

Global Complexity New Opportunities

Jim Collinson



Energy-Environment-Economy

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Global Complexity – New Opportunities

ENERGY - ENVIRONMENT – ECONOMY

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Executive Summary

The recent noticeable convergence of many different yet related factors makes it feel as if the whole world is moving under our feet. At times in the past, changes appeared to introduce complications: now it seems more complex. Many changes are occurring together, and for perhaps the first time, these changes are affecting a broader range of people. At every turn, they face a problem that seems somehow to be similar to and as overwhelming as all the others. Intuition based on past experience and ingrained reductionist training tells us problems should be able to be broken down into neat pieces and addressed as individual problems. That is no longer a solution that works. Complexity now brings all factors together more than ever before, and every problem (or even solution) is just a dot on a very large and

¹ Jim Collinson (Agricultural Economics, U Manitoba; Resource Economics, U Michigan) is a management consultant specializing in research and strategy in the complexities surrounding energy/economy/environment issues. Consulting followed 30 years in senior public service positions in the Manitoba and Federal governments.

Clients have included medium to large businesses (e.g. Spar Aerospace, Ecoscapes, Ontario Horticultural Industry, Hobbs and Associates, Canadian Air Transport Association), government departments (e.g. Alberta Industry, Newfoundland and Labrador Rural Development, Auditor General for Canada, Privy Council Office, Industry Canada) and international (World Bank, FAO, Government of Venezuela).

Jim's federal government experience included heading Canada's delegation to the OECD High Level Committee on Environment and Economy, and two terms as President of the UNESCO World Heritage Committee. He was Assistant Secretary to the Cabinet; headed Parks Canada for five years; was responsible for Canada's State of the Environment Report; Assistant Deputy Minister for Regional Economic Development for Western and Northern Canada, including responsibility for PFRA; and Assistant Deputy Minister for Industry, Science and Technology.

Special research and policy assignments: chaired the Neilsen Task Force Program Review for Aboriginal Programs; reported on the social and economic impact of the Churchill and Nelson Rivers and Lake Winnipeg Regulation Hydro-Electric Project; established the Native Economic Development Fund (now Aboriginal Business Canada); and carried out research, policy and program development work leading up to the Federal-Provincial Rural Development Agreement on Manitoba's Interlake region and another on Northern Development.

Other responsibilities included Assistant Secretary to the Manitoba Cabinet responsible for federal-provincial agreements; Assistant Deputy Minister for Mines, Resources and Environmental Management for Manitoba.

intricate web that does not react in a simple linear fashion. This complexity process guarantees change through time: time does not change it, change occurs as time passes.

Fortunately, the ecological system that makes up the entire planet (the ecosphere) is so complex that it dampens the impact of individual actions outside the immediate location where the action took place. Thus, anthropogenic activities have had their impacts dampened through time without major disaster. Cumulative effects and the magnitude of actions, however, may run the risk of overwhelming the beneficial functioning of complexity if care is not taken.

This is the world of complexity: everything is related, everywhere, all the time!

With the exception of radiant energy from the sun and gravity effects from the moon, whatever exists on earth today has always been here. The earth may have cooled, some parts moved about (as in continents), and materials may now be in different forms and locations as a result of both natural and human activities, but what's here now has always been here. In this context, the major issues facing most countries and their populations today can be categorized into three major areas: economy, environment and energy. In this complex world, with everything interrelated, these now need to be seen as interconnected issues, not separate ones, and thus considered together. Regardless which issue initially appears to be the problem, the other two quickly come into play.

Energy has risen in concern due to shortages and security worries, and has become a lever for countries or companies to use to improve their economic or political positions. It has also become a concern, in particular in relation to oil and coal, regarding the apparent impact of its extraction and use on the environment.

Environmental concerns have coalesced around the issue described as global warming driven by greenhouse gas emissions, perhaps at the expense of other environmental matters such as land use and toxic chemicals. Opinions vary as to the relative impact of anthropogenic activities in the context of climate change. However, there seems now to be a conventional wisdom that greenhouse gas generation has become a key factor in observed weather and climate events in recent years. This concern has resulted in decisions, global in nature, to address

greenhouse gas emissions, making it a direct factor in all economic and energy considerations.

The current global economic recession has drawn the attention of virtually all governments, and impacted companies, unions, working individuals and retirees, as well as third world countries that rely on others for outside aid. As the recession shifts back into growth, most economies will find their structure will have to be modified to remain competitive in a changed world. The auto industry is only a simple but obvious example. Growth in jobs will obviously lag other indicators and will be the final measure that the recession is being left behind, but underlying the structural adjustments necessary are the obvious adaptations necessary in the skills that will be needed for the post recession economy. Longer term visions are essential to adapt to changed realities: short term tactics to satisfy the immediate interests of shareholders/stakeholders will lead to greater recessions and other disequilibrium in the future. Environmental factors will impact energy pricing and options, and open up opportunities for new processes and products, and strongly encourage all outputs, including what has previously been considered waste, from economic activities to be in a form suitable for inputs to further economic activities.

Management, in the broadest sense, will have to undergo a sea change. Complexity will reward new perspectives in governance that embrace greater reliance on collegiality, analysis and objectivity in developing a long term strategy for directed change. Governments, companies and other organizations will find that by taking a more comprehensive and longer term view of issues, they will be more successful. This implies, in many cases, ensuring that planning processes encourage “outside the box” thinking, and a multidisciplinary mix of skills and perspectives that will give confidence that all relevant aspects of complexity are given appropriately consideration.

Inherent in this planning and governance process is a structure of inclusion: the opportunity for all interested parties to be involved in contributing to decision-making by involvement in the process. Interested and affected parties, depending on the issue, could include, in addition to management (could be Cabinet or senior level committees in a government setting, Boards of Directors or senior committees in a corporate setting, etc.) include knowledgeable people from

universities, unions, public interest groups, and /or individuals with appropriate expertise: a more horizontal rather than exclusively vertical involvement and contribution to the solution. Such inclusion permits all perspectives to be considered, but the atmosphere needs to be collegial, not combative (attitude shift for all parties). Lobby groups would have an opportunity to understand and contribute their knowledge on all the issues involved in a decision or strategic approach. To the extent that cooperation and careful listening to understand all points of view are valued, the process will be successful. The resulting compromise will be a win-win-win situation. Confrontation will, in the long run, be to the detriment of all, as short term, narrow self-interest solutions will position organizations to become less competitive with time. Other more horizontal and inclusive organizations with longer range vision will have worked out their differences and found ways to be more competitive and consequently, successful.

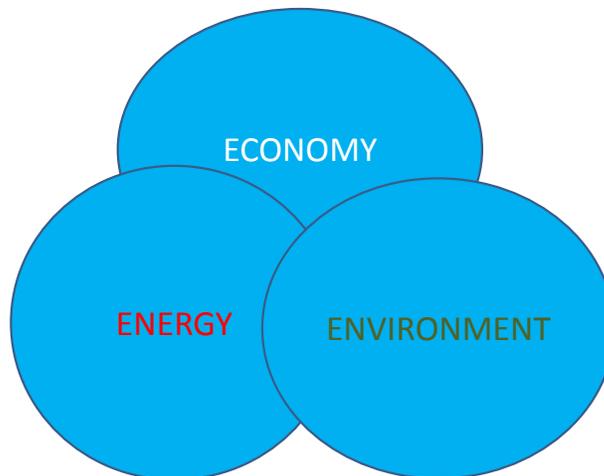
PART 1

Global Complexity is the New Reality: Introduction

Energy, Environment and Economy are priority issues for senior management in political, business and special interest organizations. Not surprisingly given the pervasive nature of the impact of these combined issues, it is also a central topic around coffee shop and kitchen tables. Although most often treated as separate entities, it is becoming clear that they are part of a complex set of interrelationships at a global level: Global Complexity!

Attempts to break these elements down are frustrated by the inter-connections as shown in the diagram below. Attention to all variables all the time will become the new challenge for management.

