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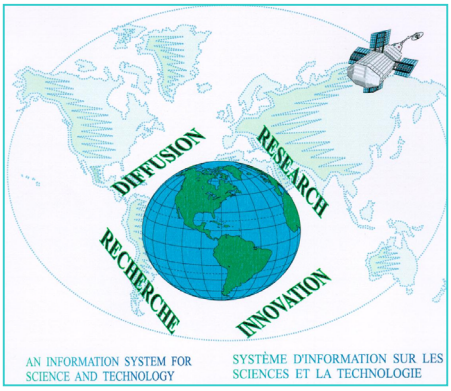
Innovation is a social process



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Innovation Is a Social Process

Judith Maxwell
President
Canadian Policy Research Networks

Paper prepared for Statistics Canada
(based on a speech delivered to the Annual Economic Conference on May 6, 2002)

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The Science and Innovation Information Program

The purpose of this program is to develop **useful indicators of science and technology activity** in Canada based on a framework that ties them together into a coherent picture. To achieve the purpose, statistical indicators are being developed in five key entities:

- **Actors**: are persons and institutions engaged in S&T activities. Measures include distinguishing R&D performers, identifying universities that license their technologies, and determining the field of study of graduates.
- **Activities**: include the creation, transmission or use of S&T knowledge including research and development, innovation, and use of technologies.
- **Linkages**: are the means by which S&T knowledge is transferred among actors. Measures include the flow of graduates to industries, the licensing of a university's technology to a company, co-authorship of scientific papers, the source of ideas for innovation in industry.
- **Outcomes**: are the medium-term consequences of activities. An outcome of an innovation in a firm may be more highly skilled jobs. An outcome of a firm adopting a new technology may be a greater market share for that firm.
- **Impacts**: are the longer-term consequences of activities, linkages and outcomes. Wireless telephony is the result of many activities, linkages and outcomes. It has wide-ranging economic and social impacts such as increased connectedness.

The development of these indicators and their further elaboration is being done at Statistics Canada, in collaboration with other government departments and agencies, and a network of contractors.

Prior to the start of this work, the ongoing measurements of S&T activities were limited to the investment of money and human resources in research and development (R&D). For governments, there were also measures of related scientific activity (RSA) such as surveys and routine testing. These measures presented a limited picture of science and technology in Canada. More measures were needed to improve the picture.

Innovation makes firms competitive and we are continuing with our efforts to understand the characteristics of innovative and non-innovative firms, especially in the service sector that dominates the Canadian Economy. The capacity to innovate resides in people and measures are being developed of the characteristics of people in those industries that lead science and technology activity. In these same industries, measures are being made of the creation and the loss of jobs as part of understanding the impact of technological change.

The federal government is a principal player in science and technology in which it invests over five billion dollars each year. In the past, it has been possible to say only *how much* the federal government spends and *where* it spends it. Our report **Federal Scientific Activities, 1998 (Cat. No. 88-204)** first published socio-economic objectives indicators to show *what* the S&T money is spent on. As well as offering a basis for a public debate on the priorities of government spending, all of this information has been used to provide a context for performance reports of individual departments and agencies.

As of April 1999, the Program has been established as a part of Statistics Canada's Science, Innovation and Electronic Information Division.

The final version of the framework that guides the future elaboration of indicators was published in December, 1998 (**Science and Technology Activities and Impacts: A Framework for a Statistical Information System,** Cat. No. 88-522). The framework has given rise to **A Five-Year Strategic Plan for the Development of an Information System for Science and Technology** (Cat. No. 88-523).

It is now possible to report on the Canadian system on science and technology and show the role of the federal government in that system.

Our working papers and research papers are available at no cost on the Statistics Canada Internet site at http://www.statcan.ca/cgi-bin/downpub/research.cgi?subject=193.

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Preface

This working paper is based on a text delivered by Judith Maxwell, President of the Canadian Policy Research Networks. In her discourse, Ms Maxwell challenged her listeners to "think outside of the box" on innovation, to wit to be creative and innovative in how they approached the topic. For her, innovation extends beyond economic activities into societal interactions and culture. Therefore, innovation translates into more than productivity growth and improved efficiency but also better living, working and learning conditions. This important thesis is partially reflected in some of the groundbreaking data collection undertaken by Science, Innovation and Electronic Information Division (SIEID).

