

Creating a Sustainable Health Research Industry in Northern Ontario

Appendix 5: Discussion Document

June 3, 2005



**Northern Ontario
School of Medicine**

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The Purpose of this Document

Context

This is a Discussion Document and is prepared as part of a project, commissioned by the Northern Ontario School of Medicine together with a number of key stakeholders in Northern Ontario and carried out by SHI Consulting. This project's purpose is to develop a practical, implementable strategy for the expansion and development of the health research industry in Northern Ontario with the objective of creating additional employment opportunities in the region.



What this document is

This document is a Discussion Document describing three high level strategic plans building on the health assets in Northern Ontario that are aimed at creating a vibrant health research economy. These strategies are based on information gathered from facilitated sessions and individual interviews in individual city visits (Dryden, North Bay, Sudbury, Sault Ste Marie, Thunder Bay and Timmins), benchmarking of five health research clusters, thirty interviews conducted with leaders in Government, Industry, Academia and Non-Profit organizations as well as information gathered from Statistics Canada and other information banks. The purpose of this document is to illustrate how assets and activities can be linked or configured to build different health research themes. By ascribing “high level” values to many of the proposed activities we can assess the potential impact on job creation, economic development and return on investment. More importantly this model enables one to examine where key risks and potential rewards may occur within the plan.



What this document is not

This document is not a final report on the outcome of a consulting engagement. It is neither an implementation plan. This is still to be developed subsequent to the second round of facilitated sessions being held in June 2005. It is also not intended to limit the discussion of other ideas, strategies or research themes. If you read this document and find that key initiatives are not warranted or research themes are missing, you are invited to raise this during the facilitated session to be held in your city.



In conclusion

The authors of this document invite you to participate, think, debate, raise issues and contribute as much as possible to this process. The outcome of this work should be the development of a comprehensive plan to stimulate economic and employment growth in your region. The more you are able to contribute to it, the more successful the outcome will be.

I. Executive Summary

A fundamental and universal concept in strategic development is that the success of a community or organization depends on its ability to exploit core assets and strengths. However, it is possible to look at core assets and strengths from a number of different angles. This is the purpose of the present discussion document. We have delineated four scenarios that leverage regional assets and strengths in Northern Ontario in different strategic directions. The four strategic directions were developed based on (1) workshops and interviews with local stakeholders, (2) interviews with leaders in the health research sector and (3) benchmark comparisons.

Scenario 1: Dispersed Networked Health Research

The first strategic scenario is focused on research in a dispersed environment with multi-centre collaboration. All research is carried out with maximum collaboration across numerous centres in Northern Ontario, with numerous collaborative research links within the region.

This approach aims at combining strengths to differentiate health research in Northern Ontario and developing niche expertise. A number of core research strengths are identified for the region and are used to build the research platform in the scenario. Key challenges to be overcome include:

- Getting noticed in a competitive research funding environment
- Northern Ontario's health research assets are physically dispersed
- Perceptions about distance from other centres
- Commercialisation of health research is new for Northern Ontario

Some key opportunities are identified for partnering beyond the region. Enabling initiatives for the strategy to be implemented are identified and discussed, related to the five major pillars of a successful health science cluster, namely: infrastructure, human resources, capital, scientific innovation and optimal commercialization processes. Examples of issues and initiatives relevant to these pillars include:

- Community-based Clinical Research Institute
- Health Research and Resources Network Health Research Portal
- Hub for First Nations Health Research
- Research parks network with flexible space for commercialization
- Harmonization of Institutional Ethics Review Boards.
- Collaborative research fund
- Dedicated regional venture capital seed fund
- Health informatics research network with establishment of a chair
- Virtual reality simulation network
- Bio-prospecting research network
- Occupational health research network
- Network of linked technology transfer offices
- Harmonization of the regulatory environment

Scenario 2: Developing a Niche Strategy

The 'Niche Strategy' involves focusing on one specific area and building upon the region's assets and strengths. Northern Ontario has a number of cancer-based research centres and initiatives across its health environment. This strategy examines all of the research aspects that could occur to bring products or services to a disease market. When all of the assets are examined in this framework, clear links or opportunities to collaborate are identified. Once identified, fostering these links by providing the appropriate resources creates stronger bonds. Northern Ontario can begin to compete on a global scale when non-obvious links are created within a niche strategy. For example, combining geography, demographics, economics, information systems and cancer

clinics across Northern Ontario enables researchers to solve unique problems with novel and relevant data sets.

Scenario 3: Leveraging Current Assets

In this strategy, the focus is on research activities that are currently ongoing and have reached a certain momentum in Northern Ontario such as clinical trials, cancer research, mitochondrial DNA, bio-prospecting, to name a few. The 'Leveraging Current Assets' strategy is built around three 'pillars'. The first pillar aims at empowering current stakeholders in clinical research, by bringing them together and providing infrastructures needed to establish them as competitive players in the market. The second pillar of the strategy is to provide infrastructures and support to nurture research activities that have a strong basis in the region and which have commercial potential. The third pillar builds the commercialization enablers for the region. This strategic scenario aims at maximizing potential commercial outcomes, attracting private research contracts, and raising competitive research grants. Altogether these initiatives could reasonably result in public and private investments of up to \$31 million over 5 years. Capital investment would represent \$21 million, with the remaining \$10 million in research funding.

Scenario 4: Maintaining the Status Quo

The status quo strategy assumes that no additional action would be taken other than to focus on the medical school and its mandate to train 56 medical students annually. The status quo scenario is essentially a 'baseline' scenario that permits an assessment of the potential value of investing time, energy and money in a health research cluster. Medical school activities have a budget of \$22,000,000 on a yearly basis. This investment alone will contribute to economic growth in the region.

II. Introduction

1. Defining the Opportunity

In September 2005, the new Northern Ontario Medical School (NOSM) will be offering for the first time in the region, classes for medical students. Fifty-six students will begin their medical training in a program that is tailored to the health care needs of the Northern Ontario region. This program has recruited faculty members and local clinicians. This program will attract and retain highly qualified personnel in health care, health science, and health research.

The Northern Ontario region already hosts several health research activities in basic and clinical research, including:

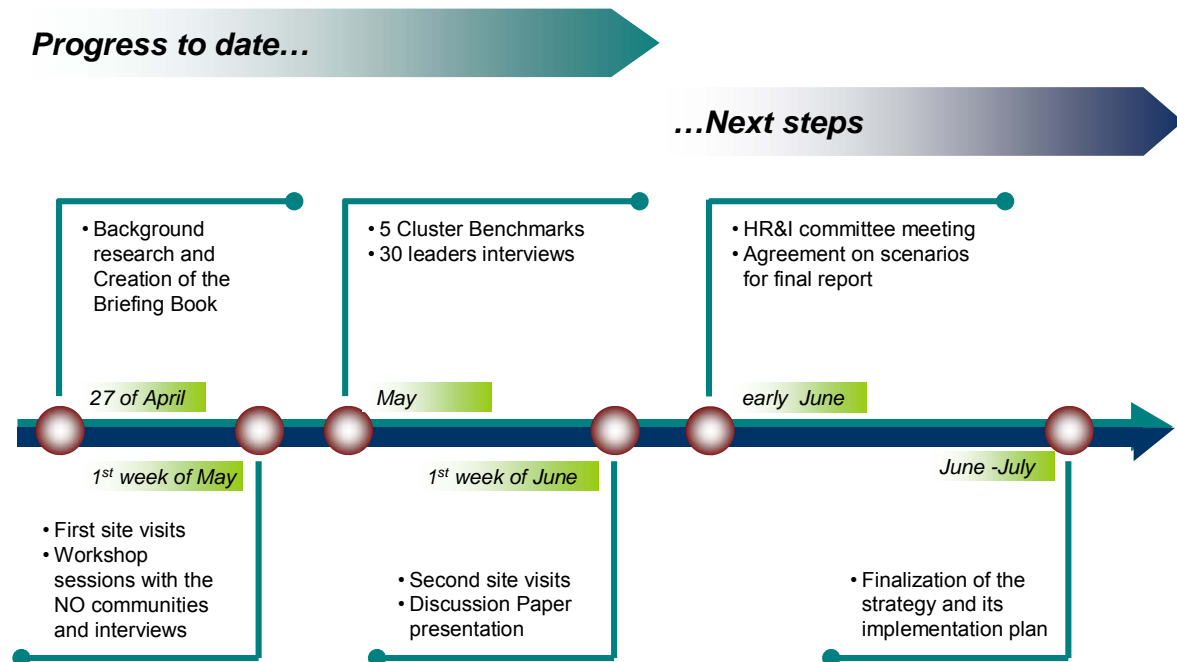
- population health/public health issues
- diseases/disorders specifically affecting northern populations
- occupational health
- evaluation of health and health education delivery approaches
- healthy aging

The inauguration of the new School of Medicine will bring new leadership and assets into the regional health science spectrum. This can provide NOSM with new opportunities to leverage current assets and create synergies among local research activities and assets. In order to capitalize on the growth of the health sector in Northern Ontario, a strategy is required to link existing strengths in the region, enhance globally competitive assets and leverage opportunities for regional development and economic growth

As northern and rural health research and innovation is emerging quickly, success in growing a specialized health research program in Northern Ontario would provide economic development and diversification benefits. Therefore, an effective strategy is needed with a practical implementation plan to accelerate the growth of the health research sector in Northern Ontario over the next decade.

