

**The Underpinnings of Accelerated Dynamics  
and Utilitarianism:  
The Shifting Roles of Governance in the  
Knowledge Economy**

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## **The Underpinnings of Accelerated Dynamics and Utilitarianism: the Shifting Roles of Governance in the Knowledge Economy**

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### **Summary**

The new theory of demand presents the micro-foundations for establishing the complex dimensions of growth as they reflect on the ability of individuals to exercise their freedom in the market places. What GDP, and even disposable income measure as growth is quite different and only partially reflects growth in individual freedom or, in Canada, its possible decline during the 1990s. Inadequate though the measurements are, Canadians have experienced a decline in personal disposable income per capita relative to Americans from \$2,885 in 1992 to close to \$9,555 per capita in 1998. A recent survey of high-tech workers underscores this point. In four of five of Canada's largest centres, married high-tech workers were deficit financing their households before making any discretionary purchases (income after taxes and purchases of basics including health care), whereas in five cities in the United States, discretionary income was 3.1 to 40 per cent of total income. The resulting pressures of emigration to the United States are growing and emphatic. Measurement issues with respect to capital productivity are compounded because measurements of real growth in computers and peripherals take elements of the new theory of demand into account while the output measures of the industries adopting these new technologies do not encompass those same considerations. Growth measures need to be revisited and the widening gap in real disposable income redressed if Canada is to continue to participate viably in the knowledge economy.

### **Introduction**

There is little doubt that microeconomic theory has its genesis in utilitarian thought. The very starting point of demand theory from Mill to Hicks and on through to the much broader New Theory of Demand is that individuals maximize their utility subject to certain constraints. Where differences arise among economists is in just how those constraints apply and in the detailed relationships between goods and services and utility. Rather than deploying overly simplistic economic models, this paper opts for more complex theories as better starting points for understanding the evolving policy context of the knowledge economy. It generally eschews the use of mathematics, in the interests of reaching a broader community than professional economists and other technocrats, albeit some dynamic considerations are also introduced.

Relatively simplistic comparative static methods were generally sufficient for analysing the first eight decades of the 20th century. Those constructs however fail to explain the paradigm shifts that have been accelerating during the last two decades. Governance based on the old economic constructs runs high risks of creating barriers rather than facilitating movement to take advantages of the opportunities afforded by the new technologies. In the hands of well meaning people, good government, the heart of the federal government's responsibilities under the Canadian constitution, can too easily be used to establish barriers to growth on protectionist grounds, thereby substituting short-term gain for long-term pain. If governments follow the

short-term rewards, economic historians 50 years hence will view the federal government's actions as being contrary to its constitutional rasion d'etre, thereby, making either the government or its strategy an expensive anachronistic oxymoron. In this sense the clear and present danger is from within. Given leadership and vision, this danger may be avoided.

### **Modern Utilitarianism: Classical Demand Theory**

Economics 101, teaches the basic Marshallian proposition that individuals maximize their utility,  $U$ , from their consumption of goods and services subject to their income constraints and market determined prices. Pareto extended this proposition by recognizing that an individual receives the same level of utility by consuming combinations of two goods along the points of an indifference curve. In a mapping of these contour curves, an individual optimizes utility by reaching the highest contour possible within his or her means given relative prices and his or her income constraint. Hicks extended these propositions into a general theory of demand, albeit his mathematical appendix is inconsistent with his geometric presentation in the book. Hicks' systems produced unique solutions as long as consumers receive less and less utility as they consume more and more of any good or service. The theoretical constraints have been applied at a given point in time, over the life span of individuals or even over the history of families. In short,

**Max  $U = f(\mathbf{X}_i)$  subject to  $\mathbf{Y} = \mathbf{E}\mathbf{P}_i \mathbf{X}_i$** , where  $Y$  represents income over some duration, perhaps adjusted for inheritances and bequests and  $\mathbf{X}_i$  the  $i^{\text{th}}$  good or service sold at the  $i^{\text{th}}$  price,  $P_i$  where  $i = 1 \dots n$  contains the universe of available goods and services.

Over time these concepts can be expanded to account for savings and annual consumption patterns measured in net present value terms. As disposable income grows the income constraint rises, thereby allowing for more consumption, leading to higher levels of utility. Economies that fail to perform at capacity forego growth with long lasting effects on the income levels of their populations.

As a theory of individual behaviour, the classical model is limited in that it does not explain how or why individuals of the same age with the same incomes and facing the same prices make different purchase. It gives little guidance to monopolistic competitors and oligopolists, whose competitive strategies are based on differentiated goods, such as producers of automobiles, white goods, telephones and jewellery. It is also difficult to optimize transfers among individuals, since there is no measure for the relative change in utility of the persons giving or being taxed and those receiving funds. Transaction costs of collecting funds and distributing them also need to be considered.