For instance, the recent pilot Knowledge Management Practices Survey, 2001 looked at how organisations acquired, retained, developed, captured and shared knowledge. This survey looked at a set of 23 management practices that spanned human resource or knowledge development such as training, inter and intra-firm communications such as mentoring, apprenticeships, virtual teams, and work teams composed with external experts, knowledge sharing strategies and values, and knowledge acquisition from external and internal sources. As well, networks and linkages with suppliers, customers and competitors were included and a theme that was developed in the 1996 Survey of Innovation in Selected Service Industries. The forthcoming Survey of Innovation in the Services Industries will gather more information on networks and linkages, showing the importance of human interaction and social dynamics to innovation in the Canadian economy. The Biotechnology Use and Development Survey, 2001 highlighted the use of collaborative arrangements between firms in the biotechnology innovation process. It also looked at knowledge flows to the firms from external industry sources and public research institutions. Finally, human resource development such as training and staff upgrades were included as part of knowledge development strategies.

Judith Maxwell quite rightly looks at innovation as more than the development of new or significantly improved products or processes that have been introduced to the market or production operations. In her thought provoking text she has insightfully shown how innovative thinking and actions should be applied to all aspects of Canada's social fabric.


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Introduction

It is a pleasure to participate in this year's annual economic conference "Innovation in an Evolving Economy held in Ottawa, May, 2002.

My hypothesis today is that innovation is a social process. It is a process in which place, people, and social networks are essential. I want to convince you that innovation fits into a very broad landscape, and to tease your imagination with a combination of anecdotes and broader analysis.

Everybody starts from the same place with respect to innovation. We know that innovation drives productivity growth, and, as a result, we focus our attention on the world of commercial enterprise. We do not think much about innovation in other sectors of the economy – the non-profit sector, the social sector, or, heaven forbid, the public sector. And yet each one of these sectors consumes resources and produces outputs. And every one of them is being reshaped by technology and by knowledge-based activity. So our productive potential, writ large, depends on the capacity for innovation across markets, governments, communities, and even families.

Defining innovation

The most widely used definition of innovation comes from the Organisation for Economic Co-operation and Development (OECD). Paraphrased, this definition states that "Innovation is new or significantly improved products or processes introduced to the market"[1]

I agree that innovation is doing something new, but I do not agree with the constraint that it only happens if it is introduced into the market. Indeed, there are two images that come to mind when people write about innovation. The first image includes the scientist in the lab, the computer whiz at the keyboard, or the engineer building a complex structure. The second image involves people like you and me – people in dialogue, brainstorming, and waving their hands.

Both images – technology and dialogue– can be applied to all the different sectors I just mentioned – market, state, community, and family. Both images have both macro (system-wide) and micro (individual) dimensions. The macro dimensions get most of the press, and the micro dimensions are often under-estimated.

[1] According to the Oslo Manual (OECD/Eurostat, p. 47), "**Technological product and process (TPP) innovations** comprise implemented technologically new products and processes and significant technological improvements in products and processes. A TPP innovation has been **implemented** if it has been introduced on the market (product innovation) or used within a production process (process innovation)…. **The TPP innovating firm** is one that has implemented technologically new or significantly technologically improved products or processes during the period under review."

For the market and technology notion of innovation, the macro debate includes such issues as the under-investment in research and development (R&D), shortages of faculty to teach information technology, the number of patent applications in Canada compared to other countries, tax rates, exchange rates, consumer protection and government regulation. These are the subjects that tend to dominate the speeches of Canadian opinion leaders. But there are also micro issues which are the sub text for those speeches. They include innovation on the shop floor, workplace training, trade in intellectual property, and participation in IP networks involving suppliers, customers, educators, and researchers.

The dialogue image of innovation is also present in these speeches. Business leaders talk about skills, labour shortages, the war for talent. They talk about collaboration, behaviour change, entrepreneurship, ambition, and risk taking. They sometimes refer to good management and organizational culture.

But this discussion of the second image of innovation is too narrow. It focuses mainly on the supply of talent and the rhetoric of management science and does not pay enough attention to the subtleties or the importance of the processes at work in innovation. One important reason for this is that they tend to focus on codified knowledge, as opposed to tacit knowledge. Codified knowledge is in our books, manuals, and web sites. An individual can read and learn on his or her own.