Figure 1: Management Challenge



Management challenge:
Everything inter-related, everywhere, all the time

Energy

Peak Oil: apparent scarcities of crude oil in different forms have brought uncertainties to economic activity through higher prices. Energy security has become a serious concern in many parts of the “developed world” due to uncertain pricing methods and threats from certain oil producing nations. It’s not just a separate energy issue because the “waste” by-products, including CO₂, are believed by conventional wisdom to contribute to “global warming”.

Environment (climate change)

Global Warming: argued to be caused by excessive release of CO₂ and other greenhouse gases into the atmosphere. Models suggest potential sea level rise from melting land based glaciers and ice sheets, and other climate changes including more devastating storms. It impacts current use of oil and coal for energy, increases costs and forces a rush, not always efficiently, into alternative forms of energy, pushing prices even higher.

Economy

Economic Recession: blamed by most on excessive optimism and irresponsibility in the global financial sector. It was initiated in large measure by unsecured credit in the US, but can also be traced to uncertainties and cost and price rises/fluctuations in global energy markets, particularly oil. In the longer term, a drop in unemployment will indicate movement away from the recession, but economic structure will change significantly, in part due to economic factors, but in many respects as a result of environmental concerns and shifts in energy sources and applications.

Synergy/Interrelationships

The effect of these combined global issues occurring simultaneously and being so interrelated may be an advantage. First, the recession has reduced economic activity so that the “breathing space” can be used to think through options, and begin to adapt to the complexity manifest in the interrelated issues. Second, the security/price issues surrounding oil provide an urgent incentive to consider options in a planned and coordinated long term fashion. Finally, it provides an opportunity to examine the processes that have led to the production of a considerable range of undesirable by-products (pollution in all its forms). These processes themselves can be modified under a new philosophy whereby the processes themselves create products that suit a particular need but are in forms that can later be “inputs” to other products, thereby eliminating “waste”.

Globalization

Real or myth, conventional wisdom now supports the notion that human activity has led to increased release of greenhouse gasses to the point where global warming impacts have resulted. Sufficient energy and policy decisions have been taken to date that it is now crucial to ensure that intellect and technologies are

focused on better use of materials and more careful product design. Rather than “input-output” , the new complexity model must ensure that what has to date been classified as waste becomes “inputs” to further modification and product development in the closed system of the ecosphere .

It is important to understand that everything is interrelated, everywhere, all the time. Globalization of trade has evolved to the point where most sophisticated products have components that came from many different countries in the world. For example, minerals might come from Africa, Asia, North or South America; labour from many different countries in more than one continent; production of components in and of material from different nations; with partial and final assembly in several locations; and ultimately transportation of components and final goods to markets around the world. In economic terms, this has strengthened economies all over the globe by taking advantage of their various strengths, resources and interests. But, it has also made them more interdependent and thus more susceptible to global “economic diseases” such as credit crunches and recessions, even though over the longer term everyone benefits.

Evidence shows the global climate has gradually warmed, at least up to 2005, corresponding in some measure to the period of rapid increase in industrial activity in the recent centuries. Some argue it is directly related to this industrial activity and the effect of greenhouse gases holding radiant energy from the sun within the ecosphere. Geological evidence, others argue, shows that climate has varied considerably over thousands of centuries, and that the current warming trend is part of that process. Yet others note different climate depending on sun spot activity. No doubt, the debate will continue, more data will be collected and analyzed, and models will be revised and improved. This issue is truly a manifestation of global complexity, and perhaps a good example of how difficult it is to understand. Clearly, the processes of climate change are not linear, and in large measure are due to natural and very long term (geological time) cycles. For some there is a lingering sense that anthropogenic activities may well have had an effect, and for others there is simply no doubt at all. Of these latter, some argue from large masses of scientific evidence and analysis, others from an almost religious type of dogma that does not permit debate. Perhaps it doesn't really matter who is right or wrong: it may not be that simple anyway, but significant actions now underway make the argument almost irrelevant.

Alternatives to current energy sources need identification and development, taking care that they in turn do not cause other or even greater problems. Ethanol production from agricultural land, for example, has proven to be a significant misallocation of resources, impacting the food supply and prices, and yielding energy not especially helpful in reducing greenhouse gas emissions. Recognition of the differences in energy efficiency and output characteristics (wind turbine energy generation varies with wind velocity, so transmission acceptance and energy management must take this into account; nuclear has tremendous future potential, but public acceptance/understanding of very limited risks needs recognition; solar energy needs considerable improvements in efficiency, hydrogen production requires significant energy itself, etc.)

To expand on the fact that everything is related, everywhere, all the time, consider **pollution** itself. Contaminants in the air eventually fall to the ground or into the sea or lakes. In turn, it affects plants, animals and fish, to use a simplistic example. Those contaminated plants or creatures are subsequently consumed by other animals or by humans, and the resulting concentrations over time can lead to illnesses that impact productivity, to say nothing about quality of human life.

Population structures and numbers are important in this equation. As human populations grow, their consumption increases and their “emissions” increase accordingly. Technology has helped extend the collapse of humanity from food shortages, but can it protect humanity from their own follies in the production of pollutants and their excess consumption of resources? At some point everyone needs room to stand, sit or lie down, so there are obvious limits to population growth, even if food is available. But what about the life styles people aspire to have? Some countries, including China, have made considerable progress in controlling population growth. In turn, this, like every other solution, becomes another variable in the passage of humanity through time, and is leading to anomalies in the demographic structure of that country that will imply further adaptations to meet the consequences. India, on the other hand, is facing increasing difficulty from the huge poverty cohort associated with unlimited population growth. That in turn weighs heavily on its capacity to improve productivity and provide the scope for a “middle class” society aspired to by an ever growing segment of the population. Russia has been experiencing higher death rates than birth rates, in large measure related to the accumulative effects of

alcohol consumption and smoking. This reduces new entrants to the productive labour force while reducing older members through disease and death.

Political dynamics around the World have their own impacts on global complexity. Russian actions to impede transportation of natural gas through Ukraine, rebels in Nigeria attack oil production or shipment facilities, Somali pirates attacking ships at sea, etc., all contribute to uncertainties, increase prices and frustrate world trade. China uses resource purchases or investments abroad to guarantee resource supply, while Russia wields its oil and gas supply as a club over former USSR member states in attempts to bend them to Russia's will. Religious extremists (regardless of their religion) and political opportunists, impose actions directly (e.g. Iran, North Korea) or indirectly (protectionist US politicians; EU bans on seal products). All have impacts that skew markets, threaten security, increase prices and greatly complicate the complex world dynamic.

It is often not lack of knowledge about how to manage within complexity that is the limiting factor, but the dedication to rigid "all or nothing" points of view, largely religious or political in origin. These are counter to what is needed to live within a world where resources are sufficiently abundant even for large populations with growing economies, yet have limits if only linear thinking prevails. Newton's Third Law of Motion states that "every action has an equal and opposite reaction"... as long as complexity is ignored!

PART 2:

Complexity Defined

Dynamics and Implications

Global complexity is all about interrelationships and web-like impacts from actions and reactions, and effects both intended and accidental. Many of these interrelationships occur naturally, but changes in the magnitude and impact of human activity in recent years have altered the dynamic. It is now instructive to try to comprehend this combination of changes together and over time. Advances in IT and communication technology make appreciation of these interrelationships somewhat more understandable. Certain set views about what is “correct” and “acceptable” need examination in current reality, and greater tolerance of others’ ideas will be needed. What is probably of greatest importance is to seek agreement amongst interested parties on objective(s) to be achieved, and to be as analytical as possible about the means to achieve them. It is often rigid “dogma” about the means that results in failing to meet objectives.

Concepts

The following concepts are pertinent to a more detailed discussion of global complexity.