Navigating through the demands and risks associated with taking a unique discovery or invention to highly regulated global markets is challenging, yet the rewards can be very substantial. As a result, it is essential to find appropriate niche areas in which to specialize and partner, where excellence and competitiveness can be sustained and investment risks minimized.

2. Methodology



The above figure gives a graphical summary of the project to place the consultation sessions in June in context.

III. Scenario 1: Dispersed Networked Health Research

1. Strategy: Overview

This strategy emphasizes research into health service delivery carried out in a dispersed environment with multiple centres that have long distances between them. All research is carried out with maximum collaboration across numerous centres in Northern Ontario with collaborative research links within the region.

A. Rationale for this Approach

Northern Ontario requires a strategic plan that makes maximum use of research strengths already present in Northern Ontario.

Such a plan should tie most of the research together under a common theme, which is better for the region to distinguish itself and achieve recognition for its excellence in a particular aspect of health research in an environment that contains growing numbers of competitors.

By working together, the region can achieve significant critical mass to put its health research on the national and international map. This is unlikely to be achieved by operating as numerous small independent centres. Working independently will lead to duplication and the small size of the health research industry in each individual centre will mean that the outputs of those centres will be eclipsed by larger, better resourced centres of health research elsewhere in Canada and North America.

B. Research Strengths to Build Platform

1. Epidemiology of Northern Ontario, including rural and urban centres. There is an opportunity to gain recognition for excellence in rural Canadian epidemiology.
2. Health service delivery carried out in dispersed and remote environments. This would focus on best practice and best service configuration for delivering healthcare over long distances and in remote environments.
3. Bio-prospecting
4. Health Information Systems
5. Tele-health
6. Aboriginal health
7. Cancer diagnostic tests
8. Clinical research. This would include health outcomes research of specific therapies and techniques used for the management of specific pathology rather than the narrowly defined concept of clinical drug trial.
9. Mitochondrial DNA research
10. Aging research, particularly healthcare delivery to dispersed and rural elderly populations
11. Environmental health research

C. Key Issues, Challenges and Risks

Getting noticed in a competitive research funding environment

Health research is highly competitive, even for the most prestigious health institutions. Northern Ontario will need to focus on specific areas of strength to become competitive and remain that way. With health research clusters being developed in many less urban centers, niche areas of

expertise are becoming more competitive for resources and intellectual capital. Networking and collaboration is a way to achieve critical mass for research, funding and financing purposes.

Northern Ontario's health research assets are physically dispersed

Many centres within Northern Ontario have developed research expertise but they are located physically far apart. In the past, this has been an obstacle to collaboration. The region has invested heavily in communication infrastructure to overcome distance and this wise investment can now be capitalised upon to collaborate over distance using video-conferencing, tele-conferencing, the internet, e-mail etc.

Perceptions about distance from other centres

The region is perceived to be remote and far away from many potential collaboration partners in Southern Ontario or elsewhere in Canada. The marketing message delivered through the Internet and at every opportunity should emphasise that many of the centres in the region are reachable in less time than it takes to travel between some of the major centres in Southern Ontario and that they are further South than Vancouver, Seattle and other large centres.

Commercialisation of health research is a new area for Northern Ontario

To foster commercial health research ventures, several factors could be put in place, including accessible services for intellectual property management, accessible technology transfer specialists, physical infrastructure, capital, a good supply of skilled personnel and original innovative research. There is already good science present in the region and at least two examples of spinout companies from that research, showing it can be done. The environment can be fostered to build more of this as described in this document.

2. Partnering Opportunities- Beyond the Region or Outside Healthcare

- Large diagnostics firms for development and marketing of research for diagnostics tests
- Pharmaceutical companies for bio-prospecting and to offer research services such as screening of drugs against unique cell lines developed in Northern Ontario
- The Bay Crest Centre, particularly the Rotman Research Institute – aging research
- Working with workplace safety and insurance board (WSIB) and large industries such as mining and forestry for occupational health research
- Biotechnology or large pharma to invest into selected research programs for right of first refusal
- Large Pharma for clinical trials
- Working with geography (GIS) to develop:
 - o maps of health care services
 - o epidemiology
 - o maps of bio-prospecting
- Working with economics departments for health outcomes research
- Using databases like Group Health for rapid selection of patients for therapeutic research (not just clinical drug trials)
- Working with software developers to develop specialized programs for wait times etc.
- Partnering with suppliers of tele-health equipment for researching applications best practice
- Offering of research service capacity to larger centres in Canada and the US.
- Link with Medical and Related Sciences 'MaRS' Discovery District being created in Toronto and brand the region's health research as 'MaRS North'.
- To build up access to research funding needed for research programs will require building partnerships and reputations with major funding agencies and philanthropic foundations to obtain dedicated funds. Possibilities include:
 - o Canadian Institute for Health Research (CIHR)
 - o Canadian Health Services Research Foundation (CHSRF)
 - o Health foundations
 - o Philanthropic family foundations such as Rockefeller, Gates etc.

3. Enablers for the Strategy

A. Infrastructure

Community-based clinical research institute

- Community based – a network of researchers, not a building
- Strong focus on health outcomes / clinical outcomes research of specific therapeutic approaches. This is about clinical medicine in a specific setting, not about clinical drug trials.
- Epidemiology of disease in Northern Ontario
- Electronic patient records
- IT infrastructure with as much clinical research data as possible for the region
- Economic analysis including cost/benefit analyses that have application way beyond Northern Ontario. Group Health has a lot of the data needed to do this. An example would be the work currently being undertaken in Sault Sainte Marie to examine cost effectiveness of 'flu vaccination. This type of work has direct application in Northern Ontario, but is universally applicable, which helps to raise the region's profile in health research.
- Expertise in protocols for longitudinal studies using electronic patient records.

- **\$8 million over 5 years in capital expenditure and operating costs**

Health Research and Resources Network Health research portal

This is proposed as a central knowledge repository of:

- research currently being undertaken and
- available resources

This would include a web portal allowing stakeholders to look up what research is currently being undertaken in the region. Its primary function is envisaged as enabling one group of researchers to find others with whom to make contact with a view to collaboration and creating links.

This same portal would showcase health research capabilities to market services and capacity to other regions, provincially, nationally and globally. For example, research work could be sourced from the US, particularly in areas of unusual expertise such as mitochondrial DNA work. Canada can offer US standards at lower costs. It cannot compete purely on cost with certain developing nations, but can offer geographic proximity and high quality assurance to US partners.

- **\$3 million over 5 years in capital expenditure and operating costs**

Hub for First Nations health research

Research into health issues that are of particular importance to First Nations people is a very important part of health research in this dispersed environment. The outcomes would have direct applicability and successful research methodologies and be of interest to other regions in Canada. They would also have broader applicability to environments in which people of different cultures wish to find ways to collaborate and conduct research together.

There is a building available in Dryden that is well equipped technologically and could make a good communications centre for community-based research taking place over distances. It is currently an asset for sale, having been identified as no longer part of core requirements for a large paper and forestry products manufacturer. A donation could potentially be negotiated for the building that would result in a tax credit for the current owner.