The importance of tacit knowledge

Tacit knowledge is different. It requires an interchange between two or more people, through dialogue, challenging, and hand-waving. Generally speaking, tacit knowledge is exchanged and developed when people are in the same room, focussed on the same topic. They require a common language and some common understanding of the issue, and they have to be prepared to work at communication. This has been described in the literature on economic clusters and elsewhere as 'social learning.' It is the kind of learning where 'face-time' is essential, and it explains why 'place' has become an important element in industrial policy. Suddenly we have begun to pay more attention to economic clusters and to city-regions.

In fact, economic clusters like software, aerospace, or biotechnology work because there is intense interaction among people who are linked together as suppliers, customers, researchers, educators, managers and so on. Most people would accept this as a social process, but they only call it innovation if that activity has the goal of producing a new commercial product.

If you have read the two federal innovation papers released February, 2002 – *Achieving Excellence* (Industry Canada, 2002) and *Knowledge Matters* (Human Resources and Development Canada, 2002) – you will see that the federal government has conceived innovation as a social and an economic process. Again, though, the focus is on commercial success. The two documents highlight the roles of training, education, early childhood development, and skill development as central to the innovation process, as

well as regulation, R & D, and patent applications. The two papers are linked by their concern about slowing labour force growth and rising skill requirements. As the baby boomers retire in the next decade or so, skill shortages are likely to be a real challenge. And as the boomers age, they will need services and supports to look after them. Who will do this work?

Social foundations of innovation

Here we begin to see that the social foundations of innovation go even wider than I described earlier, and again there are both macro and micro dimensions. Susan McDaniel (2002, p.242) has written about "the macro-social contexts of risks, uncertainties, insecurities, education, health, environment and community." (There is also the micro context of the people interacting with each other in neighbourhoods, schools, and parks.) Now McDaniel's definition of the macro context is very broad, and perhaps hard for you to accept at first blush. So let me give you a practical example.

When the federal government was setting goals for the education system and for early childhood development, it was focussing on achievement – graduating with good literacy, numeracy, and problem-solving skills. But, when we look at the Employability Skills Profile created by a group of employers convened by the Conference Board in Canada, we find much more than traditional school achievement. The profile tells us that employers are looking for people who can work in teams and also autonomously, people who understand risk-taking and can make good judgement calls on risk.

So where do young people learn these social and interaction skills? Certainly they learn some of them in the classroom, but they also learn them through good recreation – sports, music, dance, and parks with mid-night basketball (I have to add that one for my son). Young people need safe places to play, because that is where they learn to make rules, settle disputes, and take a leadership role. So recreation is an important part of the social infrastructure for innovation. Most middle class and well-to-do families are able to provide these opportunities, but the barriers to recreation for low-income families can be insuperable.

Need for innovation in social policy

This takes us well beyond the conventional images of innovation – i.e. technology and dialogue. In order to explore this wider landscape, I will focus on smart social policy – the way in which innovation in social policy would make a difference to the quality of economic and social life in Canada. But to do that, I want to take a short detour to set the scene.

The post-war economic model was based on mass production and the assembly line. The post-war social model was the welfare state. Both models favoured the creation of large hierarchical bureaucracies. But the two bureaucracies were regarded as being independent of each other, with few connections.

Now the dominant models are different. The industrial model has been flattened by technology, and firms now strive for just-in-time production through close networking with customers and suppliers. In the social sector, the welfare state has been downsized and delegated, so that many functions of the state have been transferred to community organizations, to the market, or to families.

We still have large corporations and large government departments, but they are under pressure to change their form, and their ways of doing things. Hierarchy is being squeezed out, payrolls are much more flexible, and corporations are now contracting with suppliers or individuals to do piece-work – a practice that dates back to the 19th century. In the corporate world today, managers negotiate 90-day workplans because they know that their work assignments will soon change. The nimbleness that organizations must exhibit these days does not fit with bureaucracy, and one of the results is that knowledge workers have much more autonomy than they did in the past.

Government departments do not have the same agility, to be sure. But they are being forced to be open, networked, and consultative in ways that would have been inconceivable 20 years ago. They are also under pressure to speed up decision-making.