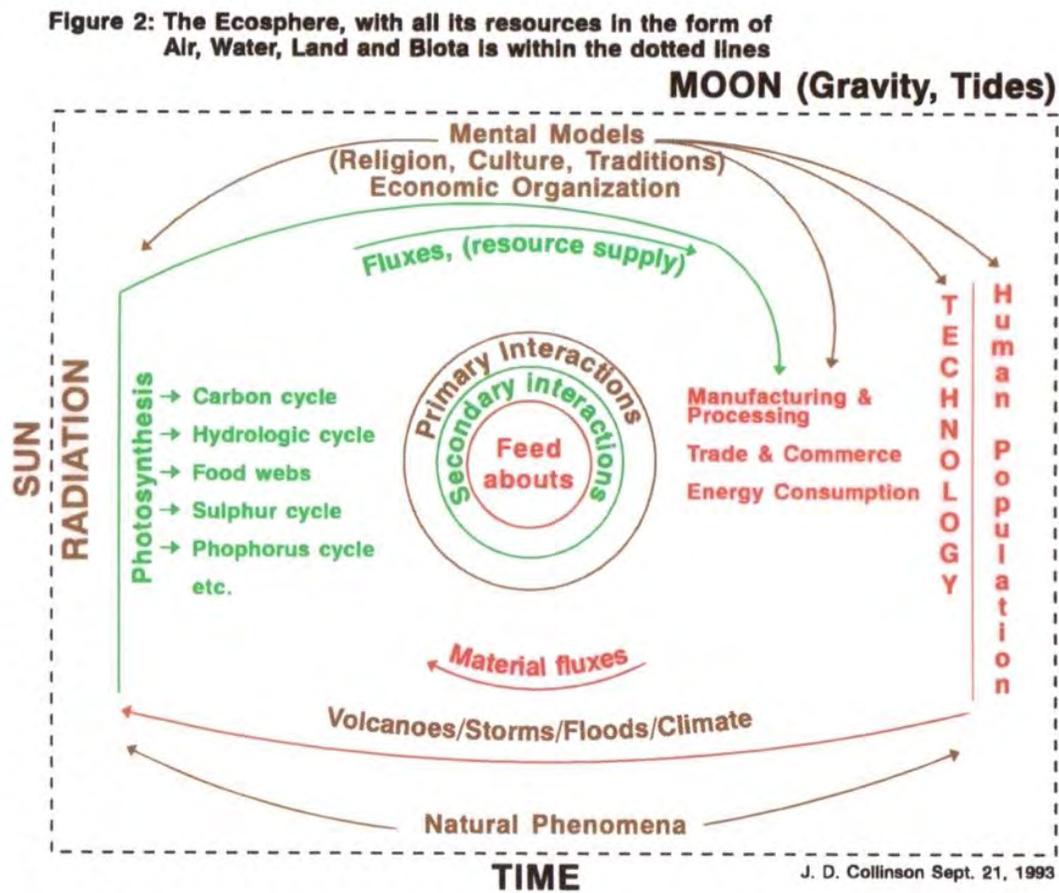
1. **Everything on earth has always been here, except radiant energy from the sun, and nothing leaves.** Consequently, whatever was here before the industrial revolution is still here, just not in the same place or in the same form.
2. **Human activity transforms/transport resources:** not always into products that are biodegradable or capable of being “inputs” to a future process.
3. **We tend to waste our most abundant resources.** This leads to unrealistic expectations, such as cheap oil forever, unlimited agricultural land, dumping sites (including locations in water), etc.
4. Words that reflect ecological processes through time include: **adaptation, resilience, accumulation, concentration; absorption, transformation, storage**, etc. Over time, ecological systems adapt to change, and can be

resilient to short term impacts, but accumulations or concentrations of new substances may have impacts beyond the capacity of normal resilience or adaptability. A viable shellfish industry in the 1960's in Chesapeake Bay has been decimated by accumulated wastes that have effectively eliminated oxygen from about 40% of the Bay. Puget Sound suffers from the accumulated addition of oil based products from a wide variety of sources that are the equivalent of an oil spill the magnitude of the Exxon Valdez every two years. Interestingly, natural oil seeps off the California coast are of a magnitude much greater: some of the oil appears to sink to the bottom sediments, but much of it seems to be degraded by bacteria: an indication that further research is needed to learn more about this set of processes.

5. **Natural and economic processes taken together have web-like consequences.** They are not just linear. The “feedabouts” described in the Figure 2 have web-like inter-relationships. Processes or actions have impacts over time that go far beyond the conventionally accepted “cause-effect” calculations most often considered. This broader set of consequences needs greater attention, as some aspects over time could overwhelm initial impacts.
6. **Every decision/action becomes another variable.** Often actions or decisions are taken to “solve” a problem, or “improve” a situation: and that may well be the short term linear effect. However, over time it simply becomes another factor inter-acting with all the rest. Its intended consequences may become tempered, while unintended consequences may be occurring as a result of non-linear impacts.
7. **Change is natural: to maintain the *status quo* is to move toward the sub-marginal!** By their very nature, ecological and economic processes will change over time. Their size and complexity helps contain massive shifts in the short term. However, even with this complex dampening system there is potential risk that accumulated negative impacts could result in catastrophic change that could endanger an otherwise adaptive process, whether it be economic or ecological. For example, a sudden and major shortage of oil, given current dependency on it, could show very clearly why the U.S., in particular, is sensitive to energy security risks.

Nature of Complexity

The diagram (Figure 2) below illustrates the nature of world complexity, taking energy, environment and economy into account. The basic premise is that all the resources that have ever existed in the world have been here since the “big bang”. The only net addition over time is the radiant energy from the sun and the gravity influence of the moon (if one ignores the minor addition of bits and pieces from space in the form of dust or meteorites).



The dynamics become manifest when all components and processes interact with each other through time. Some factors are natural (tides, fluxes, etc.) but others are affected by human demographic changes and by human activities through the application of technologies, energy, processes, transportation and consumption.

Impacts taking place may be linear in the first instance, but quickly become web-like and pervasive with time. The mental (philosophical, spiritual and religious) models carried and applied by different societies, combined with the magnitude of activity, results in varying influences on the overall ecosphere.

In the above diagram (Figure 2), it is important to note that only the sun, moon and time exist outside the earth's ecosphere. To the extent that other planets affect the ecosphere, these have not been included for the sake of simplicity.

Cycles

The natural cycles (Figure 2), relying on photosynthesis are on the left, natural phenomena below and the human activity dynamics are on the right. These reflect the numbers of people (demographics); the technology they apply; the energy they consume; the products they create, along with what is consumed and emitted in the process; and where it all ends up that in combination impacts on the functioning of the ecosphere.

Feedabouts: the tendency to think in linear terms is problematic. Terms such as “input- output”, “cause-effect” and “production-waste” are linear ideas. Although useful for immediate calculations, they ignore the fact that after the initial impact, hundreds of other effects are generated, referred to as “feedabouts” in the diagram. Because they are so complex they are not yet well understood, and with the passage of time continue to generate further changes. This is the essence of complexity.

The size of the human population combined with the sophistication of modern technologies operating in a global economy mean that linear approaches are not helpful in reaching a realistic understanding of impacts.

Management Implications

The challenge to management, whether it be in government, business or public interest organizations, is to have the motivation and capacity to take complexity into account in decision-making processes. The fact that universities have, in large measure, concentrated on narrow fields of study and research, makes the academic appreciation of complexity more difficult. Traditional scientific methodology tends toward breaking everything down to its smallest component, so as to understand it better.

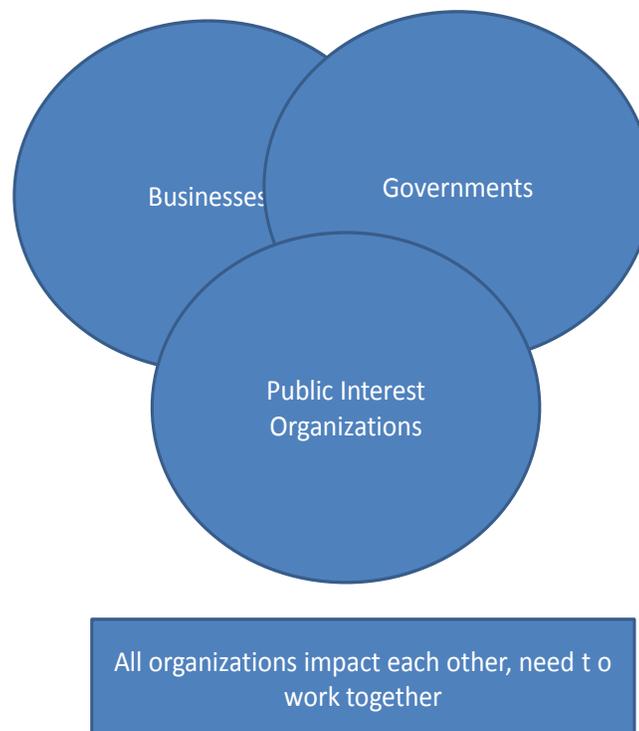
It is imperative, however, that this form of research be balanced with research that seeks to understand better how all the components of the ecosphere inter-relate.