It is recommended that a separate legal entity could be set up in the form of a trust or foundation to contain the building, administer research funds and create the networked research environment, and this would be presided over by equal numbers of trustees from the First Nations and the School of Medicine. This would be a discussion forum and a physical facility that would form a core for carrying out research. Equality of collaboration will be very important to the success of such an undertaking.

- **\$8.5 million over 5 years in capital expenditure and operating costs**

Research parks network with flexible space for commercialization

It is possible to build strategically placed research park space in key centres in the region that would collaborate with services that could be made available on a shared basis between several parks. It is too early to build these now. The research capabilities of the region should be built further before undertaking these. Detailed feasibility work would have to be undertaken to determine the viability and appropriate size of each site and how they should link. Also, it is probable that some smaller incubation space could be co-located on or in close proximity to the research parks.

Likely principle sites would be Thunder Bay, Sudbury and Sault Ste. Marie. Such commercial research space should be for more than one discipline, such as mining and forestry-related research, or other industry-applicable research, in addition to more conventional health research. Such sites can be sourced of inward investment as they can attract companies that wouldn't necessarily spin out of a local university, including specialist research divisions of large corporations.

B. HR

Harmonization of Institutional Ethics Review Boards.

Harmonization of the regulatory environment is needed to make it easy for collaboration within the region and with other parties from beyond the region.

For research that involves human subjects, collaboration within the region and from beyond the region would be far easier if standardized guidelines are adopted with mutual recognition of the review boards within the region. This will allow a project that is approved in one centre to be carried out at several centres without time delays and the 'hassle factor' of having multiple review processes, which have the same objective and duplicate one another.

- **\$1 million over 5 years in capital expenditure and operating costs**

C. Capital

Collaborative research fund

Such a fund would specifically and exclusively provide grants for research projects that take place on a collaborative platform. This would be linked to the health research network mentioned above and provides incentive for collaborative research by providing funding that is only accessible by linking research in more than one centre.

- **\$13 million over 5 years in capital expenditure and operating costs**

Dedicated regional venture capital seed fund

Create a \$5 million fund dedicated to the Northern Ontario health technology ventures. This fund should be supporting projects with a clear path to revenue, realistic exit strategy or conditionally pre-committed follow-on financing based on reaching specific milestones. This would be likely to comprise of syndicated fund from several partners, public and private. Of particular interest are the labour-sponsored investment funds.

- **\$8 million over 5 years in capital expenditure and operating costs**

D. Science and Innovation

Health informatics research network with establishment of a chair

There are several strengths in the area of health informatics in Northern Ontario. By linking these into a research network, critical mass can be created in this area. This could build on the strengths present in Northern Ontario in certain fields, such as the excellent work at Group Health in Sault Ste. Marie in terms of patient records and the health information systems training program offered at Cambrian College, Sudbury. Research could be carried out to mitigate the challenges of coordinating records between different centres in a dispersed medical environment and facilitate the development of appropriate models for transfer and use of information for continuity of care as patients access different levels of care that may require them to be treated in other centres. Information systems are still woefully underused and fragmented in healthcare generally, and the field remains open to establish good practice in this area.

- **\$3.2 million over 5 years in capital expenditure and operating costs**

Virtual reality simulation network

Given that there are strengths such as a computer gaming degree program in Sault Ste. Marie and a Virtual Reality lab at Laurentian University, there is an interesting area that could be researched to develop healthcare training using virtual reality to simulate realistic clinical situations, particularly for critical care and emergency care, but possibly for surgery as well. This would transfer some of the technology developed from mining research to a healthcare application. This could be researched to link to tele-health or tele-surgery to look at ways to deliver virtual reality training to health personnel located remotely from the actual VR lab itself.

- **\$3 million over 5 years in capital expenditure and operating costs**

Bio-prospecting research network

The core strength of a program of bio-prospecting in Northern Ontario is that it will be a training ground for researchers and a giant laboratory for the development of dispersed research methodology and expertise, which is a niche area in which the new medical school and the region could distinguish themselves.

Northern Ontario has a rich biological resource to screen for potential compounds. A bio-prospecting research network would co-ordinate the large scale efforts of gathering samples and testing them for specific indications. It would also link different groups that have relevant knowledge such as the forestry research centres in Sault Ste. Marie with the cancer centres in Sudbury and Thunder Bay.

This network could work with key stakeholders such as First Nations, health researchers and institutions to develop:

- purification methodology and/or capacity for isolation of unique compounds
- with the geography department at Laurentian university for GIS mapping of sample origins
- electronic data management programs to track samples from origin to test results

Since the bio-prospecting research network would bring together various Northern Ontario public research institutions and private companies, it could link with the technology transfer offices network for commercialisation and would increase the ease with which national or international groups could access the resources managed through the centre.

- **\$3.2 million over 5 years in capital expenditure and operating costs**

Occupational health research network

There is currently an occupational health research group proposed for Laurentian University. There is also a sleep laboratory in Timmins that focuses on sleep disorders related to mining shift work. These are examples of research with a similar focus that could collaborate. Funding could be sought from the Workplace Safety and Insurance Board.

- **\$2.8 million over 5 years in capital expenditure and operating costs**

E. Commercialization Process

Network of linked technology transfer offices

This would be an information network similar to the research network described above. It would provide industry-seeking links to research groups or technology for licensing or investment with a 'single view' that would enable an interested party to see what is on offer across the region without having to go to multiple different offices individually to obtain this information. In the near future, it is possible that a fund will become available in Ontario dedicated specifically to research commercialization activities. This could be a potential source of funding for this exercise.

- **\$1 million over 5 years in capital expenditure and operating costs**

Harmonization of the regulatory environment- Liberal intellectual property policies

To achieve any sizable success in commercialization of health research in the region, the varying intellectual property policies of the different institutions across the region will need to be negotiated to be broadly similar. Most important of all, they will need to be liberal in the rights accorded to investigators to profit from their discoveries. There are now multiple examples internationally and in Canada that show that health research clusters are more successful and produce more new technology businesses where investigators have rights to the intellectual property they develop. Conversely, institutions that are overly controlling and retain all rights to intellectual property developed by their employees are poor at commercializing their discoveries.

Adopting a liberal approach to intellectual property is a critical success factor for commercialization and to attract investment into Northern Ontario for a health research industry. With the setting up of a new medical school, this is a golden opportunity for the school to distinguish itself and create a competitive advantage by having the most investor-friendly intellectual property policy of any medical school in Canada.

This would achieve two aims: Firstly, this will attract good researchers who see commercial applications for their work and who may move to Northern Ontario from other environments that are more stifling for entrepreneurial scientists.

Secondly, it would be more attractive for private sector investment to the region. It helps to overcome barriers such as physical distance from the offices of many venture capital funds by providing a motivating factor.

- **\$500,000 over 2 years in professional time and advisory fees.**

4. Major Milestones

A. Years 1 & 2

- Community-based Clinical Research Institute founded
- Health Research and Resources Network Health Research Portal- negotiations initiated
- Hub for First Nations Health Research– negotiations and planning
- Research Parks network with flexible commercialization space- planning and feasibility for research park space
- Harmonization of Ethics Review Boards- negotiation of policies, standards and mutual recognition agreements
- Collaborative research fund- negotiation with public funding bodies and establishment of fund (12 to 18 months)
- Health Informatics Research Network- collaborations set up, network established
- Virtual Reality Simulation Network- initiate discussions, examine feasibility, build frameworks
- Bio-prospecting research network- planning and establishment
- Occupational Health Research Network established
- Network of linked Technology Transfer Offices- negotiation of policies, standards and mutual collaboration
- Harmonization of Regulatory Environment- intellectual property policies, negotiations and framework

B. Years 3 - 5

- Health Research and Resources Network Health Research Portal- widespread adoption & usage
- Hub for First Nations Health Research- centre established and research commenced
- Research Parks network with flexible commercialization- commence first phase of a research park
- Harmonization of Ethics Review Boards- completed and functioning
- Collaborative research fund running at full strength
- Dedicated Regional Venture Capital Seed fund- business planning, fund manager selection and fund raising
- Health Informatics Research Network- expansion of research program, chair endowed
- Virtual Reality Simulation Network- commence research program and application based on feasibility
- Bio-prospecting research network- expansion of research and training program
- Network of linked Technology Transfer Offices- running
- Harmonization of Regulatory Environment- intellectual property policies implemented