There are many challenges that flow from these networked, web speed organizations. First, we are in an era where creative destruction rules. Products are disappearing, and industries are exploding and imploding. Towns and cities are either thriving, or at risk of dying because they have been left behind by the new trends in economy and society. We have created what I call the 'double-edged' society where the risks of reward and of ruin are higher than the post-war era.

Second, for policy analysts, researchers, and statisticians, there are serious challenges to our ability to capture the knowledge we need to do our jobs. Our analytic tools do not keep pace with the structural change. We have trouble valuing knowledge assets.

The dot-com crash of 2001 illustrates both challenges. An explosion of wealth disappeared before our eyes. And the assets that were once worth billions are now lying idle or being sold for a song.

Further challenges arise from the way that the double-edged economy spills over to the social sector. The post-war social model was based on two assumptions – full employment and the breadwinner family.

Breadwinner families are those where one adult works full-time at a steady job and the other stays home to support the family in what we now call unpaid work. Low unemployment (for men) and rising real wages enabled breadwinner families to steadily increase their standard of living in the post war years. Times have changed, however. Real wages have been stagnating, and unemployment rates have been high until recently. Today, just over 60 percent of two-parent families with children have two people working, and almost 10 percent of non-elderly families are headed by a lone parent (Statistics Canada, 2002b, p.125).

The flexible payrolls, rising skill requirements, and the displacement of workers through the creative destruction process I described have undermined the social model. This new risk/reward structure produces great wealth for some and excessive downside risk for others. The result is that there is growing evidence of skill shortages in some sectors and, at the same time, an emerging underclass.

Education seems to be the fault-line from what we can see in the data. Canada created 2.5 million jobs for people with post-secondary education in the 1990s, but it lost 1 million jobs from people without high school education (Statistics Canada, 2002a). But education is not the only determinant of how life unfolds. It was Aristotle who highlighted the importance of good fortune as a source of well-being. So I would argue there are three determinants of success in life – good education, good health, and good fortune.

The people who are caught in the web of this emerging underclass lack one or more of these three ingredients, and for many of them it is bad fortune that makes the difference.

We have begun to talk a lot about the great divide between rural and urban Canada, as more and more of the population moves to the cities. This migration leaves rural and small town Canada with a real dilemma. But the greatest divide occurs within our cities. John Myles and his colleagues at Statistics Canada report that the most extreme concentrations of wealth and poverty are inside our cities. The richest of the rich and poorest of the poor live in their own neighbourhoods, but they are not far apart.

The distinguishing features of the poorest and most distressed neighbourhoods are:
- At least one in three adult men do not work full-time;
- At least two young men in five are neither working or studying;
- And at least one in three families with children is headed by a lone parent. (Hatfield, 1997)

Still undocumented is the fact that a high proportion of these people come from Aboriginal or immigrant backgrounds, and many are in poor health.

In other words, there is a 'place' dimension to social well-being. Just as Kanata and Kitchener-Waterloo have created dynamic engines for industrial innovation, there are neighbourhoods in all our major cities where the odds are heavily stacked against the successful passage from youth to adulthood and self-reliance. Indeed, these places become magnets for distressed people. And they are places where people have no hope for the future, no access to technology, and no possibility of finding safe, affordable housing.

One of the reasons for this is that we have not seen the innovation in social policies needed to meet the needs of 21st century Canadians who encounter bad fortune. Rather our social policies are rooted in the post-war welfare state model. The programs have been cutback and modified at the margin, but they do not acknowledge the facts of 21st century life.

- How is a lone parent supposed to work and care for his or her child(ren)?
- How are workers supposed to upgrade their skills if employers do not make the investment?
- How are families supposed to cope when there is illness in the family and both parents work, when jobs are episodic and do not pay a living wage?

Examples of the room for innovation in social policy

In order to demonstrate the scope for innovation that would save money (in the long run), and help people thrive in the new economic environment, I will turn to two anecdotes.

