangible goods. For example, with output of $230.4 billion, one service sector on its own - the "FIRE" sector (Finance, insurance, real estate, etc.) - generates more output than the entire Manufacturing sector ($186.6 billion). High as the Canadian service sector contribution appears to be, in fact Canada is a relative laggard when compared with other OECD economies.

Table 3. GDP Output of the Canadian Economy, 2006 ($ million)

	$ million	%
All industries	**1,193,905**	**100.0%**
Business sector industries	**1,005,146**	**84.2%**
Business sector, goods	373,048	31.2%
Business sector, services	632,638	53.0%
Non-business sector industries	**188,687**	**15.8%**
Non-business sector, goods	2,437	0.2%
Non-business sector, services	186,248	15.6%
Total Industries	**1,194,351**	**100.0%**
Goods-producing industries	375,489	31.5%
Service-producing industries	818,862	68.6%
Specific Industries	**1,194,782**	**100.0%**
Goods		
Agriculture, forestry, fishing and hunting	27,847	2.3%
Mining and oil and gas extraction	57,174	4.8%
Utilities	30,128	2.5%
Construction	74,087	6.2%
Manufacturing	186,631	15.6%
Services		
Wholesale trade	68,383	5.7%

	$ million	%
Retail trade	69,015	5.8%
Transportation and warehousing	55,501	4.6%
Information and cultural industries	43,147	3.6%
Finance, insurance, real estate, rental, leasing, management of companies/enterprises	230,362	19.3%
Professional, scientific and technical services	55,377	4.6%
Administrative and support, waste management and remediation services	30,524	2.6%
Educational services	56,221	4.7%
Health care and social assistance	74,780	6.3%
Arts, entertainment and recreation	11,410	1.0%
Accommodation and food services	27,365	2.3%
Public administration	66,758	5.6%
Other services (except public administration)	30,072	2.5%

As indicated in the chart below, due to our relatively high level of commodity production our level of service production is comparatively low in relation to other advanced economies.



Source: OECD. Directorate for Science, Technology and Industry Committee for Scientific and Technological Policy. Working Party on Innovation and Technology Policy. Promoting Innovation in Services. Paris. 14 October 2005.

3.2 Knowledge and Training Inputs

One way of comparing companies and industries is to examine where their "knowledge inputs" come from. Many companies and industries create products, technology or processes based on knowledge acquired from science, technology, engineering or medicine (STEM). We will label these companies or industries as "STEM companies" and "STEM industries", in that their core knowledge input comes from these disciplines. For example, a company such as Nortel Networks is a STEM company, in that its products are rooted in such fields as physics, electrical/electronic engineering, optics, and so on. Likewise, the industry in which Nortel is located - Electronic product manufacturing - is a "STEM industry", consisting largely of STEM companies.

On the other hand, many companies and industries produce services that are based on knowledge gained from SSH - the social science and humanities. We can label these companies and industries as "SSH companies" and "SSH industries" (Table 4). For example, a company such as the Royal Bank makes extensive use of technology, but is not primarily in the business of developing and selling technology. Most of its day-to-day banking and investing business draws on such SSH fields as commerce, marketing, survey research, economics, political science[20], and so forth. Likewise for many of the other companies in the so-called FIRE (finance, insurance, real estate) sector. In these sectors technology is an "enabler", but not the commodity being bought or sold.

Of course, it is true that neither STEM nor SSH industries or companies rely exclusively on STEM or SSH knowledge inputs. The reality is that there is considerable cross-over; STEM companies require many SSH inputs (e.g. law, management, marketing, writing, etc.) and SSH companies depend heavily on technology (e.g. computers, software, Internet, etc.). However, as a generalization, it is fair to say that goods-producing companies and industries tend to rely on STEM knowledge inputs while service-producing industries tend to rely on SSH knowledge inputs.

Table 4 presents a prima facia analysis of which industry sectors are STEM-oriented and which are SSH-oriented, according to their primary knowledge inputs. On the face of it, it seems that one-third (6 of 18 industry sectors) can be characterized as STEM industries and two-thirds (12 of 18) as SSH industries.

On the surface, it is reasonable to surmise that knowledge inputs from the SSH are the dominant knowledge sources in a considerable number of industries, especially those in the service sector.

[20] e.g. For country risk assessments for export insurance.

Table 4. SSH and STEM Industry Classification		
Industry	**Primary Knowledge Inputs**	
	STEM	**SSH**
1. Agriculture, forestry, fishing and hunting	✓	
2. Mining and oil and gas extraction	✓	
3. Utilities	✓	
4. Construction	✓	
5. Manufacturing	✓	
6. Wholesale trade		✓
7. Retail trade		✓
8. Transportation and warehousing	✓	
9. Information and cultural industries		✓
10. Finance, insurance, real estate, rental, leasing, etc.		✓
11. Professional, scientific and technical services		✓
12. Administrative and support, waste management, etc.		✓
13. Educational services		✓
14. Health care and social assistance		✓
15. Arts, entertainment and recreation		✓
16. Accommodation and food services		✓
17. Other services (except public administration)		✓
18. Public administration		✓
TOTAL		
STEM = Science, Technology, Engineering Medicine; SSH = Social Sciences & Humanities		

3.3 Research and Development in Service Industries

The GDP data showing the importance of the service sector are reflected in the national industrial R&D (research and development) data as well (Table 5).

Of the 14,324 companies that performed scientific research and experimental development in 2003, almost half (48.5%) were in Service industries - a greater number than in Manufacturing (44.3%).

Table 5. Number of R&D Performers by Industry, 2003		
Industry	**# Performers**	**%**
Agriculture	456	3.2%
Mining and oil and gas extraction	106	0.7%
Utilities	69	0.5%
Construction	402	2.8%
Manufacturing	6,351	44.3%
Services	6,940	48.5%
TOTAL	**14,324**	**100.0%**
Source: Statistics Canada. Industrial Research and Development - 2006 Intentions. Cat. #88-202-XIE		

These data reinforce the point that the economy has evolved towards a service economy, and that this fact is reflected even in the world of private sector R&D.

3.4 SSH as an Input to Employment

Another means of assessing the role and influence of the SSH on the economy is to examine the structure of industrial employment, and determine what proportion of jobs in different industries require (or substantially benefit from) employees with SSH qualifications (training) (Table 6).

Table 6. Employment by industry, 2007 ('000)

	No.	%
Goods-producing sector	**3,993**	**23.7%**
Agriculture	337	2.0%
Forestry, fishing, mining, oil and gas	339	2.0%
Utilities	138	0.8%
Construction	1,134	6.7%
Manufacturing	2,045	12.1%
Services-producing sector	**12,874**	**76.3%**
Trade	2,682	15.9%
Transportation and warehousing	823	4.9%
Finance, insurance, real estate and leasing	1,060	6.3%
Professional, scientific and technical services	1,137	6.7%
Business, building and other support services	702	4.2%
Educational services	1,183	7.0%
Health care and social assistance	1,846	10.9%
Information, culture and recreation	782	4.6%
Accommodation and food services	1,069	6.3%
Other services	724	4.3%
Public administration	865	5.1%
ALL INDUSTRIES	**16,866**	**100.0%**

Source: Statistics Canada, Catalogue no. 71F0004XCB

In the goods-producing sector, which accounts for less than 24% of total employment, one could argue that SSH training is a small component of total job requirements. After all, how many jobs requiring SSH training are there in Agriculture, Forestry, Utilities, Construction, or Manufacturing? But even in these "hard" industries, many jobs demand SSH skills - ranging from human resources management, to economic and business analysis, strategic planning, and market research.