C. Years 6 - 10

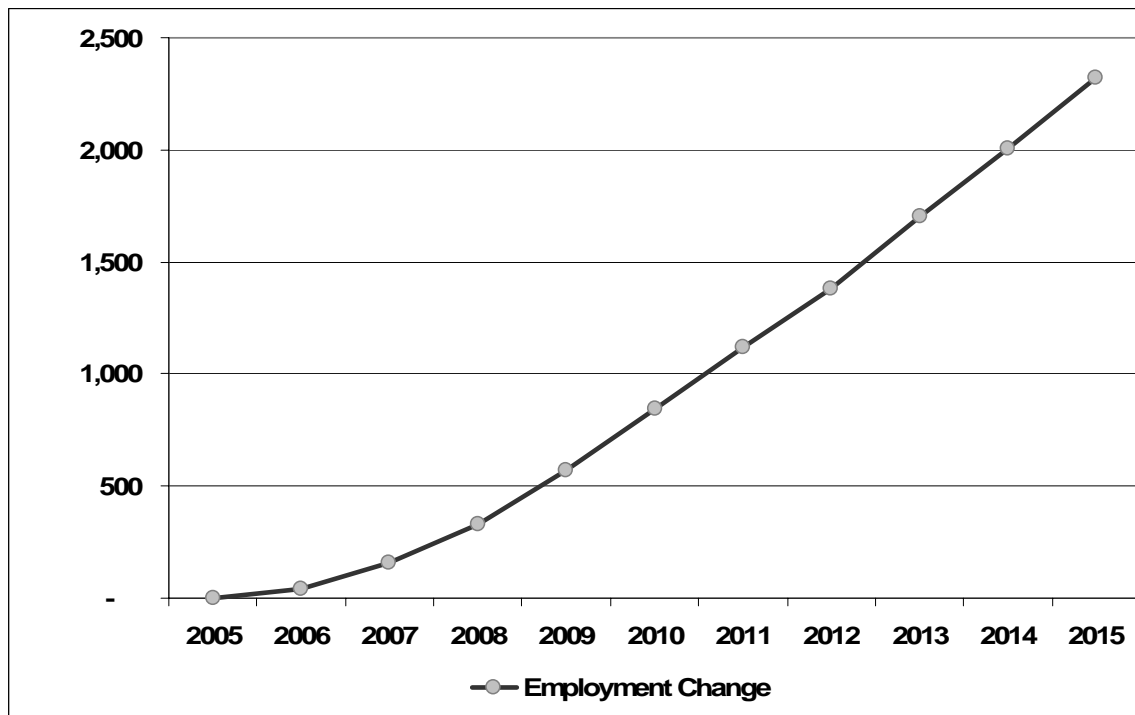
- Research Parks network with flexible commercialization space- increase, with follow-on phases
- Dedicated Regional Venture Capital Seed fund- investing, may exit first investments by year 10
- Bio-prospecting research network- ongoing search and discovery

5. Economic Impacts

Employment Change

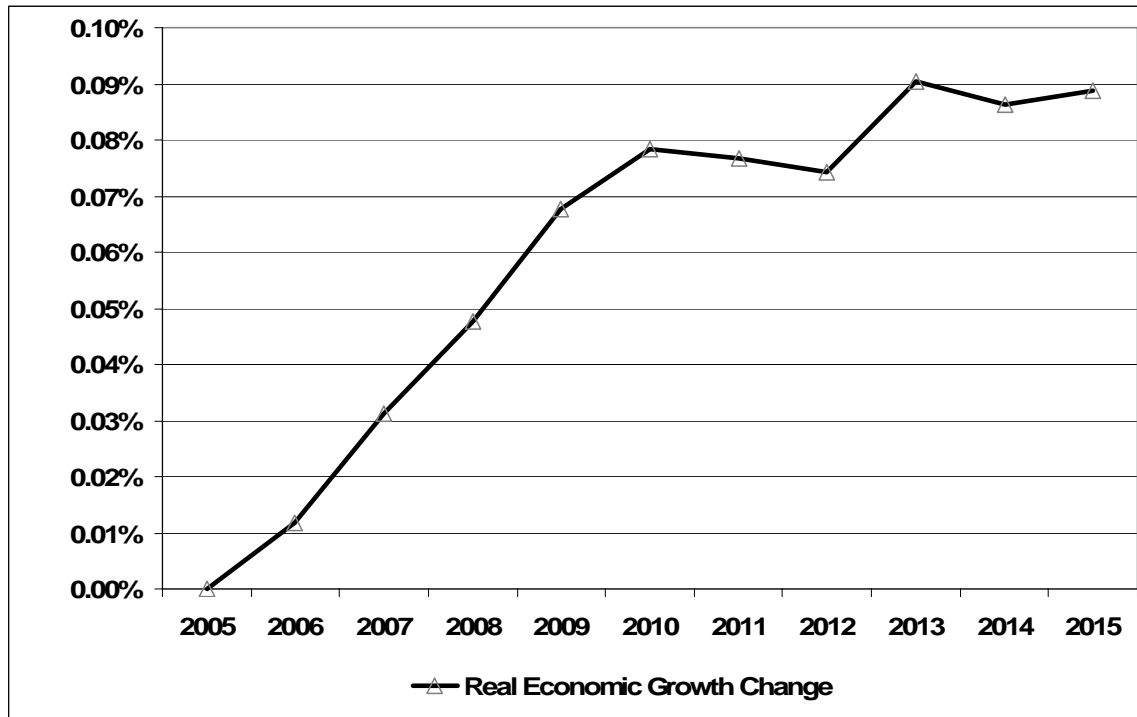
Significant benefits begin to flow by 2008. The projects begin to have economic effects by 2008. From 2006 to 2009 there is an investment period and then the benefits begin to accrue from 2009 to 2015, but the momentum is strong and shows a good propensity to keep increasing employment.

This scenario shows ability to generate growth in employment for less investment than the original investment for the medical school. But, the presence of the medical school creates the basis for being able to do this.



Real Economic Growth Change

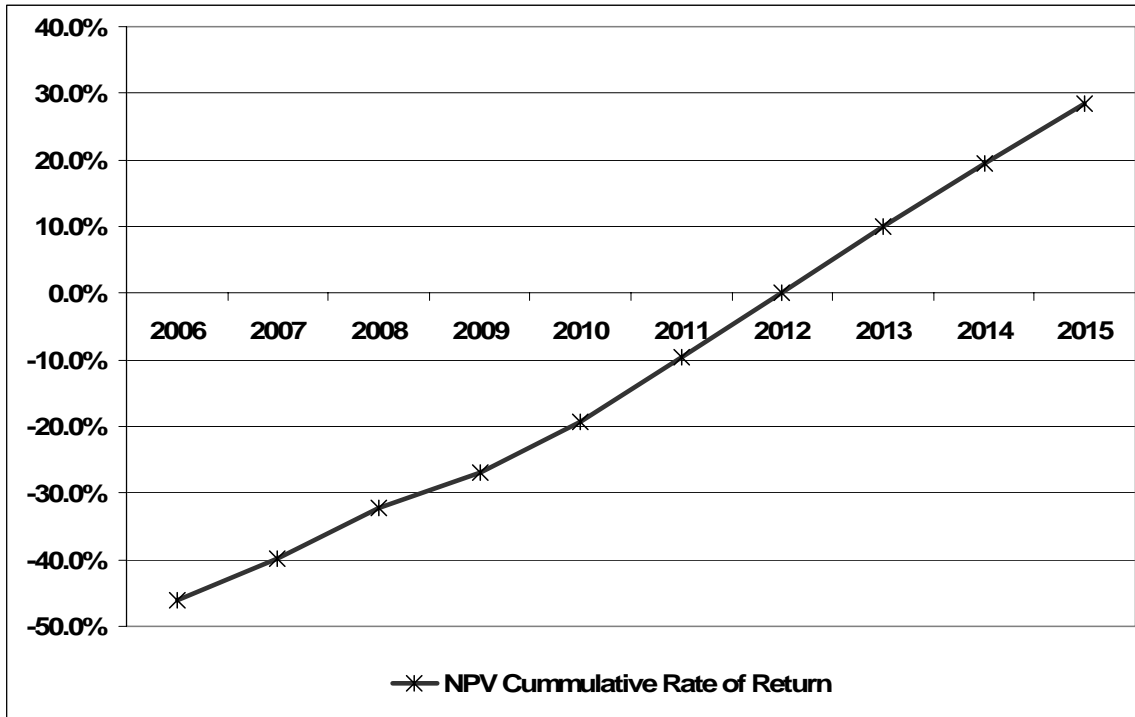
The economic growth becomes statistically significant around 2007, at which point it develops strong momentum. The period 2009 onwards will manifest if the initial period has been well managed. This scenario produces quite strong economic growth for its level of investment.



