Venturing the Future:

Being a Creative Ice Breaker of Conventional S&T Wisdom

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Creativity in science re-orients the seemingly intractable problems of the present world into new opportunities for the passion of the imagination and frames the next challenges for the ever-inquiring instinct of the intellect to overcome. Creativity expresses the play of invention and the reward of application that becomes innovation. Creativity imagines and then proceeds to simulate alternative futures by exploring the boundaries of present reality and looking for holes of intrigue in which to play and follow the paths of knowledge. Play creates the explorative space, and simulation and application provide the discipline of bringing imagination forward into reality.

The best scientists and technologists interweave these capacities like the spiral helix of DNA, or the wave and packet bursts of the new multi media and broadband optical communications future, that will soon be as ubiquitous, accessible and familiar as writing, signage and dial tone.

The National Research Council of Canada has always had a creative bent. It has created music synthesizers, imagined the future of animation on computers, given scope to the inventors of buckminster fullerenes, applied lasers to switching for high speed optical telecommunications and enlarged the field of view of the planners of the next generation of broadband fibre optic systems through wave length division multiplexing. Today the NRC is playing with the fundamentals of molecular structure and configuring the interactions between quantum phenomena, DNA signalling and future computing horizons through its quantum dot and bio-computing projects. NRC is also today examining some of the playful frontiers of the future broadband learning environments and virtual reality interfaces that can only be glimpsed from today's early vantage points.

What these areas of creative opportunity and knowledge exploration and development represent are the frontiers of present risk and future potential economy which through the knowledge developed will, in as yet unknown ways, fundamentally shape the lifestyle and employment choices of our children and our children's children.

The NRC acts as an Ottawa-centred, but nationally-accessible creative resource. It has done this consistently over the years as its researchers have been encouraged to link directly into their natural and networked communities, so that the seeds of imagination can be propelled forward into the new areas and interfacial domains of opto-electronics, bi-informatics and, ecological plastics.

The NRC represents a form of patient research capital for its business and institutional stakeholders, in its ability to catalyse and then reach further into the disruptive domains. It extends these scenarios and takes longer term risks and invests earlier than business and new ventures discovery practices normally allow.

When pursued within a public institutional context, these more speculative, more integrative and more enabling technological platforms and research activities are inherently community and learning oriented because few of those involved really can claim to understand where they are going. This is the essence of the inventive and innovation seeding process.

Learning always occurs when teams of people and communities of interest or affiliation address solutions to their problems. This learning approach to NRC's strategic long term investments is demonstrated by the many early stage new technology ventures that have been seeded and incubated within the knowledge realms of the NRC over the years. These have been well-documented by the Doyletech studies of the origins of the national capital region's high technology cluster firms and the pool of motivated and technically trained personnel which they have consistently attracted. Their awareness of future technical opportunities can also be seen to at least partly derive from NRC's early risk taking and mitigation.

Because these disruptions are being pursued within an idea-rich institutional framework at the NRC, where researchers are encouraged to challenge conventional wisdom, the ideas which are creating the new opportunities are largely only able to be exploited by those who see the need to move outwards and onwards.

In this way they port from the public side to the private, their intellectual capital, enhancing the inter-relationships and interconnections which tie together the community's identity. These resources are mobilized and applied to real business opportunities, as well as to social needs, quality of life and wealth creating innovations that advance the whole cluster of activities which will ensure the continuance of a highly civilized and wealthy community.

These private innovations that can be traced to longer term public investments, also mirror the best aspirations of our own individual imaginations for the future because they affirm the value of community in ways that shape the next forms of our evolving civilization.

NRC's role is like that of an icebreaker that moves into solid ice fields and disrupts the binding forces, thereby creating the opportunity to form new and disparate patterns, which can be perceived in new ways. New routes open up and new configurations of possibility can be contemplated. Similarly, in technology explorations, the early and bold venturers seek to disrupt the existing patterns - leading to what some observers are now calling disruptive technologies.