In the service-producing parts of the economy, which account for over 75% of total employment, it is clearer that many job categories are dependent on SSH skills. For instance, the FIRE (finance, insurance, real estate and leasing) sector is comprised of jobs that are fundamentally SSH in nature. Likewise much of the Business, building and other support services industry. The Educational services industry inherently relies on SSH training. Similarly, SSH skills are in high demand in the Information, culture and recreation industry. One could argue that the field of Public administration is practically dominated by jobs that require qualifications in SSH. Also, a large part of Professional, scientific and technical services (e.g. management consulting) are reliant on SSH qualifications or knowledge.

Employment figures confirm that the Canadian economy has evolved into primarily a service economy. Whereas Goods-producing industries account for 31.5% of total GDP, they make up

only 23.7% of total employment[21]. Services-producing industries account for 68.6% of GDP but for 76.3% of employment.

One useful avenue of research to get at the economic role and influence of the SSH would be to determine the SSH requirements/qualifications for each detailed employment (sub-)category within each industry.

3.5 SSH in the "Real World"

Our thesis is that the social sciences and humanities are not merely academic pursuits un-connected to the real economy. Rather, they are fields of research, training and practice that are applied in the economy every day. In the same way that many companies can be described as "STEM companies" (e.g. Nortel, RIM, Pratt & Whitney Canada, etc.) many of Canada's leading business enterprises can be thought of as "SSH companies" or organizations. These are entities that either rely largely on SSH inputs, or whose business is primarily involved in creating and selling SSH outputs. Although our examples emphasize SSH in the private sector (traded economy), the role of SSH in the non-traded economy (e.g. government) is also addressed.

The Thomson Corporation

Business
Provides integrated information solutions to business and professional customers in the fields of law, tax, accounting, financial services, scientific research and healthcare.

Annual Revenues
$7.5 billion (2007)

Typical Jobs
Accounting and Finance, Administration, Business Development, Customer Service/Support, Engineering, Facilities, Financial Market Research, General Manager, Human Resources, Legal, Marketing and Communications, Procurement and Contract Administration, Product/Technical Training, Production, Professional/Consulting Services, Publishing/Editorial, Research, Sales

Torstar Corporation

Business
A broadly based media group and a publisher of the Toronto Star. Its businesses include CityMedia Group, publishers of daily and community newspapers in Southwestern Ontario, Metroland Printing, Publishing and Distributing, publishers of community newspapers in Southern Ontario, and Harlequin Enterprises, a publisher of women's fiction.

Annual Revenues
$1.5 billion (2007)

Typical Jobs
Writer, Editor, Marketing, Advertising Sales, Publisher, Producer/director, Copy Checker, Lawyer, Accountant, Strategic Planner, Programmer/Analyst, Production Operator

[21] Obviously, average GDP output per employee is higher in goods-producing industries than in service industries. However there are exceptions: GDP output per employee in the legal profession (for example) is undoubtedly higher than in agriculture.

Consider, for example, The Thomson Corporation (soon to be Thomson-Reuters). This Canadian multinational provides value-added business information services to customers in law, accounting, financial services, scientific research and healthcare. (With the pending acquisition of Reuters it will also be providing news services.) Virtually all of its products are digital information products, with a distinct SSH flavour.

Cossette Communication Group Inc.

Business
Provides services in strategic planning, advertising, media planning and buying, direct marketing, database management and sales promotion, public relations and alliance marketing.

Annual revenues
$825 million (2007)

Typical Jobs
Strategic Planner, Senior Account Supervisor, Rédacteur de contenu Web, Retoucheur, Producer, Planner interractif, English writer, Développeur/Animateur, Director Search Marketing, Directeur en communications corporatives, Directeur adjoint à la Création, Digital Media Specialist, Chargé de projets , Billing & A/P Assistant, Account Supervisor, Account Manager, Account executive

Cirque du Soleil

Business
Cirque du Soleil is a major Quebec-based organization providing high-quality artistic entertainment. The company has almost 4,000 employees from over 40 different countries, including 1,000 artists. Through its multimedia division called Cirque du Soleil Images, Cirque creates original and innovative content for television and DVD

Annual Revenues
$600 million +

Typical Jobs
Artist, Set Designers, Costume Designer, Marketer, Talent Coordinator, Musician, Composer, Writer, Publicist

Torstar Corporation is another well-known SSH company. Torstar has extensive digital and print publishing enterprises. It owns the *Harlequin* fiction publishing brand, which reaches a worldwide audience. *Harlequin's* "core technology" is fiction! Torstar employs writers, editors, journalists, planners, business analysts and many others with SSH training.

Cossette Communications is an $825 million communication and public relations company that trades on the Toronto Stock Exchange. Among others, it employs writers, planners, web designers, producers and a host of other professionals whose training is in SSH disciplines such as literature, history, fine art, journalism, and so forth.

Headquartered in Montreal, Canadian entertainment icon Cirque du Soleil is an internationally-renowned multinational company with revenues in excess of $600 million. Cirque employs artists, designers, talent coordinators, marketers, video producers, musicians, composers, writers, and publicists. It relies heavily on employees with SSH training.

Canadian Western Bank

Business
Canadian Western Bank is a federally chartered, Schedule I bank that offers commercial and personal banking services throughout Western Canada. Personal and corporate trust services are offered through subsidiaries Canadian Western Trust and Valiant Trust Company. Personal automobile and home insurance is provided through its subsidiary, Canadian Direct Insurance.

Annual Revenues
$601.6 million

Typical Jobs
Help Desk Specialist, Business Analyst, Account Manager-Retail Banking, Client Service Officer, Senior Manager-Operations, Account Manage-Retail Banking, Junior Administrator-Stock Transfer, Administrator-Incentive Plans, Manager-Commercial Banking, Senior Manager-Credit Risk Management, AVP-Credit Risk Management, Senior Account Manager-Retail Banking, Retail Services Officer, Sales and Service Representative, Regulatory and Accounting Supervisor

Manulife Financial Corporation

Business
Manulife Financial Corporation is a financial services company. Manulife Financial offers clients a diverse range of financial protection products and wealth management services.

Annual Revenues
$35.5 billion

Typical Jobs
Associate Actuary -Valuation Projects, Wealth Management - Service Associate, AVP-Strategic Asset Allocation, Senior Analyst/Analyst - Monitoring and Risk, Communications Officer, Individual Insurance-Medical Tele-Interviewer, Director-Individual Wealth Management, Service Associate - Billing and Payments, Junior Business Analyst, Summer Diversity Program- Sales and Marketing Assistant, Economist

Canadian Western Bank and Manulife Financial Corporation are two representative companies operating in the "FIRE" sector (finance, insurance, real estate). Between them they employ thousands of people with SSH skills for such positions as actuaries, business analysts, help desk specialists, account supervisors, communications officers, economists, strategic planners, and so on.