Net Present Value Cumulative Rate of Return

This scenario has the highest level of funding risk of all the scenarios, which is indicated by the fact that the cumulative breakeven point is only in 2012. Consequently it has the most reward. This manifests above in the greater ability to generate employment and economic growth.

The biggest management risk will be in the period 2006 to 2009. Well-managed, it will generate good rewards after 2009. Poor management of this period will take longer to manifest.



IV. Scenario 2: Developing a Niche Strategy

1. Strategy: Overview

Northern Ontario has a variety of healthcare research-related activities. Many of these activities occur in different disease areas or are potentially applicable across multiple diseases. With this strategy many of the key activities and assets are united under one therapeutic focus to foster collaboration and innovation. This strategy constitutes an approach designed to quickly gather critical mass and build momentum.

A. Rationale for this Approach

To compete and actively attract resources on a local, national and global scale, Northern Ontario could focus on one disease or expertise area. Key to this strategy is to build upon key strengths within the region and create synergies between key groups. By focusing on an integrated single disease area, Northern Ontario would identify key strengths and build on those by creating links between these strengths. This initiates building of critical mass as well as the subsequent momentum necessary to grow a sustainable research economy.

The array of assets in a specific disease area can be identified by looking at the pieces required to develop marketable medical product(s). For example, to develop suitable therapies for a disease indication in a specific region, one could employ many of the following steps:

- **Assay development:** Creation of rapid tests to preliminary screen for compounds for a specific indication.
- **Compound creation or development:** Source of novel products that could be tested against specific assays.
- **Preclinical research:** Further refine compounds or indications. Drug and drug targets can also be identified here.
- **Clinical research:** Ability to effectively run clinical trials from Phase I to IV (IV being post-approval trials) and determine long-term outcomes of treatments including cost benefit analysis.
- **Healthcare delivery:** Having qualified personnel, resources and infrastructure to deliver best practice healthcare in a timely manner.
- **Epidemiology:** Understanding and mapping disease epidemiology in a region over time.

Using this framework numerous activities and assets (pillars of innovation) can easily be seen in a specific disease such as cancer. Strong links between specific activities and/or opportunities within and between centers can clearly be seen. When acting in concert resources are shared, knowledge is quickly transferred and thus many large scale projects that may have previously appeared to be unattainable now become attainable.

B. Research Strengths to Build Platform

- Cancer research institutes
- Diagnostic and radiotherapy devices with under-capacity
- Large IT network and capacity (PACS, electronic medical records within major centers)
- Development of a cancer research park

- Ground hemlock and taxol for cancer
- Breast screening highest in Ontario in specific centers
- Large numbers of cancer clinical trials across Northern Ontario
- Development of standardized procedures with Cancer Care Ontario
- Research groups working on novel breast cancer markers
- Novel cell lines for drug resistant cancers
- Nano drug delivery technology
- Health systems performance metrics
- Aiding other countries with their cancer programs
- New health informatics training courses
- Epidemiologist studying cancer
- Non-transient aging population (outward migration of youth)
- High incidence of cancer
- Radiology program at Laurentian University
- Viral genomics research chair tier II – could it be for oncology viral genomics (cancer specific virus)
- Health informatics programmers
- Potential chair in cancer research

C. Key issues, Challenges and Risks

Cancer is a globally competitive disease to investigate

Health research is highly competitive, even for the most prestigious health institutions. Northern Ontario will need to focus on specific areas of strength to become competitive and remain that way. With health research clusters being developed in many less urban centers, niche areas of expertise are becoming more competitive for resources and intellectual capital. If Northern Ontario fosters growth by linking research groups and attracting excellent primary investigators then the health research community could build to a critical mass.

Northern Ontario cancer assets are physically dispersed

Many centres within Northern Ontario have expertise in cancer but they are located physically far apart. Although this problem is attenuated by the electronic infrastructure within Northern Ontario it can still limit collaboration. Once major centers can work together and share resources between the North East and North West, then the entire Northern Ontario region can begin to import capacity (either public or private investments) from other regions.

Cancer's competing interests

Cancer is a major priority for federal, provincial and local governments. Northern Ontario must ensure that their strategies are aligned with the provincial and federal priorities and are not competing with them. Northern Ontario should work with these agencies in order to maximize funding potential.

2. Partnering Opportunities – Beyond the Region or Outside Healthcare

- MDS Nordion for radio therapy. Partner with oncology research that would use radioactivity combined with technologies available such as biologics
- Ontario Cancer Regional Network
- Large diagnostic and therapeutic equipment manufactures that supplies
- Countries for best practices in cancer research or remote diagnostics etc (see ICR)
- Working with workplace safety and insurance board (WSIB) or steel mills for occupational cancer research (i.e. bladder cancer research)
- Biotechnology or large pharma to invest into health institutions for right of first refusal
- Large Pharma for clinical trials
- Working with geography (GIS) to develop:
 - o maps of health care services

- epidemiology
- maps of bio-prospecting
- Working with economics departments for health outcomes research in cancer
- Working with software developers to develop specialized programs for wait times etc.
- Partnerships with other cancer centers in Southern Ontario and other countries

3. Enablers for the Strategy

A. Infrastructure

Harmonizing Technology Transfer Offices

This would be an information network similar to the research network described above. It would provide industry-seeking links to research groups or technology for licensing or investment with a 'single view' that would enable an interested party to see what is on offer across the region without having to go to multiple different offices individually to obtain this information. In the near future, it is possible that a fund will become available in Ontario dedicated specifically to research commercialization activities. This could be a potential source of funding for this exercise. Northern Ontario has many research institutions generating technology with commercial applications. Efficiencies in operations will be generated by linking the technology offices together (North East and North West) under a common umbrella organization. These efficiencies may include:

- resource infrastructure
- increased ability of small institutions to interface with investors looking for technologies
- ability to bring potential disparate technologies together and present stronger value propositions

- **\$500,000 per year**

e-infrastructure research for oncology care delivery

Northern Ontario has good technology capacity from fibre optic networks to high performance computer systems. Programs could be developed that utilize these assets, including:

- to improve healthcare (including test results) delivery and/or access for oncology patients
- to improve the scheduling for diagnostic and therapeutic devices across all of Northern Ontario

- **\$250,000 per year**

Creation of a meta-electronic patient registry that provides information to healthcare workers as well as researchers.

There are many electronic patient record systems within Northern Ontario. Many of these systems are not electronically linked or have the proper security features to allow research to be accomplished. Linking these databases together will greatly enhance and provide unique research possibilities. When other databases are linked into the electronic medical records (EMR) such as pharmacy, billing, WCIB and geographical information system (GIS) mapping data, the number and scope of potential research programs attainable are greatly enhanced. These programs could include:

- Greater clarity and documentation of epidemiological data for specific cancers including regional and occupational health variations.
- Multi-generational analysis of cancer indications
- Potential for genomics-based research if cancer biopsies are banked and genetic tumour profiles are ascertained
- Outcomes-based research including cost effectiveness of treatments
- Increased ability to identify, recruit and conduct long-term studies for clinical trials

- Ability to begin managing an increased number of records outside of Northern Ontario
- **\$250,000 for the first year and doubling every year for the next 5 years**

Creation of a Northern Bio-prospecting Centre.

From taxol (bark of the Yew tree) to digitalis (foxglove plant) many of the therapeutics commonly used today are derived from our environment. Northern Ontario has a rich biological resource to screen for potential compounds. A bio-prospecting center would co-ordinate a large-scale effort of gathering and testing samples for specific indications. Key to this opportunity would be to develop assays applicable to oncology. This center could work with key stakeholders such as First Nations, health researchers and institutions to develop:

- purification methodology and/or capacity for isolation of unique compounds
- unique in-vitro oncology assays
- GIS mapping of sample origins with the geography department
- electronic data management programs to track samples from origin to test results

The resource to set up this centre would be directed in large part to building capacity to handle many samples. This centre would handle the bio-prospecting assays for cancer in Northern Ontario but eventually become a centre for oncology bio-prospecting for national and international samples. Since a bio-prospecting centre would bring together various Northern Ontario public research institutions and private companies, a unified intellectual property office could facilitate the creation of ownership policies. Furthermore, a unified office would increase the ease with which national or international groups could access resources managed through the centre.

