INFORMATION RESOURCES

DRAFT ECONOMIC ENVIRONMENT

DISCUSSION PAPER

YUKON 2000

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What are information resources? Do we have to do research and development? Why do we need a strategy for science and technology?

Not long ago in a wild rush to find gold, men and women came here by the thousands from all parts of the globe. The Yukon entered the modern world. Now, a century later, Yukoners still live by exploiting the natural resources that lie so abundantly around them. The Yukon, like Canada, is built on fur, fish, forest, farms, water, and minerals, which have made us richer than almost any other country.

Natural resources will always be valuable. But which natural resources in particular? What forces a resource to gain or lose value? What happens when a resource is used up? And what happens to us if some other country can sell their resources cheaper? Yukoners know the answer to the last two questions; the answer is called boom and bust. If natural resources are valuable, they also make us vulnerable.

In fact, this vulnerability is growing, and growing rapidly. Control of natural resources used to be one of the key factors of economic, political and industrial competition among nations. Things have changed. In the past few decades, a new factor of international competition has arisen -- science and technology. Natural resources are no longer the unique source of wealth they used to be; in fact, they are steadily decreasing in importance compared with "information" resources.

The Prime Minister recently made the following comparison to illustrate the point. He said, "When you buy a ton of ore, you're paying for the material and its transportation. When you buy a microchip, you're paying very little for the silicon, but you pay as much as 70 per cent for the knowledge and only 12 per cent for the labour." The difference is the proportion of information resources to physical resources. And the source of the information resources is the brainpower of individuals channelled into science and technology.

Science and technology have become the weapons of international economic competition. Through science and technology we can make more things with fewer resource inputs, invent new materials that are cheaper and better than natural ones, develop products that make old resources unnecessary. New cars are smaller and have less metal in them. Artificial fur is replacing real fur. The

Japanese are developing ceramic houses -- made of clay -- that require very little timber.

Very few Yukoners and Canadians seem to realize that other nations consider international economic competition almost as a battlefield, and that some of the most important weapons are science and technology. We are strangely complacent about this, and foreign visitors notice such attitudes even if we do not. A senior Japanese businessman, recently investigating the construction industry in Canada, was asked for his impressions by a Canadian colleague. He replied, politely, that he found us overfed, overpaid, underworked and thoroughly confused.

There is no confusion in Japan over science and technology; they have been the centrepiece of their economic policy for decades, and the Japanese continue to pour both money and manpower into science and technology at an ever-increasing rate. They are not the only ones. The Koreans are hot on their heels. In the last thirty years, by developing a strong and central science and technology strategy, Korea has risen from being one of the poorest countries in the world to increase its per capita wealth by some 40 times! Korea now sells us ships, steel, computers and automobiles. We still export raw logs and unprocessed minerals. The examples go on and on. Canada (and the Yukon) are still well off, but relative to our competitors, we have declined disastrously.

In the Yukon 2000 process it is essential that a strategy for science and technology including research and development be discussed. Without a strategy for science and technology the Yukon will become a backwater, largely at the mercy of events and decisions taken far away, by people with little concern for the welfare of Yukoners. With a strategy for science and technology, the Yukon has a chance to take charge of its future and become a vital (if small) partner within Canada and international society.

What is a strategy for science and technology?

Yukoners consume science and technology as much as people in any other advanced industrial society, but Yukoners neither produce new science and technology, nor use much science and technology to develop their economy and their society. Science and technology can be developed and used in the Yukon. If you have an image of science as something you could never understand, something that is done by a kind of elite priesthood of men with long white hair and wearing white lab coats while surrounded by complicated gadgets humming and bubbling away -- then either you have been watching too much television or else you are a Canadian. Canadians unfortunately appear to have such an image of remote and unapproachably wise scientists doing pure research from which all good things flow.

The reality is quite different. Science is nothing more than a formal and careful way of looking at the world, to understand how it works. And technology is developing something that works, something that meets a need: a new product or an improved process. Everybody participates in science and technology: a child learning a new skill; a trapper experimenting with a new bait; a placer miner figuring out a labour saving change with some equipment. Because most Canadians tend not to recognize this, they have much less interest in science than other peoples -- the Japanese and the Koreans, for example.