Stratford Festival

Business
The Stratford Shakespeare Festival is a repertory theatre festival, permanently located in Stratford, Ontario, Canada. It produces the best works of theatre in the classical and contemporary repertoire, with special emphasis on the works of William Shakespeare.. The festival provides direct employment for 1,773 individuals.

Annual Revenues
$53.9 million

Typical Jobs
Audience Development Representative, Business Systems Analyst, Director, Producer, Writer, Dialogue Coach, Choreographer, Dancer, Lighting Designer, Publicist, Actor, Costume Designer.

Industry Canada

Business
The Department's mission is to foster a growing, competitive, knowledge-based Canadian economy. It works ... to improve conditions for investment, improve Canada's innovation performance, increase Canada's share of global trade and build a fair, efficient and competitive marketplace. Industry Canada has 5,522 employees.

Annual Expenditures
$1.6 billion (2005)

Typical Jobs
Economics, Special Advisor, Industry Portfolio Adviser, Special Events Coordinator, Senior Policy Adviser, Editor, Graphic Specialist, Business Development Officer, Network Coordinator

Another well-known business enterprise - The Stratford Shakespeare Festival - is a major employer in Southwest Ontario. This $50 million business provides direct employment for 1,773 individuals, and indirect employment for thousands more. Its "core technology" is the humanities, a centrepiece of which is a "dead language", mediaeval English.

Finally, we cite Industry Canada, a federal government department, as a typical example of a public sector organization whose activities are heavily rooted in the SSH[22]. With over 5,000 employees and an annual budget of around $1.6 billion the government's lead industrial development agency is the perfect example of a non-business SSH organization.

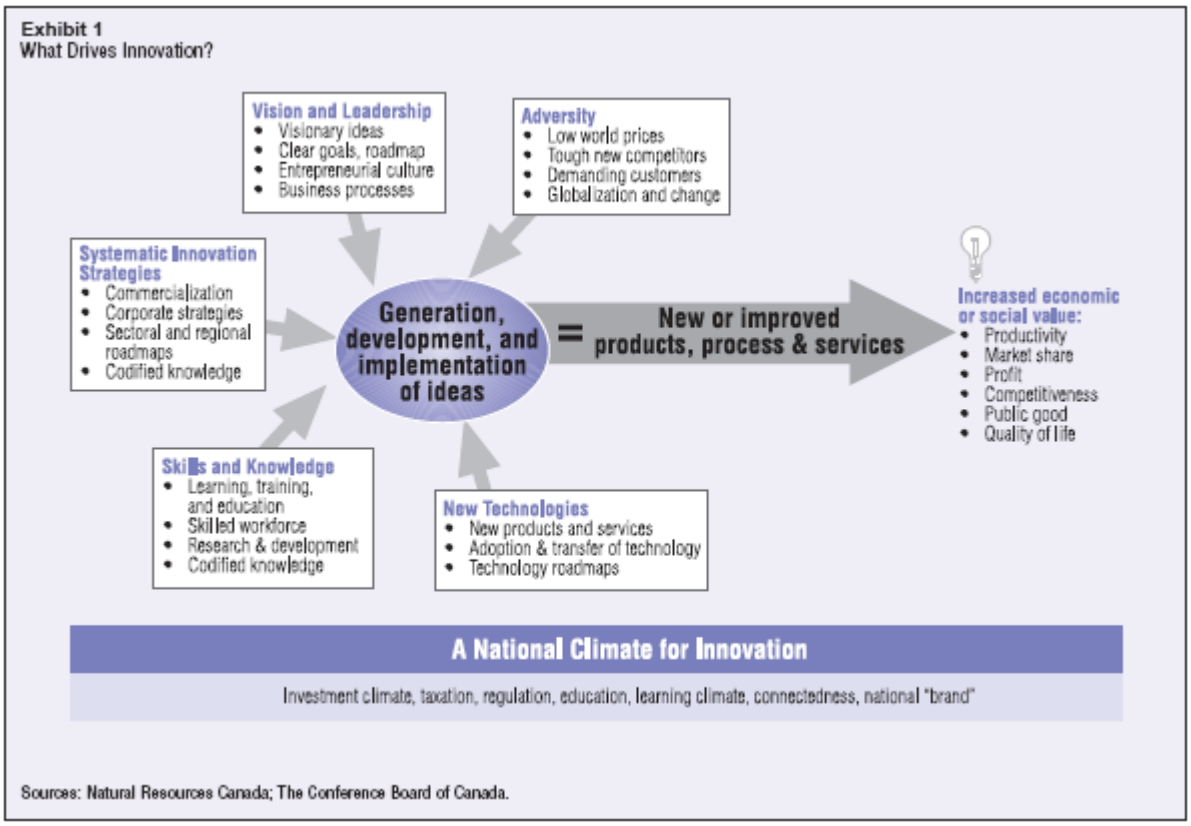
These are but a few examples of "real world" companies and organizations whose bread-and-butter is applying and adding value to knowledge and information that are largely SSH in character. Entities such as these rely on employees with training in a wide range of SSH disciplines. When we talk about the "service economy", to a large extent we are talking about firms and organizations like these that account for the bulk of employment.

[22]Our experience is that most government departments and agencies are staffed by people trained in the social sciences and humanities.

4.0 ECONOMIC INPUTS OF THE SSH

Before beginning a more focussed exploration of the economic influence of the SSH, it is worthwhile to consider how research in general contributes to economic growth, social value, consumer welfare, etc. The Conference Board of Canada defines innovation as: *"A process through which economic or social value is extracted from knowledge/through the generation, development, and implementation of ideas/to produce new or improved products, processes, and services."*[23]

According to the Conference Board's model, increased economic value is the result of new or improved products, processes and services. These in turn arise from the generation, development and implementation of ideas. (The CBOC does not distinguish between SSH or STEM ideas.) The knowledge development and application process is influenced by factors such as: Vision and Leadership, Adversity, Systematic Innovation Strategies, Skills and Knowledge and New Technology.

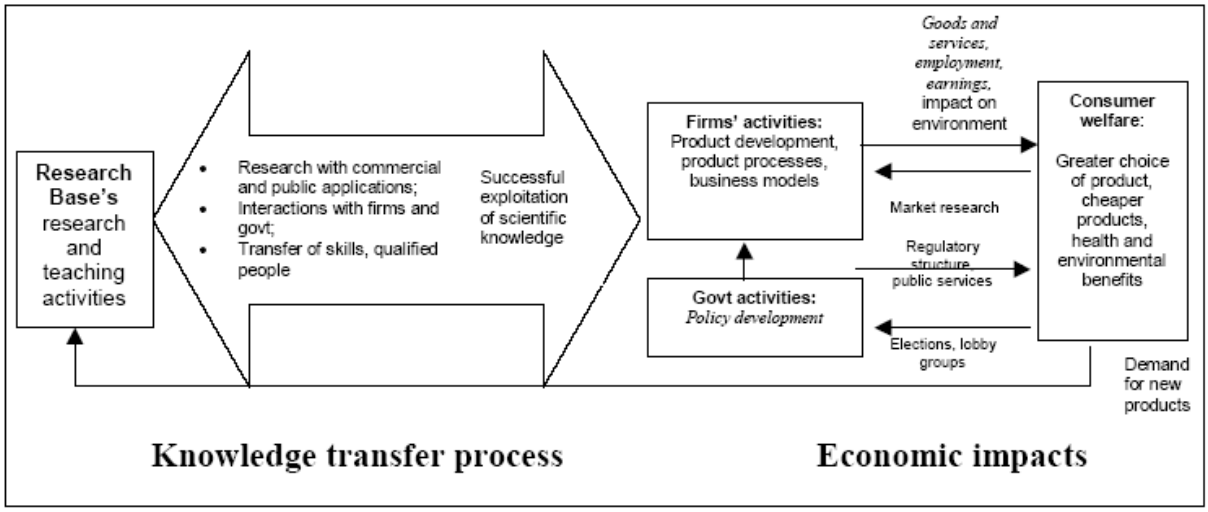


CBOC. 5th Annual Innovation Report 2003. Trading in the Global Ideas Market.