This multidisciplinary approach has largely been missing in research, education, business and political institutions over the past century. The result, by way of example, is a conventional wisdom verging on religious zeal about global warming based on incomplete models of atmospheric history, movements and content. There may well be some impact from human activity on ecological processes and climate. Land use, often driven by land tenure factors, has led to significant changes in natural systems, but in many respects these systems have adapted and responded. Toxic pollution, however, clearly affects air, soil, water and subsequently plant and animal health, and ultimately human health, through both direct and a complex series of processes that need to be better understood. Studies and conferences on climate change have begun the needed process of multidisciplinary work, but much more is needed.

Redefinition of “inputs” and “outputs”: a new philosophy of management geared to the production of “inputs” rather than “products with associated waste and exhaust”, would go a long way to addressing shortages and enhance security of energy. By producing “inputs”, all short term products would consist of components that are in a form that permits them to be re-used or re-processed for other purposes once their initial use has been completed. The energy needed would be created or acquired in a manner so that any by-products (waste/exhaust) could be used as inputs for other processes (recent experimentation with using tractor exhaust as fertilizer is an example of this).

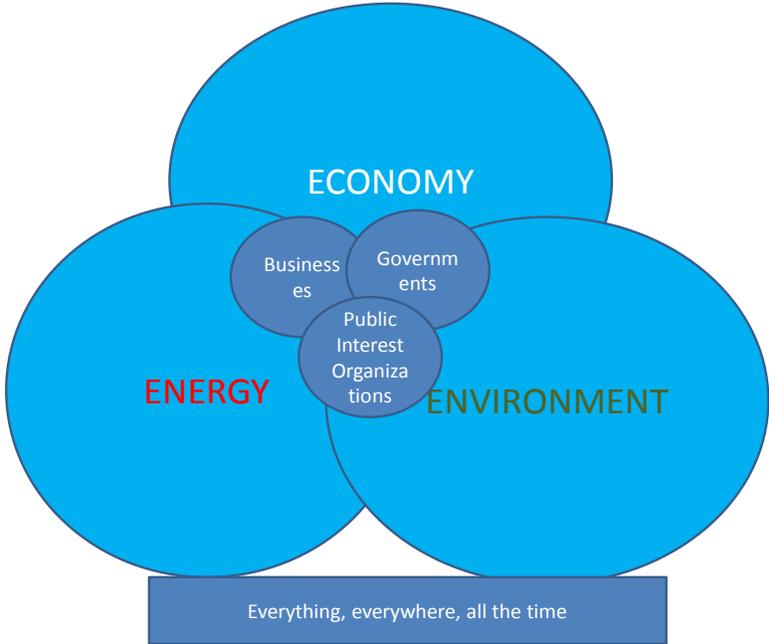
A further complication for management is the growing need to consult and involve interested and associated organizations. Governments can no longer act alone, but simple bilateral lobbying by business organizations misses other interests represented by public special interest groups. Clearly, all need to be prepared to set aside “all-or-nothing” positions: a radical attitude shift will be crucial to success in the future. Open cooperation and sharing will improve the understanding of complexity and lead to better decisions. The diagram below illustrates organizational overlap, impact and complexity.

Figure 3: Organizations do not operate in isolation



The two concepts of ecosphere complexity and organizational complexity are combined in the diagram below (Figure 4). This illustrates how the scope of the subject area and the coordination of organizational interests come together. To the degree management of each affected party does not find some way to communicate their views and concerns, and seek means to accomplish mutual objectives, sub-marginal solutions will result. These results will skew impacts over time towards negative availability of needed resources and consequent insecurities.

Figure 4: All is interrelated through time



PART 3

Global Complexity – Implications for Canada

GLOBAL

It is useful to put Canada in a global context, to have a sense of the relative magnitudes of Canadian activities in a global setting. A few illustrations of that context follow:

1. **Population:** from 1998 to 2008, the population of the United States grew by the size of the entire 2008 Canadian population: from 270 to 303 million, vs 30 to 33 million for Canada. During this same period, China's population grew from 1248 to 1337 million, and India has over 1130 million, 40% of whom are under age 15, which differs from China because in China couples are allowed only one child. If India and China's birth rates continue for another generation, India's population will exceed that of China.
2. **Energy consumption:** from 1998 to 2008, Canada's GDP grew by about 50% (some related to oil prices), that of the US by about 30%, and China by a factor greater than 8! India's GDP grew at annual rates exceeding 6% from 2004 – 2008. These rates for China and India have huge implications for energy consumption and consequent emissions of greenhouse gasses, particularly as China is burning rapidly increasing amounts of cheap but dirty coal.
3. **Oil imports:** the US increased from 3909 to 4711 million barrels/day while Canada's exports of oil increased from 575 to 922 over the 1998 – 2008 period. Comparable data for China were not available, although China increased coal consumption significantly, and India imported 121 million tons of crude oil in 2007/8.
4. **Greenhouse gas emissions:** from 1996 to 2006, greenhouse gas emissions grew in Canada from 660 to 721 million tonnes (peaked at 743 in 2004), while those of the US grew from 6600 to 7150. In the case of China comparable figures were 2700 to 7100 (about the same level of magnitude in 2006 as the US). After the US and China, Russia is the largest emitter of greenhouse gasses.

Although Canada is a relatively small contributor of greenhouse gases, on a per capita basis it is relatively high, and has not been perceived as interested in doing

much about it. Consequently, it has left itself open to criticism as well as barriers to trade from countries either more interested in addressing the argument about global warming or, perhaps less openly, interested in protectionism in trade, as recently illustrated in the US economic stimulus program as well as the climate change bill.

United States – Canada Comparison

The table below provides a brief comparative review of the current situation in the US and Canada. Note that all major issues fall into one or more of the three topics within complexity: Economy, Energy, and Environment.

United States	Canada
<ul style="list-style-type: none"> • Net importer of oil 	<ul style="list-style-type: none"> • Net exporter of oil
<ul style="list-style-type: none"> • Focus: energy security 	<ul style="list-style-type: none"> • Focus: clean energy dev.
<ul style="list-style-type: none"> • Focus: alternate fuels, reduce oil imports 	<ul style="list-style-type: none"> • Focus: limited interest in new energy, except nuclear
<ul style="list-style-type: none"> • Fix banking system 	<ul style="list-style-type: none"> • Banking system OK
<ul style="list-style-type: none"> • Job creation 	<ul style="list-style-type: none"> • Job creation
<ul style="list-style-type: none"> • Infrastructure 	<ul style="list-style-type: none"> • Infrastructure (esp. urban)
<ul style="list-style-type: none"> • Reduced greenhouse gasses 	<ul style="list-style-type: none"> • Announced it will match US Bill re greenhouse gasses as it affects Canadian exports
<ul style="list-style-type: none"> • Water deficits, current use 	<ul style="list-style-type: none"> • Water security
<ul style="list-style-type: none"> • Northern sovereignty (Arctic Ocean resources, NW Passage) 	<ul style="list-style-type: none"> • Northern sovereignty (Arctic Ocean resources, NW Passage)

United States

The United States is now behaving differently, adjusting to current reality:

The new administration in the US has shifted focus to actively pursue initiatives addressing everything from health care to foreign policy to economic and environmental concerns. Although criticized by the opposition Republicans for trying to do too much, President Obama has insisted that all need attention. Given this, and within the context discussed earlier about global complexity, none of the

old linear models for impact calculations can cope. Static vs dynamic, linear vs complexity and short term vs long term are providing the basis for debates that are not on the same topics. Statements deriving from political dogma sound irrelevant because they are. Global complexity has arrived, and decision-makers have to deal with it.