- **\$500,000 for the first year ending in \$3,000,000 after the fifth year for a total of almost \$8,000,000**

B. HR

Oncology student fellowship program

Attracting highly qualified personnel into health research can be difficult. Universities across Canada are beginning to provide additional funds to national scholarship-holders to attract graduate students into their Universities. A similar program would be beneficial to attract students into specific cancer research. Participating programs that would relate to cancer could include epidemiology, public health, basic science, occupational health research, geography (GIS mapping), botany (bio-prospecting), economics, sociology and aboriginal studies. This fund could also be used to attract students that may not have access to national scholarships.

- **\$500,000 per year**

Creation of cancer Research Chairs

Attraction of accomplished principle investigators can be difficult. Creating Research Chairs centred on a specific research theme will greatly enhance the ability to attract researchers that would have overlap in a specific area. For example, three Research Chairs could be proposed and funded every 2-3 years. Key to this strategy is deciding on the area of research and city in which such research would be undertaken. Each University or institution should support the applications of the other Research Chairs. These Chairs could include:

- Chair of mitochondrial DNA in cancer
- Chair of cancer diagnostic and radiotherapy
- Chair for cancer epidemiology
- **\$2,000,000 every other year**

C. Capital

Northern Cancer Collaboration Research Fund

This would involve the creation of a specific Northern Fund that would be accessible to groups partaking in cancer research where individual research groups would only receive funding if they collaborated with other groups. Specifically priority could be given to grants that linked different research groups:

- from different cities
- from different research departments (such as physics and biology)
- with different research programs (such as drug delivery systems and compound creation)

This fund could begin with a pan-northern conference on cancer. Departments and staff from geography and epidemiology to botany and clinical trials could be involved. This would enable groups to “discover” what research is happening in other centres across the North. Once this has occurred people can plan grant applications to work together. These conferences could be held every two years to strengthen ties between communities. During non-conference years, this fund should provide specialized oncology-based workshop training courses for students. Specifically a different research site should be chosen each time and all students from across the region should be brought together. This process would enable long-lasting ties to develop between groups, not just at the principle investigator level but more importantly at the student level.

- **\$4,000,000 per year**

D. Science and Innovation

Harmonization of ethics boards across Northern Ontario.

Conducting clinical research across diverse populations can be difficult. In particular, working with multiple ethics boards across different institutions can impede the ability to conduct large scale clinical research. Having unified research ethics boards across Northern Ontario would facilitate larger scale clinical research. This would include the use of electronic medical records for epidemiological based research.

- **\$500,000 for the re-organization costs**

Northern Tumour Network

Northern Ontario has many assets currently in place to create a tumour network that would be beneficial to many aspects of pre-clinical and clinical research. Building a tumour bank that would be competitive on an international scale requires each tumour sample to have a comprehensive medical record associated with it. Accordingly the tumour network would work with the follow groups in order to build a competitive database that could be used by a variety of groups:

- *epidemiologists* to determine prevalence of cancers to begin to categories
- *unified research ethics boards* to develop standardized patient consent forms for all of Northern Ontario, approve research with all institutions and provide other pan-northern support
- *healthcare groups* with electronic patient records to associate patient histories with individual tumour samples
- *researchers* with specialized tissue arrays to determine 'omic data
- *researchers* with developing cell lines (bio-prospecting center) to increase the number of cell lines available for testing compounds for chemotherapeutics
- links to the Ontario Cancer Research Network tumour bank

- **\$200,000 first year with and on average \$1,000,000 thereafter**

Community Cancer Diagnostics and treatment

Development of devices or capabilities to enter communities and conduct complex care on a transient basis but electronically supported by a regional cancer center. For example specific or complex cancer screening could be undertaken in remote communities during specific visits. Specialized tests could be developed which would ease the detection of cancers or determine when more invasive or costly procedures could be undertaken. Creating mobile cancer diagnostic centers could validate a model that could be exported to other regions or countries. When exporting this technology and expertise the main cancer centers would still direct the training and potential research. Potential partners would include:

- Cancer treatment institutions
 - Cancer diagnostic biotechnology companies
 - Health economists to quantify the cost savings and health benefits of such a delivery mechanism
 - IT infrastructure personnel to aid in creating the tools necessary to carry out mobile healthcare delivery
- **\$500,000 per year**

E. Commercialization Process

Private investments into health institutions by biotechnology companies

Healthcare research institutions could actively seek strategic alliances or partnerships with biotechnology or pharmaceutical companies. Medium or larger companies could provide research money in exchange for first right of refusal on commercializing drug targets, compounds, drug delivery systems in cancer either for specific indications or for a broader spectrum of conditions. Smaller biotechnology companies may require patent rights assigned to the company. Researchers would still require academic freedoms and incentives to participate in such programs.

- **\$6,500,000 in total within five years**

4. Major Milestones

A. Years 1 & 2

- Initiate discussions with technology transfer offices about unifying the technology transfer offices across Northern Ontario
- Initiate discussions with the MaRS Discovery District
- Identify, fund and complete a pilot project to use e-infrastructure for oncology care delivery
- Initiate discussions with key stakeholders for the development of a meta-electronic patient registry. Build a framework and timetable to move forward. Link the first two sites together.
- Initiate discussions with key stakeholders to create a bioprospecting centre. Source funding mechanisms and source site for centre.
- Obtain funding for an ongoing matching grant program for graduate students with federal funding (eg. NSERC)

- Initiate discussions with northern health researchers to prioritize and determine the location of three Health Research Oncology Chair positions. Obtain funding and search for the first Chair position.
- Initiate discussions with key stakeholders to develop a Northern Cancer Research Fund. Identify key funding sources.
- Initiate discussions on harmonization of all ethics boards for health research institutes in Northern Ontario
- Initiate discussions with key stakeholders to organize the Northern Tumour Network. Submit proposals for the required funding. Initiate partnerships with agencies (OCRN) and health research groups. Initiate a pilot project to validate processes that can be scale up.
- Initiate discussions with key stakeholders to organize a community cancer diagnostics and treatment facility. Obtain the required funding for a remote community pilot project.
- Identify and work with specific cancer biotechnology and pharmaceutical companies to invest into health care research institutions in exchange for right or first refusal of technologies.

B. Years 3 - 5

- Merge and/or unify technology transfer office procedure and hire a representative for all the offices
- Assess outcomes of a pilot project for e-infrastructure for oncology care delivery. Work with key partners to implement the first project in other centers within Ontario. Identify, select, fund and plan a larger scale project.
- Continue to expand the number of sites participating in the meta-electronic record.
- Obtain required funding for Bioprospecting centre and enter full scale planning of building. Work with colleges and universities to develop specialized training courses. Develop internal infrastructure required to process large numbers of samples and assays. Create a minicentre in a lab to test out processes on a small scale.
- Obtain funding and search for the second Health Research Oncology Chair positions. Fill first chair position.
- Obtain funding for the Northern Cancer Research Fund. Hold the first conference for cancer researchers. Initiate a *call for grants* in the first granting round. Identify, plan and implement a training course applicable for graduate students undertaking cancer research.
- Create standardized forms and policies for ethics boards across Northern Ontario
- Obtain funding for the Northern Tumour Network, select site and modify infrastructure to accommodate data and scientists.
- A first investment into a health research institution by a biotechnology or pharmaceutical company in exchange for right or first refusal of technologies.