[23]Conference Board of Canada. The Road to Global Best Leadership, Innovation and Corporate Culture. Innovation Challenge Paper #1 May 2002.

A second contemporary model is contained in the Warry Report[24]. This model also describes how knowledge that arises from research is translated into economic impacts. In Warry's model the academic sector transfers some of the knowledge from research it performs (research with commercial and public applications) to the commercial sector (firms) or public sector (governments), in part by transferring people with requisite skills and qualifications and in part through direct interaction between researchers and firms and governments. Like the CBOC, Warry does not distinguish among the contributions of knowledge from different fields of research.:

Transmission mechanism of research base benefits to economic benefits: supply and demand side



Source: Warry. Op. Cit.

A recent OECD ministerial meeting also addressed how economic value is created from intellectual assets[25]. It pointed out that:

> *The ability to create economic value from intellectual assets is highly contingent on the management capabilities of individual firms and the implementation of appropriate business strategies. For example, leading firms have adopted new R&D management practices that aim to link R&D spending more closely to their business strategy, while relying on external sources to gain access to complementary knowledge and round out technology portfolios. As intellectual assets become a more important source of value creation, so does the firm's ability to retain them. There is a need to further explore the trade-offs between open and controlled access to intellectual assets such as via intellectual property rights and the effect on business innovation*

[24]Op. Cit.

[25]Creating Value from Intellectual Assets. Meeting of the OECD Council at Ministerial level, 2006.

and economic performance, especially in industries where innovative products rapidly become commodities through follow-on innovation and imitation. This includes a range of policies involving intellectual property rights, confidentiality agreements pertaining to highly qualified employees and the receptivity to foreign ideas and investment. (Emphasis added.)

Note that while the OECD comments were primarily directed to NSE companies and industries, all of the important success variables (the underlined terms above) are ideas or concepts that are borrowed directly from the social sciences ! What the OECD analysis tells us is that if we consider economic value creation through increased intellectual assets to be the dependent variable, then success rests on a host of independent variables which are largely social-scientific. For example, the OECD authors report that:

As investments in intellectual assets increase, so does their economic impact. OECD expenditures on R&D were around 2.2% of GDP in 2003 and increased steadily by 3.7% annually (in real terms) between 1995 and 2003 ... The estimated strong impact of R&D on productivity may be partly due to the fact that complementary investments in innovation (e.g. training, organisational change, marketing) are often excluded. These can be quite high ...

... Organisational changes are increasingly difficult to separate from innovative activities, especially in the services sector ... and organisational structures can be regarded as an increasingly important intellectual asset of firms. Indeed, in innovative firms total quality management, lean administration, flatter hierarchies, decentralised decision making, and better communication channels are inter-related with skills ... Moreover, such organisational changes also increase the ability of firms to adjust to changing market conditions, e.g. through technological innovation, the reduction of inventories and supply chain management.[26] (Emphasis added.)

The same OECD report points out that *"understanding of how technology should be deployed and used or of how people work in groups"* is also required for (scientific) research to be effectively applied. Furthermore, *Developing such long-term research needs would benefit from a greater involvement of services firms in the formulation and implementation of research.*

In other words, while investments in STEM (science, technology, engineering medicine) research are necessary for economic returns, these investments need to be accompanied by other investments or innovations that are largely social-scientific in nature.

Common to all these models is the notion that knowledge - often derived from research - leads to economic growth. With these models in mind, it is possible to construct a simple model of how the social sciences and humanities generate, develop and transfer knowledge that leads to new or improved products, processes and services.

[26] Ibid.

4.1 Three Kinds of Knowledge

Accepting the modern paradigm that knowledge drives economic growth, let us consider for a moment we mean by "knowledge", and whether there are useful distinctions between knowledge generated by the STEM and SSH disciplines. Pace the Encyclopaedia of Business (2nd edition), some types of knowledge - which can either be disembodied or embodied - manifests itself through technology.:

> *"Technology is generally available in two forms: disembodied and embodied. Disembodied technology is knowledge and practical expertise recorded in written and electronic form, such as technical papers, drawings, databases, patents, and trade secrets. The value of disembodied technology depends upon its transferability from donor to recipient, and its protection from unauthorized uses. An example of income from disembodied technology is royalties generated from patents.*
>
> *Embodied technology is incorporated in new or improved products, processes, systems, and services, that are offered to the marketplace. The value of embodied technology depends upon the ability of its producer and marketer to obtain a sustainable advantage over competitors, thereby achieving higher share, sales, and profits."*

In this view, knowledge has value when it is converted into technology. Knowledge then becomes either disembodied (codified) or embodied (in goods, software, etc.). Michael Polanyi[27] adds the element of "tacit" knowledge to the mix: *"Tacit knowledge comprises a range of conceptual and sensory information and images that can be brought to bear in an attempt to make sense of something"*. More colloquially, tacit knowledge is the knowledge resident in people's minds, sometimes as know-how, sometimes as intuition. So, there are essentially three forms of knowledge:

- Codified knowledge
- Embodied knowledge
- Tacit knowledge

We would argue that regardless of whether it emanates from SSH or STEM disciplines, knowledge can be grouped into these three categories, and that there is no practical need to distinguish the structure of SSH-generated knowledge from STEM-generated knowledge.

Economic growth takes place when these kinds of knowledge - often in combination - are successfully translated into economic activity by business enterprises and others operating in the

[27]Professor of Social Sciences at University of Manchester (1948-58). Source: http://www.infed.org/thinkers/polanyi.htm

"traded economy". Economic growth is also stimulated when governments adopt policies that promote the use of knowledge, for example, in setting regulations.

5.0 TRANSLATING KNOWLEDGE INTO ECONOMIC INPUTS

What are the specific "knowledge outputs" of research (whether in SSH or STEM) that can provide useful "inputs" to the economy? In other words, how does research support innovation in the economy? The OECD[28] recently presented an excellent synthesis of our current understanding of the role of knowledge in economic growth. According to the OECD (emphasis added):

- Value creation is being affected by the evolution towards a knowledge-based economy. The pace of this process has accelerated owing to the expansion of the services sector, stronger competition resulting from globalisation and deregulation, and the emergence of new information technologies.