The first story is about a lone parent with two daughters, whom I shall call Nancy. In 1995 she was employed as a psychiatric nurse in a large Toronto hospital. Her first misfortune was that she was laid off during the big cutbacks. Her mother was very ill at the time, so she decided to care for her, rather than look for another job right away. She did this until her mother died, but then she encountered a second misfortune. Nancy fell ill herself and while she was sick she exhausted both her severance and her eligibility for Employment Insurance benefits. The next problem was that she fell behind in her rent, and lost her apartment. She then moved in with her father, but those arrangements did not work. For awhile, she lived in the car parked in her father's driveway, but eventually she applied for welfare. With nowhere to live, and no personal networks to turn to, she and her two daughters ended up in a welfare motel on Kingston Road in Scarborough.

So Nancy was a victim of misfortune, and society did not have the tools to help her recover her self-reliance. If she had had access to affordable housing, through income-adjusted rent, or if Ontario paid a social wage to employable people who stay home to provide care for a dependant, she might have made it through her troubles.

Both these policies are actively used in Europe. In Canada, they are not available. In fact, both federal and provincial governments withdrew from social housing programs in the early 1990s. And the result is that when misfortune hits, lives of skilled, middle class professionals can disintegrate.

The second story is about a group of boys in the east end of Montreal, where high school drop out rates for young men are as high as 50 percent. About 15 years ago, Richard Tremblay, a researcher at the University of Montreal, started a major long-term study. He introduced a two-year program of counselling for six year-old boys and their families to help the boys manage their anger and learn pro-social skills (Vitaro, Brendgen and Tremblay, 1999 and 2001). The cost for each boy for the two years was $2000. Richard has been tracking these boys, who are now in their early 20s. He also tracked a control group of boys who had the same symptoms but did not receive the counselling.

To Richard's surprise, there were no big differences between the two groups of boys for several years. But by age 17, there were some remarkable differences. Drop out rates for the boys who had received the counselling (11 percent) were <u>half</u> the average for the control group. In addition, their track records on substance abuse, physical aggression,

vandalism, and theft were also much better. Dramatic differences in their pathways through life have continued.

Now, you would think that with evidence like this, there would be a truly smart social program here. But Richard tells me that there are no schools in Montreal that provide this counselling. And drop-out rates are as high as ever.

These two anecdotes illustrate how much room there is for innovation in all parts of our society. Innovations in the form of affordable housing and caregiver compensation could have made all the difference to Nancy and her two daughters. And given the shortage of nurses in Toronto these days, I suspect she would be fully employed today in the profession for which she was trained.

Innovations in the form of counselling for six year-old boys who need it would help those boys to avoid the risky social behaviours that lead them into a downward spiral, which will be hard to reverse when these boys reach their late teens. An investment of $2000 at ages 6 and 7 yields a high return in the form of more successful high school graduate with choices about whether to study or work.

Innovation is a social process

The lack of innovation in social policy in Canada is obviously impoverishing some people. But it is impoverishing our whole society because people like Nancy and those boys do not get a chance to be productive members of their communities.

This is why I argue that innovation is a social process. As I said early on, there are social dynamics at the root of almost all innovation through the social learning which occurs in the workplace and in economic clusters. People interacting with each other create the new ideas that lead to new products and processes to take to market. But innovation is also a social process in the sense that the more we do to ensure that every citizen can live up to their full potential, the greater our total economic potential will be. And the greater will be the total well-being of Canadians as a collectivity.

Over the past 20 years, we have worked very hard as a country to put our economic house in order. But over the same period, we have, slowly but surely, eroded the social infrastructure which underlies innovation. For the people caught in this undertow, this can lead to poverty and social distress. There are dead-weight costs associated with this distress – the costs of welfare, health care, the justice system, and so on. Smart social policy would avoid these dead-weight costs. It would make investments designed to enable more Canadians to play the innovation game, and to cope with the periods of misfortune associated with the double-edged economy.

Summary

In summary, I agree that innovation policy must focus on R & D, tax structure, and efficient regulation, and the skills agenda. But we must still levy some taxes and some of that tax revenue should be devoted to smart social investments – in recreation, counselling, affordable housing, good public transit, and all the other enablers that help people to recover their self-reliance when misfortune strikes. That is how we can make the most judicious use of our financial and human resources. It is not a question of either the economic model or the social model of innovation. It is a question of **both economic and social.**

In sum, what I am saying to you today is that innovation can work its magic wherever you live, work, or play. Innovation is, fundamentally, a social process that supports good science, strong productivity growth, and a more inclusive society.

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