Although the US Congress has taken considerable liberties by working in the equivalent of “earmarks” to the stimulus and climate/global warming legislation, the direction is different: there is a new set of problems to be addressed and they cannot be ignored. The economic situation deserves careful attention, not just for the short term, but over time, as does energy security and the public interest in greenhouse gas emissions.

As usual, the devil is in the details. Although not explicitly put in the form of protectionism, both bills carry considerable protectionist elements. One requires that stimulus money be used for purchases of domestic goods. The other inserts itself into foreign economies and policies by assessing a greenhouse gas calculation on all imports to (allegedly) ensure US purchases are not inadvertently adding to greenhouse gas emissions².

Implications for Canada

Canada has no choice but to accept these changing priorities and dynamics, seek out common ground and act on them.

² Indirectly, this latter is an attempt for subsidies, lobbied for with considerable vigour by those representing alternate energy industries anxious to make themselves viable. Clothed in the motherhood of reduced greenhouse gas emissions, these provisions simply increase the cost of energy to the benefit of inefficient producers and their lobbyists. Although the US worries about reliance on oil imported from “countries who don’t like us”, they are by taking this action directly targeting Canadian oil sand production that has been a secure and growing source of oil for some time. To illustrate the difficulty in reaching agreement on this Bill, negotiations resulted in it ballooning from an initial 648 pages to over 1400, and it’s not through the Senate yet! Concessions to domestic utilities burning coal, in particular, are significant, and include similar concessions to new coal plants to be constructed. 85% of “pollution credits”, initially proposed to be sold by auction, were given away in the Bill to high polluters. Forestry and agriculture received subsidies through acceptance of their operations as a source of carbon reduction that can be sold. Solutions became variables within the same Bill!

CURRENT SITUATION

Protectionism and global warming: global warming has become the same issue as finding ways to sell to the US, Canada's largest trading partner (a similar situation can be found in selling to EU countries). Canada's influence due to the size of the Canadian economy relative to the US is small.

The US, under the lobbying of alternate energy industries and special interest groups such as the Environmental Defence Council represented by Bobby Kennedy Jr., is arguing for special "environmental but actually protectionist" purchasing policies in legislation both at the state and federal level. Canada will need to seek ways to address these indirect interventions into Canadian policy jurisdiction. Such ploys have been in place before where the alternate energy lobby tried to frustrate the import of electrical energy from Manitoba to Minnesota and Wisconsin because it was produced without (it was argued) adequate mitigation of ecological impacts and compensation to aboriginal peoples affected. Addressing greenhouse gasses and ensuring that energy production from oil sands, coal and nuclear sources is cleaner and more acceptable will be important initiatives for Canada. In the event, reduced air pollution/smog, improved water and soil quality will be welcomed by Canadians, many of whom also have accepted that global warming is a major threat to their well-being.

Economic restructuring: concurrently, the actual structure and functioning of both the US and Canadian economies will be very different once the recession passes. The obvious example is the automotive industry, where restructuring of the "Big Three" will manifest significant changes in design, propulsion and production. Further changes will become evident as consumers, transporters, farmers, fishers and others adjust to increased energy costs, to ecological concerns and initiatives, and to new forms of energy production and distribution. Change is inevitable as part of the dynamic of global complexity.

As of July, 2009, it is unclear when the recession will fade into growth. The turnaround will occur when there is persistent evidence of consumer optimism/spending (the banks seem to have survived, but are they really lending), private sector investment in capital in response, and eventually growth in employment. Clearly, employment growth will lag, and although public spending

in the US may be having some impact, the majority of it is only beginning to be felt, and more spending may be needed. In Canada, evidence suggests that implementation difficulties have held back the actual spending, and many approved projects are only on the drawing board, not yet ready to build. Nonetheless, the investments will add to job creation in the next year. This will help reduce unemployment while other investments get underway.

Although the Minister of the Environment has indicated that Canada will respond to the US climate Bill so as to be unaffected by its provisions, the actual regulations have yet to be developed (July, 2009). Energy prices vary according to apparent (not always real) demand, as well as speculation about political and pirate-like actions in various parts of the world. All of this simply highlights the need for all governments and businesses operating in the international arena, or affected by events in this milieu, to maintain constant watch and analytical assessments on current realities and likely future directions.

LONGER TERM SITUATION

1. Global Complexity: Energy/Environment/Economy Implications

- a. Need to respect US and EU standards with strategies designed to strengthen Canadian export opportunities (energy, environment, economic)
- b. Expect foreign NGO interventions such as protectionism under the guise of environmental concern (e.g. Kennedy, seals) when developing export strategies (energy, environment, economic)
- c. Energy pricing based on scarcity, security issues, imply international assessments of the situation to manage risk (energy, environment, economic)
- d. Northern sovereignty issues (energy, minerals, transport) are a medium to long term agenda item warranting considerable thought as the resources involved are coveted by many countries with considerable clout and cunning (energy, environment, economic). Perhaps permanent “settlements”, initially in the form of research stations with a greater range of activities than the weather stations previously abandoned for lack of resources would be more relevant

than periodic and itinerant “research tourists” who arrive only for the summer deserve consideration. Many research activities today utilize capacities that are not location specific, so research need not be limited to Arctic questions.

2. **Rural/urban issues:** differing philosophies now exist in rural and urban areas. Most urban Canadians are either several generations away from rural life, or from other countries where values are different, and where social as well as energy, environment and economic concerns are viewed differently. Equitable access to programs and services (respect for actual circumstances and universal objectives to be achieved, rather than universal means to achieve them) is becoming an important factor for both traditional rural as well as more remote northern communities.
3. **Aboriginal issues:** although Canada has spent huge sums of money on aboriginal issues, the circumstances of these citizens remains on average well below the norm for society, and reflect deep social and economic issues in need of attention. Health problems, high birth rates and low age of mother at first birth (results in short generation spans and education/health/income difficulties), substance abuse, abnormal suicide rates, etc. are common. Somehow, processes need to be found to allow this significant segment of society to function with pride and energy to be full participants in their country.
4. **Metropolitan regions:** need political, economic, energy and environmental attention, along with smaller urban places, to prepare them for a much changed urban society. European cities were founded on high density population scenarios, as compared to most North American cities (except possibly New York City). This makes it easier for EU countries to be critical of those in the western hemisphere who require more energy for transport within and between urban places which were in large measure based on automobile travel. Wide spaces between population centres, and colder climates also make a difference in energy consumption, but attention will need to be paid to this matter.

LONGER TERM VISION AND STRATEGIES ESSENTIAL

The current recession is of sufficient consequence that it is tempting to put off looking farther into the future. This would be a mistake. The future will, with certainty, be much different, and Canada will need to have a strategic approach to come out the other side with strength and optimism. This will require governments, businesses and other key organizations, including labour, to find ways to work together to devise a win/win/win approach. In the early stages, it is a strategy, not the fine detail, that is important. Each major organization will be at various stages in such a strategy, but those who survive will be the ones who have invested time and resources in looking into the future.

The saying “where you stand is what you see” applies. An effective strategy needs a broad understanding of the overall situation, not just the immediate and “local” one. “Objectives” must become the priority over “means”, which come out of assessing the best approach to achieve objectives. Impartial, rational hard analysis applies to the short term, soft to the long term as an appreciation of all factors impacting on future operations is developed. Strategy means looking ahead, not at the present, somewhat like flying visually at high speeds and low altitudes. It’s not the landmark right below you that’s important, but the one five miles ahead, because by the time you identify the one below it’s well behind you and of no use because you’re not there anymore!

EXAMPLES FOR LONGER TERM STRATEGY: all have economic consequences.