- In OECD economies, the shift to a knowledge-based economy has led to a structural change, from traditional scale-based manufacturing, which mainly relies on tangible assets, to new innovation-oriented activities, which rely largely on human capital and knowledge. At the same time, the increasing weight of emerging countries in manufacturing operations has obliged OECD economies to rely more on their comparative advantage, which lies mainly in the production and use of human capital and knowledge.

- The pursuit and exchange of scientific and technological knowledge through R&D – with results increasingly protected by intellectual property rights – have become more systematic, while knowledge of markets and effective management practices are being codified in software or organisational structures. Here, these various elements are collectively called *intellectual assets*, and they are becoming the key strategic assets of firms that seek to survive and grow, with beneficial effects for overall economic growth.

- There is no globally accepted definition and classification of intellectual assets. Most definitions seem to agree that they have three core characteristics: *I)* they are sources of probable future economic profits; *ii)* they lack physical substance; and *iii)* to some extent, they can be retained and traded by a firm.

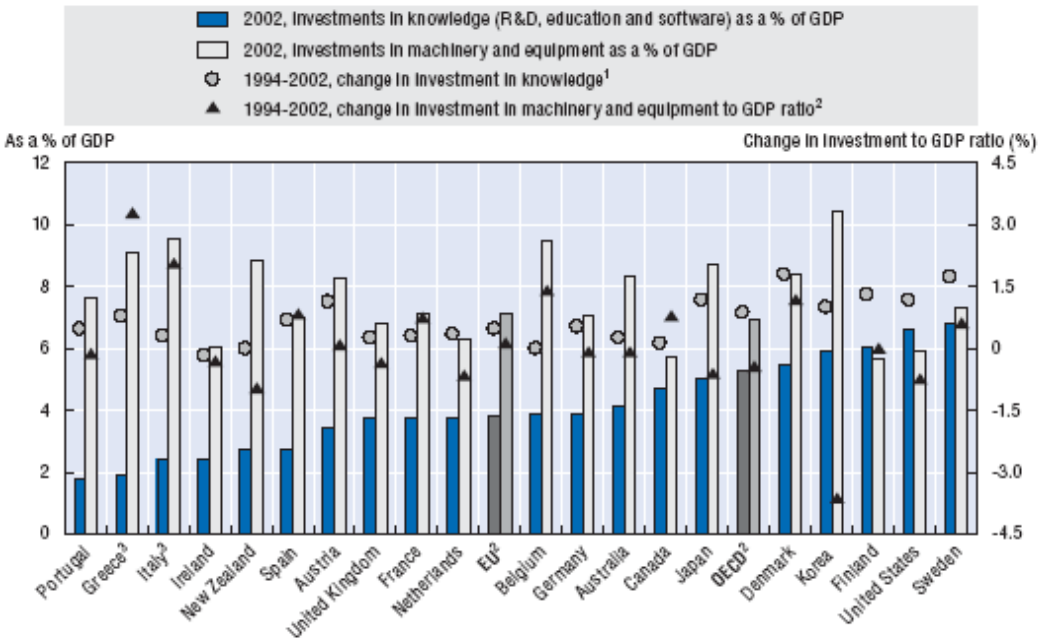
- The scope of intellectual assets has evolved in recent years from a narrow focus on R&D, patents and trademarks to a broader concept that includes human resources and capabilities, organisational competencies (databases, technology, routines and culture) and "relational" capital such as organisational structures and processes, and customer and supplier networks.

[28]OECD. Creating Value from Intellectual Assets. Op. Cit.

- The expansion in the scope of intellectual assets has, however, led to a confusion between intellectual assets themselves – such as patents, software and human capital – and the importance of managerial capabilities (also considered by some as an intellectual asset) for executing a strategy that generates value from these intellectual assets and improves a company's competitiveness.

The OECD points out that *"Investments in intellectual assets across OECD countries are sizeable and growing. They rival investment in machinery and equipment in some countries. In 2002, investment in R&D, software and higher education ranged from approximately 2% to 7% of GDP and averaged more than 5% across the OECD area. Although these investments remain below investments in machinery and equipment, which average almost 7% of GDP, they generally grew faster between 1994 and 2002 (Figure 1)."*

Figure 1. **Investment in knowledge versus investment in machinery and equipment**



1. 1994-2001 for Greece and Italy. 1995-2002 for Korea. EU figure excludes Belgium, Greece and Italy. OECD figure excludes Belgium, Greece, Italy and New Zealand.
2. Excludes Greece and Italy.
3. 2001 data.

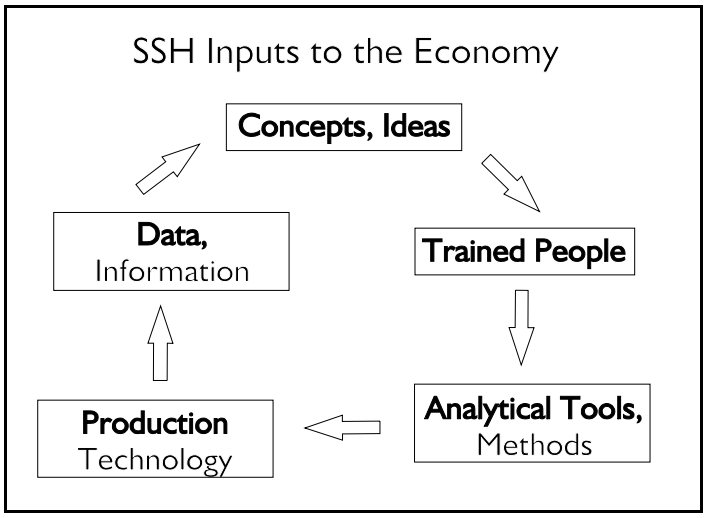
Source: OECD Science, Technology and Industry Scoreboard (OECD, 2005a).

5.1 Knowledge Contributions of the SSH

If we accept the analysis of the Conference Board, OECD and others that knowledge lies at the heart of economic growth, let us consider how scientific research contributes to economic life. Whether in the domain of the SSH or STEM, the elements are essentially the same. Scientific research[29]:

1. Generates concepts and ideas that provide key understandings of the natural or social worlds. Such ideas can range from, for example, new theories about the origin of the cosmos, to new paradigms regional economic growth (e.g. cluster theory).

2. Trains people who are able to apply "codified", "embodied" and "tacit" knowledge (know-how) in their day-to-day work.



3. Provides analytical tools (concepts and methods) for studying and understanding the behaviour of nature, materials, people, organizations (e.g. firms) and the socio-economic systems in which they function. For example, intelligence tests, aptitude tests, infectious disease tests, scientific instruments.

4. Produces production technology (embodied knowledge) such as databases, instruments, tests, surveys, machinery and equipment.

5. Generates specific data and information that individuals and organizations (e.g. companies) can apply directly in their economic affairs. For instance, legal scholars may offer interpretations of income tax laws that permit individuals or firms to maximize their net income. Or, historians might study how the stock market recovers from downturns in the business cycle, which in turn can help investors to time their investments. Nutritionists provide information about what constitutes a healthy diet.