Marketplaces – where most innovation happens - are characterized by three complementary functions: competition; cooperation; and learning. By being closely linked to technology market partners, NRC plays an important role in advancing the awareness of and learning abilities in firms that can benefit from disruptive technologies. For example, as the new world of internet worked enterprises and virtual organizations emerge and become pervasive, there will be many surprises.

NRC is already anticipating some of the disruptive ways that these new systems and structures might evolve. Since the early 1990s, NRC has been a pioneer in helping Canada to establish its place on the Internet. NRC is a founder and partner with CANARIE in CA-Net which is presently building the broadest national fibre pipe in the world, and the first points of disruption will be in technologies for access and management and in the drivers of content: entertainment

and learning. NRC is making significant strides to forge multi-disciplinary and multi-media-based learning partnerships with new companies that are exploring the ways that these disruptions will re-shape our learning and commercial systems. This has included digital music teaching, virtual research spaces, e commerce usability and seamless wireless and wired interfaces.

All this is to say that NRC acts as an early scout and icebreaker for Ottawa's new technology ventures, in removing or reducing their risks by pointing the next generation of researchers toward the coming set of opportunities and barriers in the disruptive process.

Can the Universities Not Play This Icebreaker or Disruptive Role?

Universities produce the raw talent that cluster firms need to grow, but they are not well designed to support the icebreaker function, because for the most part, in order to be able to educate and channel students, their primary structures are the traditional disciplinary boundaries which the icebreaker function actively challenges.

A second reason is that the icebreaker role usually requires a combination of staying power - continuity over several years of patient investigation – and unrestrained access to the best equipment and expert teams. A third reason is management. To challenge the present paradigms of conventional wisdom requires strategies and managerial intent. Few universities are sufficiently organized to be able to apply the multidisciplinary capabilitities necessary to be able to understand the multi-dimensional nature of the challenges – many of which are resident in the embedded business models of the firms that need their ice broken as it were.

Finally, the NRC is able to be an icebreaker in ways that are not as easily accessible to universities:

- NRC manages a portfolio of R&D using teams that combine many senior and junior levels of experience and mentoring, whereas universities tend to be structured around the professor and a few graduate students, functioning somewhat as an isolated small enterprise;
- NRC relies upon strong firm intelligence and project management discipline through regular collaborative and contractual partnerships and agreements with firms – this brings the NRC into closer contact with the business and operational environments of technology firms;
- NRC maintains strong international linkages and relations with many professional communities as well as with the most agile technology firms, with technology foresight being considered as critical to all collaborative relationships;
- NRC has additional, deeper resources that are ancillary to the business transformation process that disruptive technology engenders such as standards and measures research and strong intellectual property management regimes that can only be matched by the largest and leading universities.

The best combination of approaches to disruptive synthesis however is for universities to partner with the NRC to ensure that new talent can be directed and mentored effectively in the directions where the needs exist and where universities are able to identify and supply the new talent stream.

NRC then, acting as a post-doctoral finishing school and intermediate mentor for next stage disruptions and business futures can provide the diversity of disciplined technical training that supplies firms with the next generation of talent to help them transform the technologies they will need to stay competitive.

In the present world of tumultuous technological and social change, those who are venturing most aggressively into new territory with the most extensive foresight and ability to invest in next generation systems are becoming highly valued strategic assets for technology clusters. The NRC has been able to play this role in helping the Ottawa clusters develop and move rapidly into the next stages of succession technologies.

Probably the best example is WDM technology which over a 15 year period has enabled Ottawa to seize a global leadership role in fibre optic capacity and now forms one of the strategic backbones for the photonics cluster. Perhaps bio-informatics, bio-computing and nano-structures will be needed sooner than conventional wisdom believes in the next decade of cluster evolution.

Being disruptive and breaking the ice means finding the opportunity to be creative, to challenge the present technological paradigm and to pursue diversification of the infrastructure of knowledge through building new areas of fusion and integration.

About the Author:

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