C. Years 6 - 10

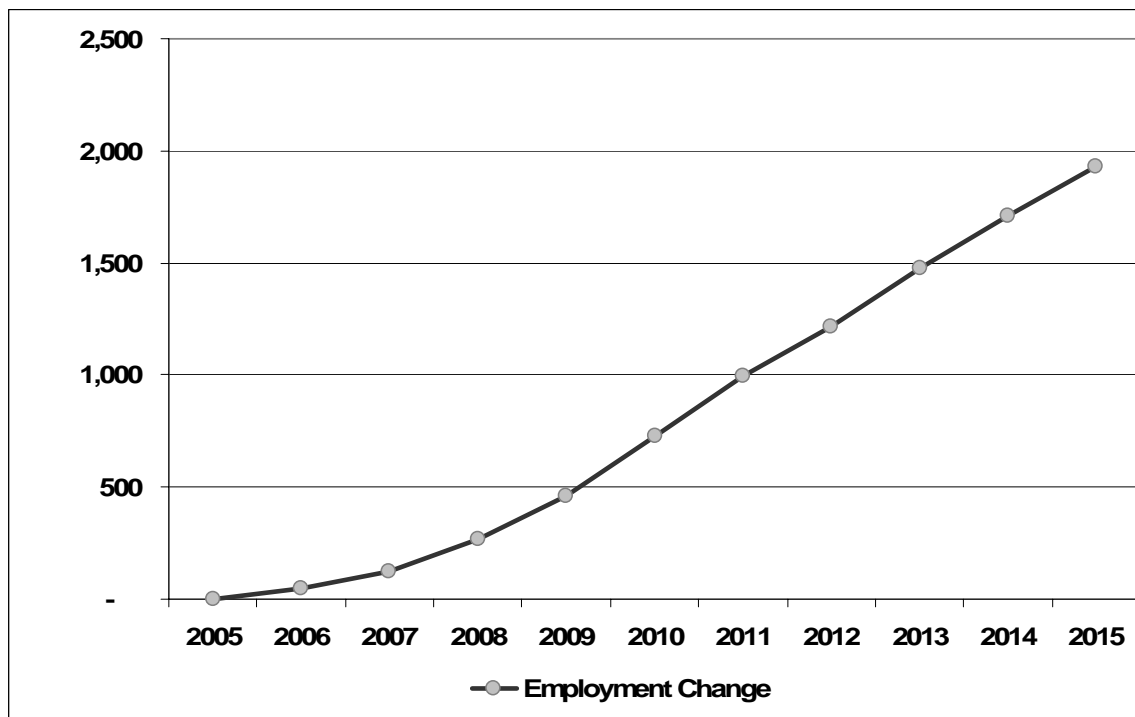
- Have successfully started a cancer related company with technology arising from Northern Ontario Research
- Carry out a large scale e-infrastructure implementation for oncology care delivery project with impact assessment. Continue to integrate more sites that use processes or products developed in years 1-5. Identify, fund and plan the next large project.
- Have a fully implemented meta-electronic record in Northern Ontario.
- Build Bio-prospecting centre. Scale up from mini centre to analyze large volume of samples
- Obtain funding and search for the third Health Research Oncology Chair positions. Fill second and third chair positions.

- Hold a second conference for Northern Cancer Research Fund for progress update. Identify, plan and implement a second training course applicable for graduate students undertaking cancer research.
- Attract one major company and two minor companies to partner or invest in the Northern Tumour Network.
- An investment into a health research institution by a biotechnology or pharmaceutical company in exchange for right of first refusal of technologies.

5. Economic Impacts

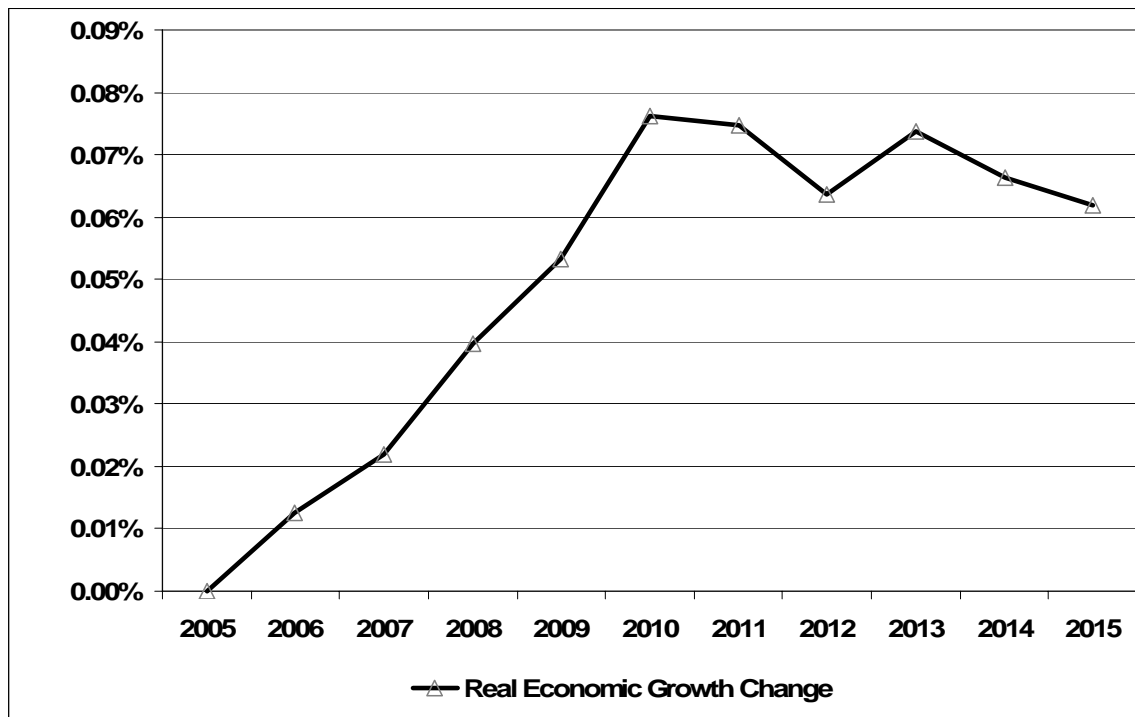
Employment Change

The exponential appearance of the graph indicates that this model has a strong ability to generate employment. This model does not distinguish between the type of job creation within the environment. But as people move into an area, a variety of services are required to support individuals.



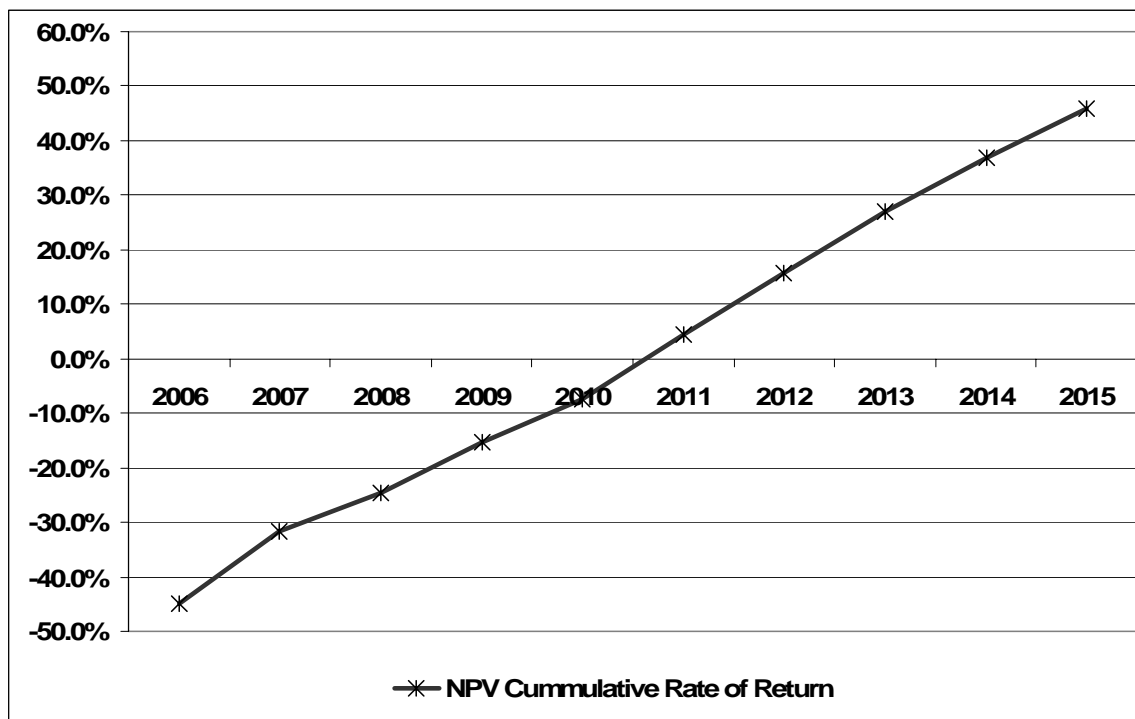
Real Economic Growth Change

This model generates marginal economic benefit until the middle of 2008. From mid to end 2009 it begins to meet its growth potential. Since one must take risk to generate a reward, the key risk time is between the years 2008-2010. This risk can be reduced by the ability of managers to execute on this particular strategy. Past the year of 2010, the economic growth begins to stabilize as indicated by the shallow dip which is followed by a recovery; with economic growth stabilizing between 0.06% and 0.08% for all of Northern Ontario. Following this stabilization, good opportunities exist for commercial growth but effectively management and strategy is required to capitalize on this position. The new medical school has created a platform for growth. The model can utilize this platform to act as a springboard for future growth in 2013-2015.