Note that these considerations apply equally to the social sciences and humanities and to the STEM disciplines. Yet, until now, the innovation discourse has largely been restricted to thinking about the economic importance of knowledge outputs from STEM, and has mostly ignored the contributions and potential of knowledge arising from the SSH.

[29]Scientific research includes research and development and related scientific activities.

6.0 INFLUENCE OF SSH AND STEM ON GDP

One challenge we set for ourselves in proposing this paper was to see if it would be possible to move past a theoretical discussion of the influence of the social sciences and humanities and quantify their influence on the economy. In chapter 3.2 we introduced the idea that the economy can be divided into two groups of industries, depending on the primary source of their knowledge inputs - "SSH Industries" and "STEM Industries". In this chapter we take a high-level view of how one might measure the economic influence of the two industry groupings.

As an initial exercise we examine the size (i.e. GDP output) of the major SSH and STEM industries (Table 7). The total annual output of the economy is about $1.13 trillion. As is evident, the 6 industry sectors whose primary knowledge inputs are derived from the STEM disciplines account for a total output of around $431.4 billion. Industries that derive their primary knowledge inputs from the SSH disciplines account for about $696.7 billion of output.

Table 7. Gross Influence of SSH and STEM Knowledge Inputs ($ million)

Industry	Primary Inputs		Financial Outputs (GDP)	
	STEM	SSH	STEM	SSH
Agriculture, forestry, fishing and hunting	✓		27,847	
Mining and oil and gas extraction	✓		57,174	
Utilities	✓		30,128	
Construction	✓		74,087	
Manufacturing	✓		186,631	
Wholesale trade		✓		68,383
Retail trade		✓		69,015
Transportation and warehousing	✓		55,501	
Information and cultural industries		✓		43,147
Finance, insurance, real estate, rental, leasing, etc.		✓		230,362
Professional, scientific and technical services		✓		55,377
Administrative and support, waste management, etc.		✓		30,524
Educational services		✓		56,221
Health care and social assistance		✓		74,780
Arts, entertainment and recreation		✓		11,410
Accommodation and food services		✓		27,365
Other services (except public administration)		✓		30,072
Public administration		✓		66,758
TOTAL			**431,368**	**696,656**

STEM = Science, Technology, Engineering Medicine; SSH - Social Sciences & Humanities

Very roughly, then, we are prepared to say that industries that rely primarily on knowledge inputs from the SSH account for about 58% of economic output, whereas those that rely on knowledge inputs from STEM account for 42% of output.

However, this approach is very crude. For example, it attributes all of the output of a sector to either SSH or STEM knowledge inputs. The reality is that industries in each sector depend on a combination of SSH and STEM knowledge. So, our second iteration is to establish a notional level of dependency for the different industry sectors, using a rough measure of high, medium or low influence (Table 8).

For example, we propose that advances in STEM have a High impact on industries related to Agriculture, forestry, fishing and hunting, because those industries are quite reliant on aspects of technology and engineering (e.g. GPS control of agricultural equipment, agri-chemicals, GIS systems for crop monitoring and planning, biotechnology, etc.). In a similar vein, we suggest that the SSH have a Low (but not zero) influence on Agriculture and related industries (e.g. commodity futures forecasting models, marketing models, etc.).

Table 8. Economic Influence of SSH and STEM

Specific Industries	Notional Level of Influence	
	STEM	SSH
Goods		
1. Agriculture, forestry, fishing and hunting	H	L
2. Mining and oil and gas extraction	H	L
3. Utilities	H	L
4. Construction	H	L
5. Manufacturing	H	M
Services		
6. Wholesale trade	L	L
7. Retail trade	L	M
8. Transportation and warehousing	M	L
9. Information and cultural industries	M	H
10. Finance, insurance, real estate, rental, leasing, etc.	M	H
11. Professional, scientific and technical services	M	H
12. Administrative and support, waste management, remediation	H	H
13. Educational services	L	H
14. Health care and social assistance	H	M
15. Arts, entertainment and recreation	L	H
16. Accommodation and food services	L	L
17. Public administration	M	H
18. Other services (except public administration)	M	M

Thus, we can attribute a level of influence of STEM or SSH to each major industry category, recognizing that this is at best a rough-and-ready analysis. (To do the analysis properly one would need to examine each sub- or sub-sub-industry sector and make an educated guess about

the respective roles of SSH and STEM, recognizing that the roles are not mutually exclusive[30].) Depending on their own perspective, different analysts will arrive at difference conclusions about the respective influences of STEM and SSH on the various industry groupings. Our interpretation - which is simply illustrative - suggests that in the 18 different categories of goods and service industries: SSH has a strong economic influence on 7 industries, a moderate influence on 6 industries and a low influence on a further 5 industries (Table 9).

Table 9. Number of Industries Influenced

Inputs	High	Medium	Low	Total
STEM	7	6	5	18
SSH	7	4	7	18

STEM strongly influences 8 industries, moderately influences 6 and has a low influence on 5 others.

Now, let us attempt to refine the calculation by assigning an (admittedly) arbitrary figure to each level of influence. In this instance we have chosen 50% for High, 30% for Medium and 10% for Low. In other words, if a particular form of knowledge is judged to have a High impact on an industry, then we will assign it an influence of 50%, and so forth[31]. (The 50-30-10 designation is our own conjecture, and others may assign different values. This suggests a useful line for future research.)

We can then calculate how much of the GDP of each industry is influenced by SSH or STEM (Table 10). Using this approach we calculate that STEM influences - more correctly has the potential to influence - a total of $399.6 billion of economic activity, because STEM is the primary knowledge input to the relevant group of industries. Similarly, SSH has the potential to influence $389.1 billion, because those industries rely on SSH for their knowledge inputs. Interestingly, the resulting figures for SSH and STEM are very similar.

Using this very crude approach it is possible to derive an estimate of the volume of economic activity that is influenced by (knowledge) inputs from SSH and STEM. The influence figure assigned to each parameter (high=50%, medium=30%, low=10%) is arbitrary, though not without merit as a starting point for additional analysis. Regardless of the soundness of this particular influence estimate, we propose that a few general assertions are warranted:

[30] An industry (sub-)sector can be influenced by both SSH and STEM.

[31] One obvious drawback of this particular approach is that it leaves a un-attributed "residual" (of 50%, 70% or 90%). This raises a question of whether calculations of knowledge influence need to be based on 100% total, and what the proper levels of influence should be for High, Medium or Low.

- A majority of the industries that comprise the economy are now based on providing services, rather than goods.

- In total, service-providing industries generate more GDP output and employ more people than goods-producing industries.

- Service-producing industries tend to draw their primary knowledge inputs from the SSH while goods-producing industries tend to draw their knowledge inputs from STEM.

- Each group of industries also relies on knowledge inputs from their non-primary knowledge source.