Within this framework, the state provides the general services of *Peace, order and good government*. Its duty is to afford such services at acceptable costs to its citizenry, within acceptable limitations to individual freedom. At least in democracies, citizens have the option of throwing out badly performing politicians. Under the theory's rubric governments also provide familiar social services:

Law and order, including defence and policing;

Ensuring access to certain resources by the establishment of common property rights for all, e.g. the Magna Carta over waters beyond high tide, or for groups, e.g. hunting and fishing rights for native persons and limited access rights for tourists and scholars in the national parks, and with these the responsibilities for maintaining the quality of environmental sinks - air atmosphere, land and water;

Provision of infrastructure, such as roads and railroads, to specific standards;

Schooling in ways that help to maintain law and order in the long term by inculcating the work ethic and positioning individuals to improve their earning abilities as well as to appreciate goods and services as provided by certain communities including fine arts;

Health services, initially, in the quest to curtail plagues and, subsequently, to provide efficient and timely services;

Measures to ensure that extraordinary market power, in the hands of one or a few individuals, is not used to limit trade and unduly influence prices. Greater access to goods and services at lower prices allows more individuals to obtain higher levels of utility, providing that profits suffice to keep those with an element of monopoly power remain in business; and

Income distribution on grounds of security and safety for donors, not altruistic grounds.

In this context, it is legitimate to measure economic output as the sum of the goods and services produced by an economy. While inflation has been squelched and the federal budget balanced, other indicators show that Canada's economic performance relative to the United States has been abysmal:

For every 100 of the labour force age, 15-65 years, the United States has 12.6 more people employed than does Canada at 58.7 persons, over a 21.5 per cent advantage for the United States;

Canadian production index grew by 15 per cent from 1990 to May 1997 relative to 20 per cent in the United States;

American stock exchanges have had gains over the last five years that are multiples of the Toronto Stock Exchange ranging from 2.87 to 4.56 times while Canadians saving for their pensions in registered retirement savings plans have been hamstrung under the 80 per cent Canadian content rule;

Poor performance of base metal prices has shifted global terms of trade against Canada;

Per capita, Canadians had 4.4 per cent less disposable income, spending power, in 1997 than in 1992 while American real disposable income per capita grew by 10.0 per cent; and

The value of the Canadian dollar has declined relative to the U.S. dollar by more than thirty per cent since 1991;

From 1992 to 1998 the gap in real disposable income per capita between Americans and Canadians rose from \$2,885 to \$9,555 CDN; and

With the further devaluation of the Canadian dollar the 1998 differential will be about \$9,555, a difference of \$38,220 in annual spending power, left after taxes, for a family of four!

This recent legacy of declining real disposable income relative to the United States encourages emigration. After subtracting *housing, health, transportation and basic consumables* - e.g. *food* - from disposable income to obtain "discretionary income", married high-tech workers in four of Canada's five high-tech Census Metropolitan Areas (CMAs) found that they were deficit budgeting before they made any discretionary purchases. Personal deficits, prior to discretionary spending, ranged from 5.3 per cent of income in Montreal to 0.2 per cent in Vancouver. Only those in Ottawa had 3.4 per cent of their income left for discretionary purposes. American discretionary incomes for married high-tech workers as a percentage of their incomes were 3.1 per cent in Boston, 31.2 in Austin, 16.8 in San Jose, 40.0 in Raleigh, and 38.9 in Seattle. One of three main reasons given by high-tech workers for remaining in Canada, "High crime rates," is bogus. Canadian crime rates are higher in cities where the high-tech industry is concentrated than they are in their American counterparts.

Seventy-eight per cent of the computer science and engineering students, about to graduate from Canadian universities, are willing to work in the United States, about 30 per cent more than Canadian industry anticipated. Although 88 per cent are willing to move within Canada, the failure of Canadian aggregate demand restricts their choices. Of those willing to move, 88.6 per cent were willing, and many preferred, to go the United States. Their departure to foreign lands diminishes Canada's catch-up ability.

Indicators on connectedness show that 73.7 per cent of Canadians were on cable but only 67.3 per cent of Americans. Whether or not these results are an indicator of health is a moot point. Canada has a higher hook-up rates for telephones, 98.6 versus 93.8 per cent, but lags behind in e-mail penetration at 13.3 compared to 16.9 per cent, and use of computers, 36.4 and 36.6 per cent.

The wonder is that net Canadian migration into the United States has only averaged 15,000 annually since 1990 and was in excess of 18,000 last year. While restrictions on entry into the United States may explain partly why Canadian migration is not higher, the new theory of demand suggests other extenuating circumstances such as higher U.S. national crime rates are also important.

### **New Theory of Demand**

The new theory of demand is very much broader and far more amenable to expansion into the realm of other social sciences, - a social sciences approach to the science of the whole. The new theory of demand posits that individuals maximize utility from the perceived characteristics they

derive from undertaking activities, where activities require consumption of goods and services. Work is a special activity in that it yields income among other characteristics.