Energy:

Oil and natural gas: although oil and natural gas may be regarded as heavy contributors to greenhouse gasses, the simple reality is that they will continue to be major players in the energy field for many decades to come. But, not without change! Means need to be found to make the extraction of oil from tar sands less problematic in terms of their own energy consumption (and type) as well as the impact on soil and water resources. Current research in Alberta is making significant strides in this direction. To date, extraction companies have been

making excellent progress in rehabilitation of the lands from which oil has been extracted.

Where the work now needs to focus is on water impacts and on reduced need for natural gas. Nuclear energy may well prove to be a significant option in this case. Recent information suggests that nuclear plants could be operational in 10 years, much shorter than previously believed, and thus much more economical as the wait period from initial expenditure to production of energy is almost halved compared to a decade ago. Smaller capacity nuclear generators (mini reactors) are now available, adding to flexibility in location and transmission.

Approaches do not have to be repeats of the past. Recent agreements reached in Newfoundland and Labrador by Premier Danny Williams with extraction companies in the oil and mineral industries show that some of the old assumptions regarding roles for companies and governments may well not be realistic in the new future. Provincial equity in the business of developing provincial resources has been worked out, and acceptable arrangements to ensure value added processing and retention of jobs within the province have proven effective and acceptable to all parties. Some 93% of the work content of the White Rose project in NL will take place within the province.

Recent insightful ideas have also come from Saskatchewan. Premier Brad Wall has indicated that nuclear energy may prove to be an effective option within the province, particularly for medical isotope production.

Given the broader views being taken at the provincial level in many jurisdictions, it is conceivable that interprovincial energy grids could evolve over the next two to three decades, nuclear power could become a more acceptable and reliable source of electrical energy (where does Ontario expect to find the electricity to power 20% of its vehicles in 20 years) .

Means vs objectives: the problem of focussing on “means” vs objectives, however, is one that needs careful attention. An obvious example is the recently announced Ontario policy to pay \$10,000 to everyone who buys a new electric car. On the one hand, such a dramatic change from gas powered vehicles with all the infrastructure associated with their operation, such as gas stations that have evolved over time as needed on the basis of demand, will require comparable

stations for fuelling electric cars. In this sense, there is somewhat of an argument for a subsidy to speed up the shift. However, what it really does is imply that the Ontario government has decided that electric cars are best for many people. Missing in this equation are the notions of competition and choice. Does this mean that a new Diesel powered vehicle capable of 100 miles per gallon has to compete against a \$10,000 subsidy for an electric model not well suited to long distance travel? Why not subsidize the achievement of an objective (e.g. a predetermined degree of efficiency) rather than select one means amongst many? The US proposal to pay \$4500 for older gas guzzlers that are taken off the road may be the better approach, because it focuses on the problem and objective, not just one means that may or may not be the best under all circumstances.

The Ontario subsidy could conceivably result in more electric powered cars on the road than are practical in terms of their use, thereby defeating the purpose of the program. It will also add considerably to the demand for electricity (even if much of the charging occurs during off peak hours), which Ontario may have difficulty meeting, given the time lag between the decision on new and replacement generating stations and them coming on line. In the Ontario case, decisions on generating capacity and transmission (including possible interprovincial grids) need to be made soon to meet demand 10 to 30 years from now. Although Ontario seems to have rejected additional nuclear generating capacity, it may deserve another look, as alternatives may be much more expensive and inefficient. Wind generation has its place, but variability in power produced due to changing wind velocity, will continue to limit the proportion of total generating capacity that is realistic.

Economy

Every process has one prime product along with (usually) several secondary outputs. These latter may be in the form of heat, waste (garbage), discards and the like. If processes are designed to make these secondary outputs take the form of items useable in other processes, then the global closed system is respected. For example, hybrid vehicles capture some of the heat produced through braking to charge batteries; “scrap” metal can be re-used in steel production; and “waste” from dead animals can be turned into protein useable for food, fertilizer and other purposes.

This latter example³ illustrates how thinking through problems to solutions can pay off. Biosphere Technologies has researched, developed, tested and met licensing requirements for a process for utilizing organic material such as waste animal material, including infected material such as BSE and other microbial pathogens over a ten year period. The result has been the development of high temperature saturated steam reactors which hydrolyze proteins and fats into amino acids and fatty acids. This process effectively creates useable materials for food and fertilizer uses from infected waste organic material (includes diseased carcasses, inedible slaughter materials, rotten food, etc.). This represents as perfect example of producing “inputs” instead of waste. A further benefit derives from the use of this material for fertilizer as the organic nutrients are not readily leached out of the soil into waterways as is the case with inorganic fertilizer.

Taking energy and environment into account up front in designing manufacturing processes and business and personal services through careful planning to ensure “waste” is in a form that it can be used for “inputs” to other processes, such as in the case of Biosphere Technologies Inc. This leads to a healthier environment concurrent with the availability of more useable material for other processes or services. All three decision-making organizations (governments, businesses and interested third parties) need to consider this direction in their future planning.

The value of the arts can often be missed in considering economic capacity. Compared to manufacturing, for example, current technology offers individual and groups of artists, regardless of their chosen media, the chance to practice their art in a location of their choice. Manufacturing jobs may be shifted around based on labour costs, but artistic talent resides with the individual. All that is needed for the talent to flourish and contribute to the economy is the appropriate societal welcome and communications vehicle.

Environment:

Environmental concerns are addressed in the above sections on energy and economy, but certain factors deserve direct attention even though they in turn will have direct positive impacts on the other two subjects being addressed. These are, in particular, toxics/pollution and land use.

³³ Source: Dr. Erick Schmidt, President and CEO, Biosphere Technologies Inc., personal communication

Toxics/pollution: One concern about the intense focus on greenhouse gasses is that toxics/pollution may be given a back seat. Yet, these represent immediate danger to overall environmental health and in particular human health.

On a clear day driving through Chicago this past spring, a particular acid smell in the air caused sore throats and eye irritation for the author and his spouse, neither of whom have any history of allergies. Obviously, this was not the effect of a greenhouse gas, but some type of toxic chemical. Pollution in various forms, whether it be in the air, water or soil can affect productivity in a wide variety of ways, including health with subsequent impact on health care and associated costs. Whether the effect be relatively minor (we were exposed to the toxics in the Chicago air only as we drove through the south side) as may be the case in some instances, or serious enough to manifest itself in the form of various cancers with sufficient exposure to certain chemicals.

The impacts are of two types: illness and its related direct costs, and reduced productivity deriving from loss of work or a lower level of performance. The cumulative effects of toxins can be substantial; leading to the conclusion that attention to this form of pollution is warranted. Interestingly, application of the notion of producing “inputs” as opposed to “wastes” will help address this matter over time.

Land use: this is quite a different matter. Interesting questions of private vs public good arise from the consequences of land ownership exclusivity. Although various examples exist for mining and forestry, agriculture perhaps provides the best illustration of the dilemma faced both by farmers and by the public. Over the past 50 years or so, farmers have found it necessary to use as much of their land as possible for crop production (including hay and pasture) to be able to remain in business. Their costs for purchased inputs rise faster than the prices they get for their products, so one way to increase productivity is to use as much of their land as possible, even if it means clearing the last remaining trees or draining sloughs.

Areas were destroyed that used to produce public goods such as waterfowl and/or upland game as well as visual amenities for public consumption and admiration. Moreover, the action eliminated settling ponds for water to slow runoff (reducing flooding danger downstream) and bulrushes and other plants that retained

chemicals, reducing the amount that ran into rivers and lakes. These are public goods: the public benefits from the riparian lands but does not compensate the farmer, who must make a living the best way they can. Experimental projects have shown that farmers are quite willing to make a contribution to the public good if they receive reasonable compensation: they too, appreciate wildlife, visual amenities and improved water management and sequestering of chemicals. Globally, problems of desertification, mismanaged wildlife and poverty can often be traced to land use difficulties. Given this, the application of complexity analysis and considering effective achievement of objectives vs forcing inappropriate “means” on problems deserves consideration.