Another image we have is that all technology comes directly from science and depends exclusively on science for its advances. This is another illusion. New technology is developed by scientists, engineers, technicians and other researchers who are not just trying to understand what nature is, but to make something that works. Usually it is engineers that are the most involved with technology. Science and technology run on separate tracks, with lots of crossovers of people, hardware and ideas, from both sides. They depend on each other.

Both science and technology are advanced by investigations and experiments known as research and development. ~~(Research and Development)~~. Research and development (by itself) is not the answer to the Yukon's problems. Research and development is only the first step in a longer, more expensive and more difficult

process called innovation, in which an existing product or process is replaced with a newer more efficient one. In the innovation process, research and development is followed by design, testing, manufacturing and marketing. If just one of these steps goes wrong, or is missing, then there will be no outcome.

After the innovation process, a new and useful technology is on the marketplace. There is still another aspect to consider, diffusion. While innovation generally is carried out by one company, diffusion refers to the spread of the new technology to all the potential users. It is in the diffusion process that the technology makes its impact on the economy and the society. A single telephone is no good to anybody, but when a whole country is connected by telephone, the impact is enormous.

When you understand technology innovation and diffusion, you can see more clearly what kind of science and technology strategy the Yukon needs to create. Science and research are just two factors needed out of many, and they will not yield results unless all the other components -- engineering, manufacturing and business management are there as well. But on a broader level, in order to get all these components working together, you must have a society that is vitally concerned with science and technology, innovation and diffusion.

In a long term strategy, there must be a strong emphasis on:
education, training and public understanding (because the name of the game is using brainpower rather than muscle power);
small business (because most innovations occur in small businesses rather than in large ones);
R & D (because you stll need the new ideas);
government support (because no individual or private industry can support all this infrastructure); and
community participation (because it is people wno make it all happen and who provide a politically supportive environment for new ventures).

A science and technology strategy is one that cuts across many established boundaries and demands that people, communities and organizations take a fresh look at themselves. In the final analysis, the Yukon will only be able to meet the challenge from abroad if it develops a **Science and Technology Culture.** To do this will require effort, long term committment, cooperation, initiative, intelligence and some basic changes in how Yukoners see themselves.

What are the benefits we can expect to get?

The Yukon 2000 process has laid out seven goals for the future. In reference to these goals, we can describe some of the benefits that Yukoners can expect a science and technology strategy to produce. Keep in mind that research and development deals with

the unknown, and we cannot predict with any degree of precision what the outcomes will be, especially at this preliminary stage. In fact, your reactions to the ideas in this paper are essential if you are to discover the possible benefits more clearly.

We do know this: a science and technology strategy is essential to help Yukoners take control of the future, not in a political sense, but in an economic sense. Science and technology can help establish new businesses and keep old ones, like mining, going. They will diversify the economy, not into every possible area, but certainly into areas that are closely linked to the particular geographic situation of the Yukon. Science and technology will create more wealth through reducing energy costs, for example and creating more local jobs. Because of the increased diversity of the Yukon economy, there will be more stability. There will be a broader range of career choices available to Yukoners, especially in science and engineering. Due to an increased number of new community and business ventures, there will be an increased participation in public decision making. The quality of life will increase for most groups because of better health care, better understanding of social problems and the reduction of environmental conflicts.

Does this all sound too good to be true? If you have read the other Yukon 2000 discussion papers, you might see this one as promoting just another brand of miracle snake oil. If it is so

good, you might ask, then why have we not done something about it before this? The answer is that Canada has only recently become concerned about a science and technology strategy. Canada is well behind other countries in awareness of the importance of an science and technology strategy. We suffer from what the Australians call the curse of resource wealth, that is, we have become stuck in a comfortable pattern of economic behaviour which tends to rob us of our initiative and make us dependent on others. Science and technology strategies demand a particular economic and cultural environment in order to reach their full potential. They demand a clear social consensus on long term goals and cooperative mechansims, which Canada has not yet developed. No one knows how well a science and technology strategy will work for the Yukon, but we do know we have no choice but to try and make it work.

What will it cost?

Nothing is free. The first, and possibly the most difficult, thing that Yukoners may have to change is the image they have of themselves and their territory. The cost of doing this to most societies is usually too great to undertake; this is one of the root causes of the rise and decline of empires -- events simply pass them by as they resist change. All Yukoners will have to ask themselves how badly do they really want full responsibility for their own futures or how much are content to rely upon others to make decisions for them. How willing are they to work within

common social goals for a larger social good How aggressively are they willing to promote their vision? How well can they stick with investments in science and technology that take longer to pay off than speculation on, for example, mining stock or real estate? How hard do they want to work? How much education in science and technology can they take in? Only Yukoners can answer these questions.