Designating the basis of the new theory of demand in bold letters:

$$U = \{ C_j \}$$

where  $\{$  is a set of parameters linking utility to the characteristics,  $C_j$ , that a consumer perceives, where  $j = 1 \dots p$ ;

$$C_j = \{ A_k \}$$

where  $\{$  is a set of parameters tying perceived characteristics to activities,  $A_k$  that a consumer undertakes, where  $k = 1 \dots q$ ; and

$$A_k = P(X_i)$$

where  $P$  is a set of coefficients linking the activities to the goods and services used in undertaking them  $X_i$ , where  $i = 1 \dots 4$ .

So that:

$$U = \{ \{ P(X_i) \} \}$$

Individuals are constrained by their life expectancy, hours in a day, inherited wealth - or lack thereof, abilities, market determined prices and taxes. The new theory of demand makes more explicit connections between the consumption of goods and services and utility. This attribute allows for the integration of perceptual concepts into the relationships among activities, characteristics and utility. The new theory of demand provides a richer context in which to understand personal behavior because it forces social scientists to recognize complexities in relating the consumption of goods and services to activities to characteristics and eventually the derivation of utility. There is a developing literature in perceptual psychometrics focused on establishing perceived characteristics from perceived activities, in other words, measuring  $\{$ . In this way, the new theory of demand and the work in perceptual psychometrics complement each other in throwing-off Schumpeter's constraining definition of issues covered by economics and those excluded. For example, in contrast to Keynes, Schumpeter excluded the causes of war from economic considerations. *In a sense, therefore, we may within the limited range of our investigation look upon wars, dangers of war, revolutions, and social unrest as external factors.* Scholars are returning to the broader philosophical roots of utilitarianism and the traditions of economic historians.

Under the new theory of demand, activities interact. For example, education will influence perceptions and will build networks that will influence an individual's efficiency in converting time to income. Alternative educational institutions deliver different sets of activities and therefore different sets of characteristics and inculcate different values or linkages to individual utility functions. In this context, parents will be concerned about their children's education with increasing demands on public sector institutions, demands for attendance at certain schools with

good reputations, special orientations and private schools. Parents will demand, and the U.S. federal administration is demanding, that ineffective schools close and be replaced.

Further, the students of today have far more access to information data and analysis than did their parents' generation. Anyone who takes a moment to look at today's textbooks or spends an iota of time looking at the web sights available to today's students cannot help but marvel at the richness of material. In short, the educational activity is generating a plethora of characteristics undreamed of by earlier generations. There is an element of growth that is not well measured - \$ is not the same among all individuals and is it not constant over time. What is perceived to be haute culture, this year, will most certainly be out of fashion next year.

The new theory of demand provides stronger justification for regional diversity than does its predecessor. One of the services inputted into an activity is local ambience. It will vary from place to place. The trail from Lake Louise to Lake Agnès in the Canadian Rockies is not the same as the one from Signal Hill to Quidi Vidi Battery nor is either the same as the road from St John's, Newfoundland to Quidi Vidi Harbour. Even though they all take about the same length of time to walk, someone with fond memories of St. John's and no knowledge of Lake Louise might well gain more utility from either of the Newfoundland hikes than the one in the Rockies, strange as that might sound to mountaineers. Despite the similarities in the activity of "Hiking" in time and effort, individual \$s are different.

Regional and national allegiances can be based on individuals' abilities to garner more characteristics from undertaking activities in their region than elsewhere, thereby explaining why even economic beings do not always move to higher income areas, measured in monetary terms. Since monetary differences may be less than differences in utility, it also makes less convincing the case for transfers based on income inequalities. Such transfers prolong income inequalities and delay labour force adjustments that explain some of Canada's pathetic under employment relative to the United States. Alternatively, Canadians may be making trade-offs between work and leisure that give greater emphasis to leisure than do Americans. While lower participation rates in Canada would support such a hypothesis, higher unemployment rates and sustained net emigration to the United States suggest that the failure of aggregate Canadian demand policy is also responsible for the income gap. For the last decade, Canada has remained well above what Harry Johnson, writing a generation ago, would have deemed remotely acceptable performance. To him, five per cent unemployment was an abhorrent failure of Ottawa, its bureaucrats and, ultimately, the Canadian electorate.

Earning income is an activity that can be augmented at the expense of other activities or by increasing productivity. Individuals can change their activities to include ways of generating more income. In doing so, they may give-up other activities that would have cost them money. The reverse is also true. They can also relinquish income to pursue other activities. Work activities also differ from the rest of the activities set. In addition to the characteristics that individuals receive from the work activity - camaraderie to headaches - that activity also produces goods and services that feedback into the system when they are consumed by others or delivered as capital goods.