Pollution: these issues in the past have tended to be treated unevenly, depending on the nature/location of the problem and the extent of lobbying. The consequence is that some soil may have to be decontaminated even though it may not be necessary (raises costs), or some degradable material in water may be cleaned up even though natural processes will do it anyway. But, the unfortunate fact is that other cases pollution is left unchanged. Cumulative pollution effects in Puget Sound and Chesapeake Bay; ignoring land use issues in the Red River Valley; and refusing to consider nuclear options all represent forms of this imbalance. Complexity analysis helps with problem identification, which very often is not the pollution itself, that being a symptom deriving from the problem.

By addressing the cause of the problem and considering all potential ways to address it, a means can usually be found that adds benefits, rather than just costs. For example, paying farmers to retain wetlands as a public good maintains that public good and lowers public costs by reducing flooding.

PART 4:

Management Realities of Global Complexity

Some tough policy questions facing management in the future include the following:

1. How can the economy support rising living standards under conditions where:
 - Fossil fuel use is under pressure , alternative energy may carry uncertainties and be more costly
 - Waste production (including greenhouse gasses) must be constrained
 - Short term “solutions” (e.g. protectionism) are incompatible with longer term needs
2. What actions need to be taken today to ensure business models are suited to future needs over 5-10 and 10-20 year and longer horizons
 - Research and development (considering future demand)
 - Innovation (products, processes, supply chains, transport, alliances)
 - Inclusion of other key interests in the planning processes
 - Skills and skill mix needed, training
 - Flexibility, adaptability to change

New management capacities and approaches needed

The first diagram in Part 1 (page 5) shows the inter-connections shared by energy, environment and economy and the second (figure 2, page 12) in Part 2, illustrates that the World’s ecosystems operate within a closed system, except for radiation from the sun and gravity associated with the moon. The third and fourth diagrams (pages 15 and 16) illustrate the need for decision-makers to interact with each other while taking economic, energy and environment connectivities into account.

“Everything, everywhere, all the time”: Energy, Environment and Economy are closely related, as shown in the above discussion. Some have argued that energy pricing and security is behind much of the economic distress of the past year. Certainly, the world financial system fuelled the economic recession, and in turn eased energy prices in the short run. The fact that conventional wisdom accepts “global warming” as a phenomenon exacerbated by human activity, and

that the culprit in large measure is CO₂ emissions from energy use links all three as a global concern.

Interrelationships

Taken together, these factors add significantly to the range of variables that senior management must take into account in their decision-making. All are interrelated; all are major elements in economic and ecological sustainability; and all are global in scope. Moreover, decisions need to take into account all players: governments at all levels (representing the general public), businesses and interested third party groups (includes unions, universities and their faculty members, lobby groups, etc.). All need to be cognisant of the others and each of their concerns, and all need to be prepared to communicate with each other over time to ensure all perspectives are appreciated and addressed. That is not to suggest that each party must do what one or more of the others want, but that they listen carefully to each other and assess the implications of their options with care and objectivity. The results will have more potential for successful completion and buy-in from all concerned.

At times, each category of decision-making noted here can take on dogmas not unlike religious extremism. Such dogmas are from times past, when human impact on global complexity was not anywhere near as significant to life on earth. Strident definitions constraining or proscribing specific roles for each decision-making category are less helpful in today's complex world, and greater pragmatism is worth considering as it is probably necessary for success.

Basic concepts noted earlier (see page 10 - 11) offer insights for dealing with global complexity that can be applied to issues facing senior management. This paper is being written in July of 2009. As time passes, new decisions being made this month and in the future will become variables that in turn will need to be taken into account during decision-making by all three major groups of players (governments, businesses and special interest groups).

For example, the Bill on "global warming" working its way through the U.S. Congress will have impacts well into the future. It has already pushed the Government of Canada to announce that it will put comparable regulations in place

to ensure its exports of energy, particularly from the oil sands, will not be affected by the implied protectionism of the Bill.

Internal focus by management has had to shift towards a more outward focus over the years, as agencies outside the firm or government or interest group have their impacts. In recent years, this has become ever more evident.

The multiple crises of global economic recession, global ecological concerns and global energy prices and security, in other words, global complexity, have together set the stage for everyone to look for innovative solutions. Old paradigms will not work.

Different factors will need to be taken into account. Longer time spans and increasing and more intense public interest at the domestic and international levels are part of the new reality. CEOs will not be tolerated if they focus on short term shareholder profit that dies in its tracks down the road from lack of forward attention. Governments without a vision of how to operate in a world of complexity will get little sympathy or support from a concerned public. Lobby groups who take “all or nothing” stances run a serious risk of losing credibility if they are not prepared to recognize that others have the right to their own views and may have valid concerns to be considered in reaching decisions acceptable to a larger audience. Universities have a unique opportunity to offer integrated views of complexity to assist decision-making, as well as to include multidisciplinary opportunities for students to be exposed to interrelationships amongst elements of the ecosphere. All have valuable insights to offer into the mix, but none can derive the best approach in a vacuum that excludes or minimizes others.

New Management Paradigm

New Management Scope: old management paradigm skills tend to be “inside the box”, or largely within the organization with the addition of market analysis that looks ahead for the specific product , services or concerns of the firm, government or interest group. Skills sought include technical, financial, HR, legal, accounting, product development (largely incremental), logistics and sales. Competition is viewed as the opposition.

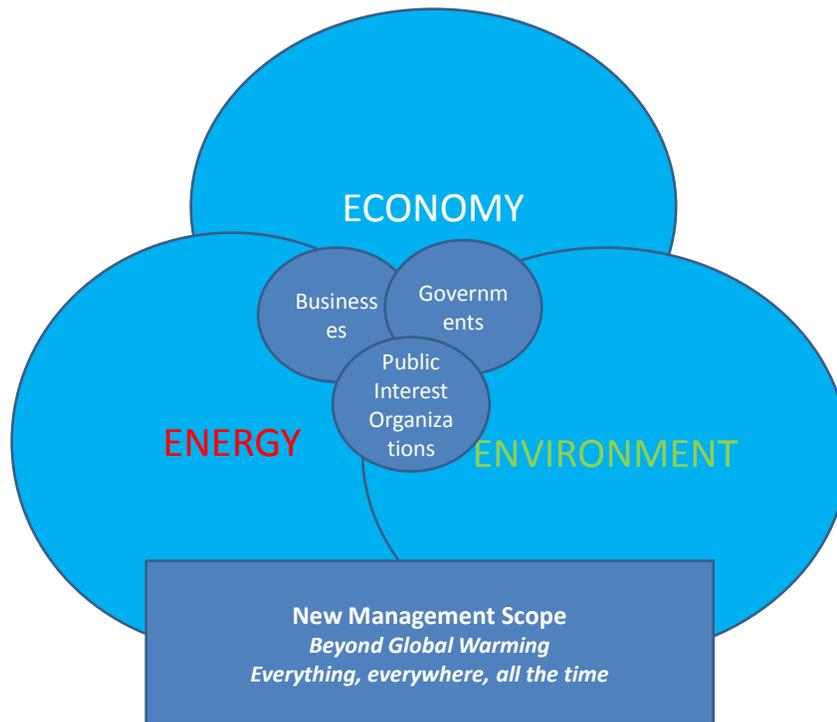
A New Management Paradigm operates “outside the box” in a more futuristic, horizontal and interdisciplinary dimension. Current skills are augmented significantly by capabilities at the senior management level that include: strong communications cross-discipline skills, particularly the ability to listen and integrate divergent and conflicting priorities, beliefs and information; capacity to “see” global complexities over time; a wide range and depth of teamwork skills; and an understanding of and capacity to work and communicate within integrated business/government/public interest frameworks.

Senior management is required to have the capacity to integrate diverse information, understand complexity and manage a process of decision-making appropriate to a changing world. The overriding approach, both inside and outside the organization is one of inclusion.

“Cookie cutter” hiring practices where clones or narrow skills are sought will not keep an organization competitive. Managers must be flexible, tolerant of a wide range of views, integrate information and, above all, be aware that “tunnel vision” or saying no to different ideas without investigation, can be dangerous to the long term viability of the organization. The confidence to consciously seek out staff who are truly visionary, intelligent and open-minded, and give them the freedom to explore new ideas will lead to significantly greater competitiveness. Ensuring that the senior management and planning teams consist of a wide mix of personality types, including the careful analysts, the aggressive implementers, the integrators, the creative thinkers and the compassionate mentors will maintain this competitive edge over the long term.