In more direct terms, reaping benefits from science and technology requires investment in education, business and government programs. Canada spends only about 1.8% of its Gross Domestic Product on research and development, while our most successful competitors spend up to 3.5% We cannot increase this all at once, because the facilities to use the extra money take time to build, and the increases will have to come from taxes, or from cut-backs in some other services.

Government can only do a small part of this; most of the increased investment will have to come from business, individuals starting their own businesses or communities working in a cooperative. This investment has to be sustained over decades; it cannot be turned on and off at a whim.

There may also have to be some social tradeoffs, or at least some compensatory socially directed activity. While science and technology may enable the general standard of living to rise, certain groups may still remain in inferior economic positions,

relatively speaking, for science and technology developments, like any other economic activity, generate their own elites who profit from the new opportunities. Women, for example, seem to have profited less than men from science and technology development; their traditional jobs have been more threatened by advances in technology than those of men. This should not mean that one shies away from science and technology; merely, that one goes in with one's eyes open and a commitment to ensure that all groups in society benefit.

Which sectors will be affected?

It is difficult to tell at present. Science and technology creates the future in unpredictable ways. Which sectors work most creatively and effectively at grasping new technological opportunities depends largely on their own initiative. A society and a government cannot plan innovation; they can put in place the conditions that favour its occurrence.

All of the Yukon's present economic sectors have potential for significant improvement in efficiency, markets and expansion. With some sectors, such as furs, it is maybe a question of better market information for existing products. With others, like agriculture and sawmilling, diffusion of more advanced technology existing elsewhere will make a significant improvement. Placer gold mining could use some applied research and some design support. Game ranching needs a demonstration project.

Manufacturing needs support for entrepreneurs to start up new ventures. Fishing needs ecological research to develop better management practices. The government is currently supporting a special project designed to generate more specific answers to this question.

How can we do it?

There is not a lot of money available so it has to be spent carefully. The first step is going on right now, as you read this paper and think about what a strategy for science and technology might look like. This is the process of raising awareness, building consensus on goals, discussing opportunities and comparing mechanisms.

A science and technology strategy must support initiative, aim at multiple targets with a mix of specific policies, integrate existing facilities, build from the bottom up and educate for the long term. The following list gives some of the specific mechanisms that could be developed.

1. A mechanism in government to coordinate, develop and promote science and technology policies within departments, and marshal resources to ensure science and technology aspects are considered at all times in policy development and execution.

2. Networks to handle information on market data, technical

experts, ongoing scientific research in specific areas, funding and contract opportunities. The network would not just be a computerized library, but a mechanism by which innovation teams could be built even when some of the participants were separated geographically.

3. Core facilities supplying meeting rooms, information resources and some research and development infrastructure. This institution would start small within an existing institution and gradually build up its staff and facilities as the market expands.

4. Mechanisms to support entrepreneurs in taking new technology, or improving on existing technology, and setting up new business ventures to manufacture and market the innovations. The entrepreneurs can be individuals or community cooperatives. This is called technical entrepreneurship. Support measures include provision of venture capital to finance the new businesses, training in business management or innovation, expert technical services for developing and marketing the innovation.

5. Science and technology education needs to be expanded and made more appropriate to the specific needs and realities of the Yukon. Training of adults in business formation and technical entrepreneurship could be instituted. Public awareness programs to promote the ways in which science and technology can improve

everyone's life can be developed and run, relying heavily upon television. Public awareness programs could also be directed to stimulate the formation of community cooperatives to undertake some parts of technological innovation and profit from them.

6. Technology and management extension agents are invaluable to provoke people into seeing new opportunities arising from technology, and realising that it is possible to improve their operations of business, farming, fishing, trapping or whatever. These extension agents would be tied into the government science and technology strategy mechanism, the network and the core facility.

Think about these possible mechanisms. They have no worth unless people are willing to support and use them. If the ideas presented in this paper suggest other ways to develop a science and technology strategy for the Yukon, make them known. Stake a claim now for the 21st century!