More importantly, how does growth occur within this view of the world? Clearly, societies can become more innovative in producing and distributing a fixed set of goods and in doing so

producing either more of them or as much of them with less time and therefore garner increasing amounts of leisure time. In the model, this type of innovation is captured by changes in P and reduced levels of X devoted to production, facilitating conservation of materials and growth simultaneously. Early retirement, shorter workweeks and higher unemployment are all indicators of increased leisure time, albeit they are not evenly distributed. Of this growth only increases in Xi get measured as "growth".

The second manner in which growth occurs is in production of new, often undreamed of goods and services, including logistics. Innovations add new goods and services to those available. In moving into this century, did many of our forefathers foresee the reality of hand-gliding (Daedalus and Icarus dreamed of it but few believed them), a man on the moon, the massive communication system that services North America based on fractions of microns or the Concord? Yet, price changes on new products and services are only measured as part of real growth once they become established in the marketplace. Accelerating growth increases the market share of new goods and services relative to the total and therefore the share of the economy excluded from price adjustments for real measurements. Thus rapidly falling prices during the ramp-up for demand in products are more frequent than in the past and deflators reflect less of and less of market place activities.

Further education, mass communications and experience contribute to growth because they improve awareness - linking activities to characteristics and therefore individual's ability to derive utility. Other than in increased wages and salaries to educators, this increased productivity goes unmeasured.

Searching for growth is rather like hide-and-seek, if you don't look in the right place you don't find it. By measuring only increased output in Xi adjusted for inflation on established products, with minor annual additions of new goods and services, there is much that goes unmeasured, including environmental degradation and cleanups by volunteers.

### Measuring Growth

The new theory of demand impacts on how inflation and growth are estimated. Under it, when individuals purchase a good or service, they are in fact purchasing things that will allow them to undertake activities that yield a set of characteristics. Among similar but marginally differentiated goods, like autos and computers, economists are then in a position to estimate annually the shadow prices on characteristics since:

$$P_{it} = E \sum_j 2_{jt} C_{jt} P_{it}$$

is the price of the ith good or service in the i<sup>th</sup> year and C<sub>jt</sub> is the j<sup>th</sup> Characteristic in t and 2<sub>jt</sub> its shadow prices, determined by econometrically derived parameters, i.e. the value of the characteristic. The product is summed by j for any given year t.

Hypothetically, consider the price and characteristics of an average laptop computer bought four years ago. It could have had the following shadow price equation where t =1995:



**Plaptop = \$1,500\*( A GIG OF RAM) + \$.20\*(GIGS OF HARD DRIVE) + \$700\*(SGVA SGREEN) + \$300\*(MICROSOFT 95) + \$2\*(PER PENTIUM RANKING)**

A one-gig laptop with 30 gigs of memory with 200 series Pentium chip would then be priced at \$3,900. By 1998, the re-estimated price equation might well be as follows:

**Plaptop = \$700\*( A GIG OF RAM) + \$.10\*(GIGS OF HARD DRIVE) + \$500\*(SGVA SGREEN) + \$150\*(MICROSOFT 95) + \$150\*(PENTIUM 200)**

The same laptop in 1998 cost \$1,950. But the old style laptop is not what the average consumer buys in 1998. The average consumer now buys a laptop with 3 gigs of RAM, 60 gigs of hard drive, Microsoft 98, shadow priced at \$300, and a Pentium 266. From the above equation, its price is \$4,000. Under the old way of measuring inflation, the prices of laptops would have been deemed to increase from \$3,900 to \$4,000. If the value of laptops produced in Canada tripled from \$5 million to \$15 million then the real growth measured by the conventional measures, without taking the improved characteristics into consideration would have been  $[(\$15,000,000/\$4,000)/(\$5,000,000/\$3,900)] - 1$  or 1.95 times. Taking the new theory of demand into account the price of the same bundle of characteristics has fallen from \$3,900 to \$1,950. Consumers can now buy twice as many laptops of the 1995 variety as they could in 1995, real growth of a 100 per cent based on improved technology alone! In total real growth would be:

$$[(\$15,000,000/\$1,950)/(\$5,000,000/\$3,900)] - 1 = 5.0$$

Real growth is more than 2.5 times that measured by methods that do not take improved characteristics into account. To their credit, Statistics Canada now measures the real growth of the computer industry in this manner.

When businesses purchase computers, they increase the stock of capital with the incremental real stock of this type of infrastructure being twice what it was three years earlier for nearly the same dollar outlays. Given similar improvements in all computers, in those industries where computers constitute a major share of the capital investments the real capital stock has been rising quickly.

Where this process runs into additional trouble is that the real output of most industries is not measured in this manner. For example the productivity of banks is measured by their ability to widen the spreads between the interest rates they charge customers and pay depositors, with no reference to changed services. Yet, bank machines have increased access for customers not only to 24 hours a day, but throughout many parts of the world. For example, 18 per cent of the Bank of the Montreal's revenues was from electronic commerce. The value of these new services to bank clients is not taken into account in estimating the banks' real productivity. Similar faster processing of transactions, arising from computerization, is allowing banks to lower the spreads and still make substantial profits. When one takes the next step and observes the real growth of productivity in banks relative to real capital employed, the results are absurd. The banks' new investments have been focused on electronic systems where the real series captures the improved characteristics of the equipment in the denominator that shows significant growth. Yet the numerator remains devoid of new services and therefore does not pick-up many of the additional services arising from the improved capital infrastructure. We measure slow or declining growth in output per dollar of real capital stock, when bank profits show the opposite!