Conceptually, this capacity to operate effectively within global complexity is displayed in Figure 5 below:

Figure 5:



Integrated, effective change factors:

Leading Entrepreneurs develop businesses, advance public policy in government or break new ground in not-for-profit or NGOs; embrace global complexity, are propelled by a creative urgency that arises from their core being; and see solutions others can't. They need to be able to articulate these solutions clearly to take organizations in new directions.

The following are factors crucial to the success of organizations in this world of complexity:

1. **Attitude:** there are attitudes of greed and of fear of change which must be addressed. This is a subject sufficiently covered elsewhere and will simply be noted here as an underlying dynamic that must be dealt with if any future adaptation is to be successful.

2. **Broad horizon with long term vision:**

- philosophical shift to production of “inputs”
- consideration of horizontal linkages along with vertical.

One of the major failings of management over the past two decades has been the shift that has taken place emphasizing short term planning horizons. Governments have platforms with short term and relatively unrelated planks; businesses have emphasized short term payoff to shareholders to keep up with Wall Street hype; and interest groups have taken “all or nothing” positions on issues, knowing that their extreme views are not tenable in the longer term. All this leads to confrontations, inadequate, biased communication and failed solutions.

The time has come for longer term decision-making. Short term push for stock value increases is doomed to result in medium term crashes. Short term and *ad hoc* government initiatives taken outside the context of global complexity produce results that are not in the public interest. Short term positions taken by special interest groups are expedient tactics taken without regard to longer term consequences. Together, such short term perspectives push society into a non-competitive position to the detriment of that society and the world.

A long term vision, developed in consultation with all parties addresses global complexity, improves competitiveness and positions those who develop them for leadership roles in global policy and decision making situations.

- ## 3. **New Management Leadership** may be needed to develop long term vision and achieve goals. Leaders will be recognised for their ability to
- visualize solutions others can't;
 - find ways to make the vision operational;
 - rally managers and organizations towards that long term vision; and
 - set standards for inclusion of both staff and other organizations with an interest in their field of activity.

4. **Organizational structure** for effective decision making within complexity is essential, and involves both the formal and informal structure to be fluid and flexible to define and achieve a long term strategy. The formal organization provides the framework for successful implementation of all “normal” projects/initiatives. The informal links to the formal by providing for comprehensive communications and horizontal as well as vertical involvement. In addition, there is a recognized link to the formal through the vision/planning process.
5. **Planning capacity:** organizations that establish a formal planning group within their structure will need to ensure that it:
 - sets up a group within the organization that aspires to effective solutions consistent with management vision;
 - avoids the appearance of “second guessing” operational elements and clearly avoids overlap or implementation responsibilities;
 - develops capacity to understand what it takes to follow through to the implementation phase, avoiding a disconnect between organizational entities;
 - ensures total integration with and understanding of the reality of production, service and marketing delivery

Task forces become an effective mechanism for integration and implementation of new directions, but it is essential they be staffed by people who are qualified, and have stellar performance histories.

An effective task force has several requirements:

- CEO and management team must personally select/contract with/ assign the coordinator of the group, and provide ongoing support and guidance. The coordinator must be a qualified executive with long term perspective, integrating and communication skills, with a capacity to lead an effective team for change;
- Task force leader must work with other line units to identify the best people to be members of the task force. This ensures that the results

will be of a nature that can be effectively implemented by the organization once a decision is made;

- Budget must be sufficient to commission selected research not available within the organization, and some future leverage on budget so as to influence program delivery, providing a basis for moving delivery units into new forms of implementation as needed.

All this implies the active involvement and support of the CEO, Board of Directors, etc. and a program in place to inform and involve all employees over time.

6. **Human resources:** the right people with a skill and personality mix with scope, backgrounds, ingenuity and confidence to address all relevant factors, develop the vision and make it happen are an essential ingredient of an effective organization.

The New Management approach recognizes that different personalities in an executive team ensure that all relevant perspectives are taken into account⁴. This approach also takes into account the time span factors explained by Elliott Jaques (Requisite Organization) in which he noted that the time span between decisions and their ultimate results increases with the future thinking capabilities of the executive⁵.

7. **Communication and interdisciplinary teamwork** for an effective integrated approach is crucial to an organization thriving in the current complexity milieu. Communication cannot be regarded as a one-way street: organizations must take considerable effort to convince others of the value of their product, the correctness of their program or policy and the reasons why their “solution” is preferable over others. An effective organization will use communications to better understand the concerns of others

⁴ For example, through understanding of the Enneagram, a 3 type (performer) will make sure the work gets done on time, a 1 (perfectionist) will focus on necessary accounting and legal needs, a 5 (observer/thinker) will provide longer term observations and forward thinking, a 7 (integrator) will take note of integration needs, and a 9 (mediator) will provide cooperative advice, etc.

⁵ A level 5, for example, looks 5 - 10 years ahead and at least within the entire country; whereas a level 6 looks ahead 10 – 20 years with some considerable international views; and a level 7 looks 20 – 50 years into the future on a global scale.

(especially by listening, not just arguing), and taken these into account before deciding on a policy, program or product. This implies an emphasis on such qualities as tolerance, patience and open-mindedness which have not necessarily been considered of high importance historically.

To a considerable degree, debates have tended to derive from the “dogma” mentioned earlier. What is now required is the introduction of facts within the context of objectives to be achieved, analysis of options and avoidance of favourite “means” to achieve something, rather than assessing the best one to accomplish what is to be done. For example, tax cuts or universality in specific programs may sound nice, but after analysis there may be other more effective means to accomplish an objective that has readily been agreed upon by all parties.

Assessing Initiatives under Global Complexity

More dynamic/interrelated/horizontal (vs linear/static) models will be needed to assist decision-makers and their organizations and relevant (politics) remain competitive in a world of unprecedented complexity. In particular, several disciplines in concert will need to be applied through a teamwork approach, including but not limited to the following:

ENERGY

- Systems assessments critical to success as energy is only one of many inputs, and considering energy as part of a system should offer insights into how different energy sources can play different roles within the larger system.
- Need to view “outputs” as “inputs” to future processes, thereby eliminating what would otherwise be considered “waste”.

ENVIRONMENT

Physical

- Ecological systems must be the prism through which decisions are assessed;
- Species alone no longer afford a paradigm that accounts for complex reality;
- All variables need to be taken into account in order to maintain a viable ecological system capable of adaptation to change.

Social

- Demographic analysis is fundamental to decision-making;
- Identifiable clients and their interests is essential;
- Market demand analysis is the basis for marketing/consumer relations management based on products available or under consideration.

Political

- Includes local, national and international – countries, agencies, etc.;
- Government, businesses and special interest groups do not operate in a vacuum;
- Interrelationships must be defined and auctioned in non-confronting ways.

ECONOMY

- Both energy and environment must be dealt with in combination for an organization to function, compete, and succeed;
- Production of “inputs” to future processing must go beyond “recycle/reuse”;
- “waste” that requires disposal at the end of a product’s life cycle should not be encouraged over the long term;
- Traditional long term construction projects need to be crunched into shorter time periods (e.g. stimulus projects) should utilize “concurrent component construction” techniques to reduce cost by generating cash flow earlier, and concurrently increasing relevance in a rapidly changing complex world;
- Internal and external dynamics: analyses within the firm, the industry, the country economy and the global economy will be needed, the detail varying with the situation; and
- Open reviews of “traditional institutions” (e.g. Wall Street, etc.) are needed to provide clarity, openness and ethical behaviour in financial markets.

ORGANIZATIONAL / ADMINISTRATIVE

- New management paradigms are required;
- Global complexity is a first priority consideration;
- Inter-disciplinary interactions are required to action solutions to current global problems;
- Priorities and requirements for human resource skills and abilities are fundamentally changed (e.g. attitudes of tolerance, inclusion and acceptance of change)

July 30, 2009