Table 10. Estimated Calculation of Economic Influence of SSH and STEM

Specific Industries	GDP ($M)	$ Value of Influence on GDP			
		STEM		SSH	
Goods					
Agriculture, forestry, fishing and hunting	27,847	H	13,924	L	2,785
Mining and oil and gas extraction	57,174	H	28,587	L	5,717
Utilities	30,128	H	15,064	L	3,013
Construction	74,087	H	37,044	L	7,409
Manufacturing	186,631	H	93,316	M	55,989
Sub-Total	375,867		187,934		74,913
Services					
Wholesale trade	68,383	L	6,838	L	6,838
Retail trade	69,015	L	6,902	M	20,705
Transportation and warehousing	55,501	M	16,650	L	5,550
Information and cultural industries	43,147	M	4,315	H	21,574
Finance, insurance, real estate, rental, leasing, etc.	230,362	M	69,109	H	115,181
Professional, scientific and technical services	55,377	M	16,613	H	27,689
Administrative and support, waste management, etc.	30,524	H	15,262	H	15,262
Educational services	56,221	L	5,622	H	28,111
Health care and social assistance	74,780	H	37,390	M	22,434
Arts, entertainment and recreation	11,410	L	1,141	H	5,705
Accommodation and food services	27,365	L	2,737	L	2,737
Public administration	66,758	M	20,027	H	33,379
Other services (except public administration)	30,072	M	9,022	M	9,022
Sub-Total	818,915		211,627		314,185
TOTAL	**1,194,782**		**399,561**		**389,097**

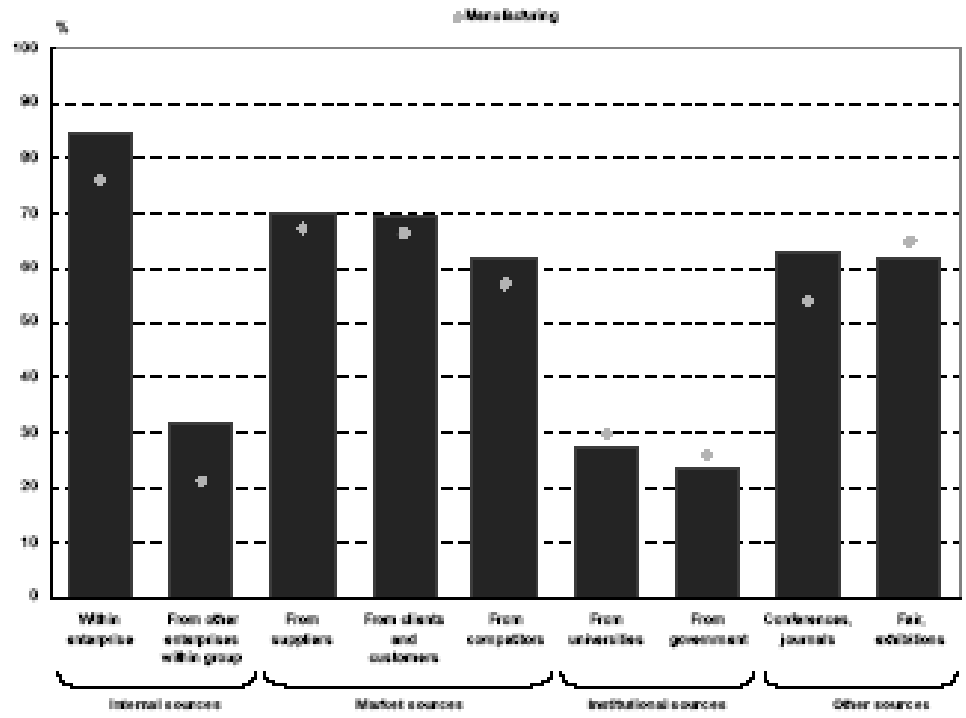
H=50% influence; M=30% influence; L=10% influence

We hope that the foregoing analysis will provoke new in-depth research on the economic influence and mechanisms of the SSH that will utilize more robust linkage assumptions and more refined measurement techniques.

7.0 CONTRIBUTION OF SSH RESEARCH TO THE ECONOMY

To this point, our exploration of the economic role and influence of the social sciences and humanities has been based on the general proposition that knowledge - codified, embodied and tacit - drives improvements in innovation, productivity and growth in all parts of the economy. SSH knowledge in particular drives growth in the service industries, and STEM knowledge drives growth in the good-producing industries. However, there is a considerable amount of knowledge being borrowed from each. That certainly appears to be the reigning paradigm according to the OECD, Conference Board of Canada, and others, and we think it makes sense intuitively. So, let us accept for the moment that knowledge is the root of economic growth, both at the firm level and at the level of the total economy. What, then are the economically-relevant sources of new knowledge? What is the contribution of academic knowledge? What are the mechanisms of "knowledge transfer"?

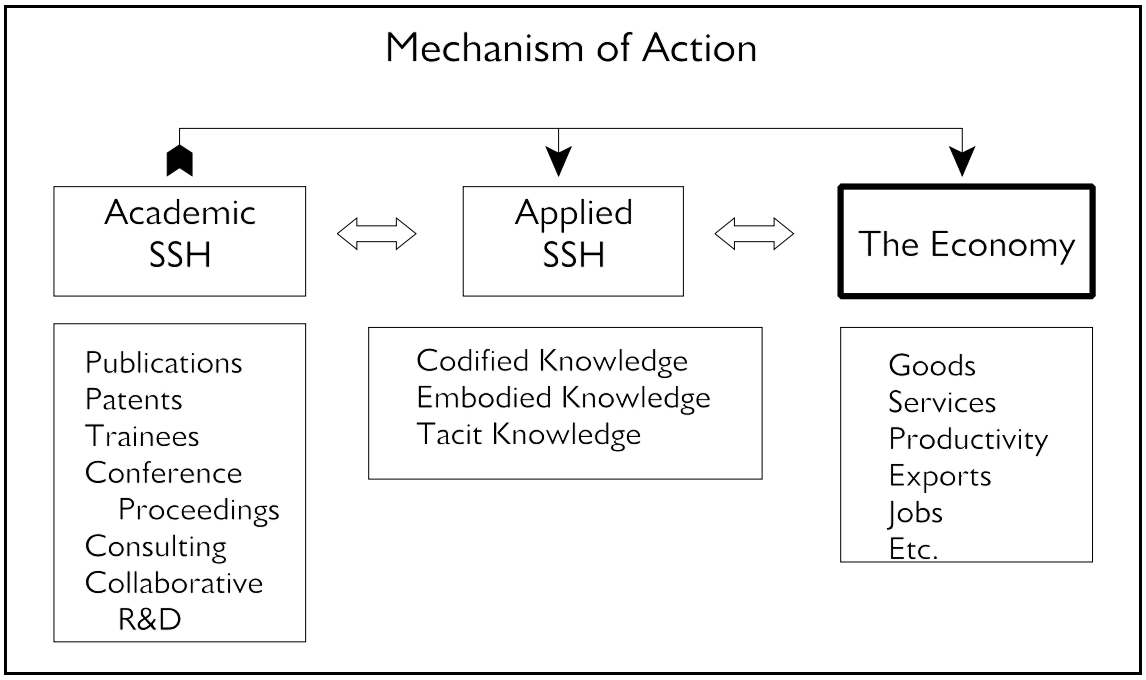
Figure 20. Sources of information used by innovative firms in the service sector, 1998-2000



Source: OECD. Promoting Innovation in Services. Paris. 14 October 2005. Op. Cit.