Real output figures are not credible and will not be until the output of all industries is deflated with hedonic indexes based on characteristics under the new theory of demand. Even then look for the other hidden avenues in which growth is occurring, particularly in links between goods and services and activities as well as activities to characteristics.

### **The Emerging Knowledge Economy**

Describing the emergence of the knowledge economy as a paradigm shift through which society transcends every hundred years is too soothing, because it implies that societies will settle down to some steady state of growth in a generation or so. This section argues that the forces for change unleashed at the end of the 20th century auger for prolonged and accelerated innovation of unprecedented duration.

Although it has grown out of Schumpeter's theory of role of innovation as the key factor influencing business cycles, the knowledge economy differs fundamentally from innovations focused on reducing inputs in that there are:

*Endogenous technological changes* - R&D involves costly processes undertaken to a large extent by firms, or under their sponsorship, in pursuit of profits and therefore is planned to respond to markets and expected markets with high fixed costs and associated risks;

*Increasing returns to knowledge;*

*Path dependent innovation rather than reversible;*

*Growth cannot be stopped everywhere* - however patterns and pace can be influenced;

*Technology solutions to problems of poverty and environmental stress;* and

*Accelerated dispersion through mass communications and, increasingly, teaming operations.*

The knowledge economy comes by its title legitimately. There are more people than in any earlier times who are better educated. Fully 90 per cent of the scientists the world has ever known are alive today. Their presence and the continued growth of the scientific community around the world establish an incredible catalyst to accelerate growth. Scientists not only facilitate planned innovation by industry, but also, with increasing implementations of digital communications, accelerate its dissemination and adoption. The continuing growth of the scientific community and global adoption of digital communications spreads ownership and ensures that, the dynamic will continue to be an accelerating force. New, undreamed of, goods and services will be part of the next generation's day-to-day lexicon.

While the most recent UN projections of population growth are more modest than they were in the previous incarnation, there is nothing in them to indicate any slowing down of the global spread of innovations. On the contrary, the slowdown in population growth could facilitate investment in human capital in developing countries, thereby, speeding-up the adoption of new technologies.

## **Governance**

The major genesis of global growth is then in knowledge investment for the provision of products and services that are new to the populations being served. Innovations will include effective sanitary and water systems for the vast majority of the world's population, adoption of modern communications and information systems as part of the base for the knowledge economy. The use of this knowledge in wise and efficient ways is and will be critical to the efficient development of nations.

Critical too will be the choice of "National" projects that individual countries pursue as vehicles to propel their technological presence into international markets. Richard G. Lipsey and Ken Carlaw have surveyed the history of such projects among developed nations. Clearly some "Investments" of this nature have been economic flops with debilitating impacts on their respective economies. For example, technically excellent though the Concord is, this French-British venture, with its wide turning radius that limited airports at which it can be used, is also an economic disaster. Canada's failure in the Beaufort Sea has been an illustration of technical excellence in island building and icebreaker technology and a financial disaster - virtually no production from the billions of dollars invested there, compared to good returns from investments in the more conventional Western Sedimentary Basin. Contrary to government PR releases, but implicit within its policies of national champions - Spar, Bombardier and Dome Petroleum, picking winners is important! Canada has not always chosen well.

Lipsey and Carlaw derived certain policy lessons from their analysis of successes and failures of innovation policy. Their science policy insights can be summarized:

Large leaps are dangerous;

Policy makers need to be aware of interrelationships between technology and structures housing R&D and incubation processes;

Risks should be spread, by encouraging many diverse experiments;

Induce and co-ordinate pre-competitive R&D and unleash competitive innovations;

Prestige should be a project outcome, not the objective;

Multiple objectives are dangerous - too easy to digress and loose focus;

Pursue incremental innovations;

Acquire tacit knowledge; and, this paper adds;

Avoid making past support a criterion for ongoing protection.

## **Governance Issues**

Fundamental governance issues which need to be addressed:

Governments need to facilitate growth in general and most certainly in areas that complement better management of environmental common sinks and education, necessary to participate in the knowledge economy;

While standards organizations can facilitate trade in the short term, the potential for regulations and standards to become barriers to innovation in the longer-term is large and needs to be avoided with rapid amending processes to adjust to new technologies - governments must do better than the 10 years it took to get international acceptance of digital communications standards;

Governments need to have capital accounts and targeted gains that are publicly available and open to examination by Auditor Generals;

Governments need to make efficient use of the new technologies;

Governments can assist growth by funding over-the-horizon research and being early adopters; and

Governments need to do a far better job of recognizing contributions that new products, including upgrades to existing products, make to economic growth.

Governments can facilitate growth by reviewing and frequently updating codes and regulations in order to allow use of new environmentally friendly processes and materials. Building codes, in particular, need to stress the objectives of the codes that need to be met rather than certain products per se. High-powered cements that are nonporous, longer lasting and required in smaller volumes, with less environment degradation, than conventional cements have been available for at least five years. Codes need to be changed quickly and contractors trained in the use of new and advanced materials and technologies with respect to heating, water and wastewater. Other new materials, pharmaceuticals and innovations will continue to proliferate on international markets and need to be tested and positioned for early adoption.

International regulations and standards are double-edged swords. They facilitate international communications and trade by ensuring that national communications systems interface seamlessly with each other. Similarly, they also ensure consumers that they are purchasing goods and services not only of a uniform quality but also ones that have been produced with environmentally friendly and safe methods. These are lofty and sound objectives to which the developed international community aspires.

Adoption of these regulations and standards by developed nations is however made difficult by special provisions for developing nations, allowing them either to avoid or delay implementing them. U.S. Senators are legitimately worried about the flight of investment dollars and American jobs to regulation free countries. The Kyoto Protocol's failure to meet this international test of universality may inhibit U.S. acceptance, and lead to its subsequent collapse. As Janet Yellen, Chairperson of the Council of Economic Advisors to the President informed the Senate, The President has made it clear that he will not submit the Kyoto Protocol to the Senate without meaningful participation from key developing countries (who are not included in Annex I). The U.S. administration's stance is supported by projections of business as usual scenarios indicating

that after 2030, the majority of the world's emissions will come from the developing countries of today and competitive advantages that Kyoto would confirm upon currently excluded developing countries. Manufacturers in developing countries use inferior fuels, unavailable in the United States, so that industrial shifts to the developing world exacerbate global environmental degradation. Understandable though the reasons for provisions excluding developing countries are, they will delay adoption of the Kyoto Protocol.

Chart 1 gives an international update of the adoption of ISO standards. Even though Canada had a higher percentage of its businesses registered in 1997, than did the United States, North American new registrations trail Europe and the UK. Chart 2 indicates that considerable catch-up is required.

Even if ISO provisions and those of the World Trade Organization (WTO) are accepted, there will be an ongoing need to revise and update regulations and standards to accommodate new materials and equipment and changing demands on systems. For example, as video and text take-up larger and larger shares of the communications network, there may be a need to reallocate bandwidth. It is essential that the world's economic growth not be delayed by anachronistic international standards and regulations which some nations have vested interests in preserving as barriers to trade and innovation. In the brave new world of rapidly evolving innovations anachronisms will materialize at faster rates than heretofore imagined. The international community must be prepared to be flexible in recognizing them and moving to facilitate adoption of new and improved technologies. Simultaneously, all potentially impacted firms need to be informed as soon as possible of pending changes in order to transfer tacit knowledge about such discussions and allow them to adjust intellectual and product capital to meet new and evolving standards. Without that openness to change, governments will become barriers to both growth and the adoption of environmentally friendly innovations. The new role of government is to openly facilitate these information flows efficiently using the communication tools of the new economy.

As part of the conservation thrust, to say nothing of responsible governance, governments must be accountable for their investments. It is ridiculous to run a mixed economy in which the private sector is responsible to shareholders to meet hurdle rates of 12 to 24 per cent, dependent on the risks involved, where the public sector has no proper accounting of either many of its assets or their performance. Yet, some special operating agencies and some Crown Corporations aside, that is the system we have in this country. Governments expense capital projects and then do not assess the revenues and benefits that they generate in terms of the return on those assets. Operating revenues may be known, as are the costs of operating a facility, but they are frequently not divulged and rarely if ever involve a true capital charge.

Such capital charges should be against the current market value of the asset used in an operation. The current value of government assets is what the market would pay for them now. Both the initial purchase price and replacement values are poor proxies.

While there can be special cases where government investments should meet lower hurdle rates than those of the private sector, e.g. social benefits that exceed private ones, those differentials simply need to be factored into the assessments of the viability of each investment. Privatization

is clearly one option, but it can be non-optimal when social benefits from operations exceed social costs.

Adoption of new technologies by governments can facilitate more efficient governance. Among the leading candidates are increased use of ergonomic offices, adoption of electronic information systems and intelligent use of them and improved environmental modeling and control.

Used on a shared basis, acceptable ergonomic offices minimize space-needs and retrofit costs and encourage the use of home offices, with the commensurate decreased commuting costs and environmental degradation.

Canadian libraries have been international leaders in the adoption of electronic information systems and embryonic web sties. Yet, there is much more to be done to yield massive improvements in areas such as healthcare. Home care workers are experiencing productivity gains of up 16 to 25 per cent through the use of laptops. They simply do not have to spend hours inputting what in any other industry would be called, tombstone data an average of eight times per call. More importantly, the quality of service is improving because the data are legible and transmitted to both requisite hospital libraries and to personal physicians.