According to the OECD[32], service sector firms draw mostly (80%+) on information from within their enterprise. Information from suppliers (70%), from clients and customers (70%), and from competitors (60%+) is also important to them. Information from institutional sources, such as universities (25%+) and from government (20%+) is ranked lower. Knowledge gained from conferences and journals (60%+) and from fairs and exhibitions (60%+) is also important to firms. The results for manufacturing firms are quite similar, although manufacturing firms tend to be slightly more reliant on knowledge from universities and government than their service sector counterparts.

So, in general, we can conclude that academic knowledge - whether from SSH or STEM - is not a principal input to the economy - or at least not a direct input to the economy. Yet, as we saw earlier (chapter 4.0) codified knowledge, embodied knowledge (technology) and tacit knowledge (know-how) are all important inputs to enterprises. The discrepancy, if any, we believe is due to the fact that "raw knowledge" knowledge that arises directly from research - does not become useful to business enterprises until it is expressed through publications/conferences, technology, or people (employees, consultants, etc.).



The fact that enterprises tend not to consume "raw knowledge" as it comes directly from academe, should not be confused with the fact that the same knowledge can be of immense value when it reaches enterprises through other sources, often when those sources (e.g. students, consultants) have added value to the raw knowledge.

[32]Innovation in Services. Op. Cit.

This discussion highlights the importance of so-called "knowledge transfer" activities in an academic setting, a topic that is beyond the scope of this paper.

8.0 TOWARDS AN SSH RESEARCH AGENDA

Vast parts of our economy are in the business of creating or trading in products and services that rely directly on the social sciences and humanities, or are otherwise essentially SSH in nature. About two-thirds of all industry sectors can be described as "SSH industries" - industries whose primary knowledge input comes from the SSH or that sell SSH-based services (e.g. banking) or goods (e.g. television programs). And, SSH industries employ about three-quarters of all workers. One SSH industry alone - Finance, insurance and real estate ("FIRE") - generates more GDP than all of Manufacturing, for example. SSH even contributes ideas, methods, people, etc. that impact industries whose primary knowledge input comes from the "hard sciences" - science, technology, engineering, medicine (STEM). Furthermore, the social sciences and humanities (SSH) are the chief sources of knowledge inputs - or indeed the core service/product offering - of some of Canada's best-known companies: Thomson Corporation, Torstar Corporation, Manulife Financial, Stratford Festival, to name a few.

And yet, the there is virtually no literature on the economic role and influence of SSH. It should therefore not surprise us that to date, public policy has devoted little attention to the importance of SSH for innovation and competitiveness. Authoritative sources such as the OECD are beginning to recognize the direct and indirect role and influence of SSH on innovation and competitiveness[33].

This essay is intended to stimulate thinking and discussion of the economic role and influence of the SSH. In that its ideas are still very much in the formative stage, it is still very much a "conjecture". As such, it is either "a hypothesis that is formed by speculating or conjecturing" or "a message expressing an opinion based on incomplete evidence" ... or both.

Canada's innovation and competitiveness policies and strategies are largely based on the idea that the country's economic future lies in advances in science, technology, engineering and medicine. This may well be true. But it is equally true that those advances will not succeed unless they also apply the best knowledge from the social sciences and humanities - from economics, marketing, political economy and so on. More importantly, the SSH lie at the core of many of today's (and tomorrow's) "knowledge-based industries" (computer games, educational software, etc.)

[33]See, for example, Creating Value from Intellectual Assets. Meeting of the OECD Council at Ministerial level, 2006. Op. Cit.

Canada's STEM funding agencies - NSERC and CIHR - have developed sophisticated and effective mechanisms for engaging business enterprises. Over the years they have innovated programs that bring academic researchers together with business (and government). What if those programs were transposed into the realm of SSHRC? Could they serve as useful models for how to transfer SSH knowledge to the traded economy? We believe they could.

So little has been written about the role and influence of SSH on the economy that it is hard to cite authoritative sources or research. For that reason, we have had to "invent" an approach that might or might not stand the test of time. That said, we believe that there is fertile ground for additional and specialist research about the economic role of SSH. In general, we think that this kind of research could take several directions:

1. Case studies. Firm-level studies of the relative importance of SSH and STEM inputs to individual business enterprises, government departments, non-profit organizations, etc.

2. Occupational analysis. Analysis of Canadian occupation categories to determine the SSH and STEM requirements of different jobs. This analysis can be aggregated to a national-level analysis by summing the actual number of jobs and their knowledge requirements.

3. Detailed industry-by-industry analysis of knowledge inputs[34].

4. Firm-level studies in different industries of expenditures on: tacit knowledge (i.e. human resources - staff with SSH qualifications vs. STEM qualifications), embodied knowledge (e.g. forms of technology), and codified knowledge (e.g. publications, databases, software).

Research of this type is important for Canada because so much of the economy - current and future - is based in the social sciences and humanities. We should be devoting as much effort to thinking about how we can translate the country's SSH knowledge base and infrastructure into economic advantage as we do to trying to harness the undoubted potential of STEM.

Let the dialogue begin !

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[34]Our analysis dealt only with top-level industry categories (e.g. "Manufacturing). In reality, each of the major categories is comprises of many sub- and sub-sub-industry categories. Each of these may have unique dependencies on SSH or STEM knowledge.

Partial List of Sources Consulted

Alberta Foundation for the Arts. The Economic Impact of the Arts in Alberta. Measuring the Value of the Arts. August 2005.

Arts and Humanities Research Council. Report of the AHRC Television & Radio Sector Interaction Study.

Encyclopedia of Business, 2nd ed. Technology Management

Heritage Canada. The Economic Impact of Canadian Copyright Industries - Sectoral Analysis. CONNECTUS Consulting Inc. Ottawa. 2006. http://www.canadianheritage.gc.ca/progs/ac-ca/progs/pda-cpb/pubs/copyright/tdm_e.cfm

Hill Strategies. Economic Impacts of 97 Festivals and Events. Ontario Trillium Foundation. Toronto. April 2003.

Industry Canada. Mobilizing Science and Technology to Canada's Advantage. Ottawa. May 2007.

OECD. Directorate for Science, Technology and Industry Committee for Scientific and Technological Policy. Working Party on Innovation and Technology Policy. Promoting Innovation in Services. Paris. 14 October 2005.

OECD. Creating Value from Intellectual Assets. Meeting of the OECD Council at Ministerial level, 2006.

Reeves, Michelle. Measuring the economic and social impact of the arts: a review. Arts Council of England. London. 2002

Research Councils UK. Excellence with Impact. Progress in implementing the recommendations of the Warry Report on the economic impact of the Research Councils. 2007

Statistics Canada. The impact of the culture sector on the Canadian economy. Vik Singh. Quarterly Bulletin from the Culture Statistics Program Catalogue no. 87-004-XIB Vol. 15, No. 1.

Statistics Canada . Employment by industry. (http://www.statcan.ca/english/Pgdb/econ40.htm)

Statistics Canada. Focus on Culture (Vol.14,No.3).
http://www.statcan.ca/english/IPS/Data/87-004-XIE.htm

Warry, Sir Peter. Increasing the economic impact of Research Councils Advice to the Director General of Science and Innovation, DTI from the Research Council Economic Impact Group. 14th July 2006.