With the exception of cat-scans, patients can now have their entire medical records on a smart card so that if they arrive at emergency comatose, doctors will have access to their medical records. Further, medical libraries of the future will be based on fractal technologies. These new technologies will allow epidemiologists to analyze data, without first decompressing it at speeds 1,000 times faster than in real time. With medical libraries and analytical capabilities, such as these, the HIV plague might have been avoided.

Legibility within hospitals and the ability to instantly analyze new prescriptions for conflicts with extant medications will also lower the odds of patients receiving incorrect drugs. Further, outmoded X-ray technologies and the legal requirements to retain them for at least 15 years can be replaced by compressed digital images, a savings of about \$80 million per large hospital in recoverable silver from stored X-rays. Nurses will be able to spend more time on the wards with patients and less than 70 per cent of their time doing records. The citizen's message to health departments should be clear "Quit throwing good money after bad and start investing in and sanctioning efficient-lifesaving technologies and records systems. Get quantifiable returns on taxpayer's investment dollars, in both health and economic terms!" To their credit departments of health are moving in this direction in terms of infostructure, if not accountability.

Within the knowledge economy, labour and its productive growth is essential. Employers must position their employees to derive increased positive characteristics from their work. Consider what Microsoft is really saying to prospective employees when it gives them the option to decide where they want to work. It is saying, "Go live where you can derive the most positive characteristics from the community's lifestyle." - perfectly in harmony with the new theory of demand.

There are of course other mechanisms for increasing the positive characteristics engendered in the workplace:

Improved sense of pride;

Better ambience, including edifying people and personal touches;

Recognition of excellence; and

Financial recognition and rewards.

The government needs to be clear to the public and to its employees about the services that it is providing. Every civil servant should know beyond a shadow of a doubt about how they are serving the Canadian public and get the resulting feedback. They need to comprehend both their deliverables to a project and how that project will contribute to the public good. How will Canadians derive characteristics from the project that will contribute to their utility? Canada's National Research Council (NRC) has that sense of mission.

One way of serving the public, in the context of the knowledge economy is by making information available to the public electronically through logic trees that users find easy to use. Canadian governments to their credit, have been making huge strides in this direction with their Schoolnet as one of the better known sights and, in co-operation with the provinces, Health Canada's web page as one of the best organized and informative sites. While e-mail is one vehicle for dissemination of this material, it is not the only one. Broader audiences can be reached through training sessions at major malls using sophisticated electronic kiosks - upgraded versions of the Presidents Choice/ CIBC venture of financial advice at the Loblaws stores.

The debate also needs to begin about the use of the Internet as a vehicle for soliciting public opinion. The last Quebec election made the pollsters look a little silly. They missed the effectiveness of Mario Dummont's appeal to the youth vote in the debate, perhaps because it is not the youth of the province that answers their questions. One way to overcome that bias could well be to conduct some interviews over the e-mail to reach the youth where they communicate. In small community matters, it may also be possible to have community-wide votes on key issues. How far this basically demographic approach can go is a matter of debate, since citizens may not want to spend their hard-earned leisure time on governance but would prefer to have their governments govern.

The NRC is continuing to make strides in developing over-the-horizon research and in encouraging its own personnel to participate in new ventures in order to accelerate adoptions of their technologies. That history has been well chronicled by Denzil Doyle. The NRC is also expanding its operations to assemble information on R&D around the world for dissemination to Canadian business, particularly small and medium sized businesses, that are not well positioned to undertake their own international intelligence. Due to the preponderance of Canadian R&D carried out in government laboratories, as opposed to private sector ones, mechanisms to accelerate scientific findings from the bench to production lines are particularly crucial to Canadian technological leadership and need to be examined and constantly improved vis-a-vis all federal laboratories. Efficient transfers of these technologies will require flexible human resource management under which experts can work with firms to ensure efficient transfers of tacit knowledge during start up.

## Conclusions

The knowledge economy is giving the world unprecedented intellectual prowess to develop new goods and services on a global basis at accelerating growth rates. That situation is producing both the need for and the technological capabilities to monitor and manage environmental sinks with care, rather than the not so blissful ignorance of the past. If world governance is to be successful in managing these opportunities, the pace with which it recognizes and adopts new technologies will need to quicken. The objective is to meet the safety challenges of evolving technologies while, nevertheless leaving them as unfettered as possible to service mankind revealed by consumers exercising choices in market places, including those in cyberspace. The challenge is also to fully understand the microcosmic environmental linkages and how to husband, especially the commons.

The new theory of demand,  $U = \{P(X_i)\}$ , gives clear guidance in how governments can better contribute to the well being of Canadians:

Providing, or at least assisting in the provision of, goods and services where the social benefits exceed the private benefits - e.g. management of offshore resources, highways, educational facilities, defence and policing and the health care system;

Accelerating the transition from innovation to market including government approvals and the revisions to international codes as appropriate;

### ***Improving P by:***

Undertaking the same activities with fewer resources - e.g. adoption of ergonomic offices;

Changing the mix of resources to undertake more activities efficiently - e.g. the home-care nurses and electronic health records and databases;

Undertaking new activities for which " and \$ are sufficiently positive so that new activities add to Canadian utility in a manner to justify the costs;

Returning savings back to taxpayers in order to allow them to make their own choices and reduce incentives to emigrate;

Education directed at improving productivity including information systems designed to enhance performance - e.g. the internal training systems of many companies such as the banks and automobile companies;

Adoption of safe and up-to-date standards;

### ***Improving \$, while avoiding brain washing, by:***

Advertising campaigns that alert the public to certain dangers - making people aware of the health risks of smoking, drug abuse, land mines, faulty products etc.;



Educational campaigns to enhance citizens' awareness of positive attributes on topics ranging from new technologies and the country - heritage vignettes, tourism advertisements and the rare positive TV programs - e.g. On the Road Again;

Giving people ownership over their communities through expanded opportunities to volunteer in meaningful ways; and

Formal education that increases students' abilities to derive enhanced characteristics from a lifetime of activities;

***Enhancing " by:***

Edifying people;

Building pride in what people are and do; and

***Decreasing the constraints on citizens by:***

Opening-up competition to protect consumers from predatory pricing arising out of monopolistic situations;

Prolonging life through cleaner air and water and managing the environmental common sinks;

Improving access to resources, renewable and non-renewable;

Better and more efficient healthcare;

Freedoms of speech, mobility and the exercising of consumer choice; and

Good international relations.

It is also clear that many of these aspects of growth are not well measured, except for changes in the goods and services and, in rare instances their shadow prices. In particular, in areas like the civil service and education, where GDP is measured by the inputs, rather than the outputs, increasing productivity may even be measured negatively. Similarly, improved productivity in financial intermediation, revealed by lower spreads between lending and borrowing rates, affects real GDP negatively. Social benefits, such as cleaner air are not well captured, nor are those arising from volunteer activities. It is therefore not surprising that what is measured as "growth" does not appear to be yielding the expected growth and that productivity figures do not capture much of the growth that may be occurring.

Leading European thinkers about the knowledge economy stress the shift from work to volunteer activities as being crucial to individual and community growth. From a humanist point of view, volunteers not only provide services to communities but also obtain similar peer group characteristics that many are accustomed to deriving from the work activity. European thinkers anticipate fewer, not more jobs, in the knowledge economy as mankind accepts productivity gains in the form of increased leisure time. This shift requires a more comprehensive approach to the social sciences.

As populations age in both North America and in Europe increased leisure time is being absorbed by seniors. Their volunteer activities, Meals on Wheels and other service club functions, provide services that would otherwise be at least partially carried out by the employed.

Higher rates of unemployment in Canada than in the United States and Canadians net emigration to the United States reveal individual preferences for deriving positive characteristics from work, inclusive of income, net of what individuals could receive from work or government benefits by staying. Vast differences are emerging in disposable income levels between Canada and the United States, largely because of higher American participation rates. Combined with greater international mobility of labour, these reactions suggest that higher tax burdens, inflicted by increased transfers, erode precious human resources, crucially for the knowledge economy to flourish. Their exodus is an up-front loss in Canada's knowledge investment. The fear is that policy makers will impose additional constraints on the freedom of individuals to migrate; thereby, denying to individuals the hard fought freedoms of mobility under the free trade agreements and the essence of economic growth - freedom of choice. The correct policy response is to reverse and close the widening abyss on disposable incomes between Canada and the United States, for example by cutting taxes.

Measured or not, the genie of the knowledge economy has unleashed a chain reaction powered by an abundance of scientists and proliferating communications capabilities that are only in their infancy. Further, there is little reason to believe that Americans are better, or worse, at measuring growth in all its guises than are Canadians. Canadians greater connectedness through cable television gives a platform for optimism concerning Canada's ability to realize increasing advances within the knowledge economy.

The National Accounts are not adequately capturing growth. Nevertheless, measurements of the relative performance of Canadian and American economies by national account methodologies and emigration to the United States send serious warnings to Canadians concerning any abandonment of its connectedness, jobs and growth strategies, albeit the environmental imperative needs to be met. President Clinton's unambiguous stance on the need for broader adoption of Kyoto by developing countries should be supported on both economic and environmental grounds.

Countries are not measuring well the growth they are realizing from the knowledge economy. The New Theory of demand gives a more comprehensive framework that has the ability to take social sciences closer to the realm of the whole rather than the parts. By capturing perceived characteristics and changes in them that can be both negative and positive, the framework of the new theory of demand can reveal the relative weights that mankind is placing on environmental issues.

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