Net Present Value Cumulative Rate of Return

This model has a negative net present value (NPV) up to the year 2010. When the values are negative for the NPV this is known as an area of risk which switches to a reward (a return on investment) region. Since the NPV in this model is calculated on a cumulative basis the break even point on the total return on investment occurs mid 2010. By 2015 the projected NPV on the investment will be approximately 45%. This compares to the NPV of the medical school of just over 10% during the same time period. This difference is attributed to the large percentage of the total investment capital spent on the medical school infrastructure compared to this model where a greater percentage of capital is spent to employ personnel. However in this model poor management decisions will quickly alter the NPV value and real economic growth change as compared to the medical school model where change (positive or negative) occurs at a slower rate.



V. Scenario 3: Leveraging Current Assets

1. Strategy: Overview

This strategy stems from the concept that the success of a community or a organization depends on its ability to exploit its core assets and strengths. One can look at core assets and strengths from different angles, as was done in this document. Here, the focus is on research activities that are currently ongoing and have reached a certain momentum in Northern Ontario such as clinical trials, cancer research, mitochondrial DNA, bio-prospecting, to name a few. Focus was also targeted at activities that have commercial potential or exportability.

The first pillar of this strategy is aimed at empowering current stakeholders in clinical research, by bringing them together and providing infrastructures that are needed to establish themselves as competitive players in the market. For this pan-Northern Ontario Clinical Study Initiative the following initiatives are envisioned.

- Creation of pan-Northern Ontario Clinical Study Association
- Meta-electronic patient registry for the whole Northern Ontario
- Harmonization of all the ethic boards of the medical centres in Northern Ontario.

The second pillar of this strategy is to provide infrastructures and support to nurture research activities that have strong bases in the region and bear great commercial potential. The following initiatives are proposed to support and foster these research activities:

- Fund for multidisciplinary and collaborative research on strategic themes
- Joint venture program between Forestry and NOSM for bio-prospecting
- Research program on best practices in tele-medicine, with the goal of spreading the technology and its use among Northern Ontario communities
- Program on Rural Health Economics
- Honorary Ph.D. in Aboriginal Medicine to contribute to bio-prospecting endeavors
- Fellowships program for graduate students and post-docs
- MD/PhD program

The third pillar builds the commercialization enablers for the region. It streamlines and aligns all regional stakeholders in technology commercialization to provide the best expertise and services needed to manage research discovery, to promote it, and to finance its development. The envisioned initiatives include:

- Merging the technology transfer offices of Northern Ontario Universities and Colleges
- Regional Consortium for Medical Research Discovery in Northern Ontario
- Commercialization Award
- Incubator space and virtual services
- A \$5 million VC fund

This strategic scenario aims at leveraging local strengths and assets with potential for commercial spin-off and attracting private research contract in the region. It also builds upon current local strengths and activities that have attained a momentum.

A. Rationale for this Approach

This strategic scenario is built on current NOSM strengths and research activities which have

reached a certain degree of momentum such as clinical trials, cancer research, mitochondrial DNA and bio-prospecting. In order to be successful in raising public research funding and attracting private investments, either in terms of research contracts or direct investments, it is fundamental that the research promoted be competitive on the national and international scene. This scenario focuses on further developing those research activities that have the most chance of being internationally competitive.

B. Research Strengths to Build Platform

- Clinical research (notably in cancer)
- Cancer diagnostics
- Radio-therapy (device testing, device training, research)
- Cancer Basic Research
- Mitochondrial DNA research
- Bio-prospecting
- Remote health services

C. Key Issues, Challenges and Risks

Key issues for the first pillar are:

Pharmaceutical companies are recruiting patients all over the world for their clinical trials. They are often facing tight timelines as they have to compete to be first to market. They are looking for productive sites and clinicians that can deliver quality results in a timely fashion and without exceeding budget. One critical issue in delivering on these terms is the access to a critical mass of patient in an efficient manner.

To make itself attractive for obtaining pharmaceutical clinical contract, the pan-Northern Ontario Clinical Study Initiatives could build on its strengths in being able to readily identify and recruit eligible patients for trials. In order to further streamline this process and access a larger population pool, the region would benefit from a pan-Northern Ontario electronic patient registry and from a harmonized ethic board with common standards across the region.

Key issues for the second pillar are:

To foster strategic research activities, incentives could be put forward to lead researchers to address the selected research areas. Special operational grants remain the most effective means to achieve that goal. Furthermore, research activities are highly dependent on the availability of graduate students; this would require scholarship and fellowships. To expand the pool of researchers and to create research culture in the medical school, a MD/PhD program could be envisioned.

Key issues for the third pillar are:

To foster commercial ventures, several factors could be put in place, including accessible services for intellectual property management, accessible technology transfer specialists, physical infrastructure and capital.

It may be critical to configure commercialization specialists into an effective and accessible virtual office. Additionally, public and private capital, as well as infrastructure to support start-ups should be made available to entrepreneurs.

Key challenges for the first pillar are:

The main challenge faced by the region for clinical trial activities is proper access to a critical mass of patients. Linking as many centres together as possible would be important to overcome this challenge. It may also help the region to create the visibility required to attract pharmaceutical partners.

Key challenges for second pillar are:

Successful research requires a critical mass of activities and substantial infrastructure and equipment that is normally shared among several research teams. Access to the large realm of equipment that allows leading edge science is challenging in a small research community. Focusing on niche activities would minimize this challenge.

Access to graduate students and laboratory technicians is also critical. Human resource needs should be anticipated and proper initiatives developed in order to ascertain appropriate manpower is available.

Key challenges for third pillar are:

Commercialization of research discoveries is a long and risky endeavor. Substantial investment in research may be required to generate intellectual property, of which only a small number generate revenues. A critical mass of scientists should be built and assets pooled together.

However, the foremost challenge is capital. Even large centres such as Winnipeg, Hamilton, and Kingston have difficulty accessing private funds for start-up companies, and even more so for follow-up financing rounds. A situation should be avoided in which investment in start-up companies is discouraged because there are no likely follow-up funds available to allow companies to achieve their revenue milestones.

While it is critical to provide incubator facilities, the geographical distribution of the region may render this endeavor challenging. Virtual incubators may be a more appropriate model.

2. Partnering Opportunities – Beyond the Region or Outside Healthcare

The first pillar:

- To achieve the critical mass, the pan-Northern Ontario Clinical Study Initiatives could partner with all the clinical centres in Northern Ontario and perhaps beyond
- To successfully attract clinical research contracts, it could build a long term partnership with the pharmaceutical industry
- Given the small population it serves, it could partner and coordinate with all local stakeholders i.e., Neureka.

The second pillar:

- To build the research funding that needed to nurture the regional strategic research programs, NOSM could partner with funding agencies and philanthropic foundations to obtain dedicated funds. Possibilities include:
 - o Canadian Institute for Health Research (CIHR)
 - o Canadian Health Services Research Foundation (CHSRF)
 - o Health foundations
 - o Local Philanthropist

The third pillar:

- To develop its commercialization network, infrastructure and services, the NOSM could partner with several local partners, including:
 - o Local economic development actors
 - o FedNor

3. Enablers for the Strategy

A. Infrastructure

Meta-electronic patient registry

Create an initiative to link all patients in Northern Ontario into a meta-electronic patient registry. This will improve efficiency and quality of health care and would constitute the first core asset of the pan-Northern Ontario Clinical Study Initiative.

- **\$5,000,000 over 5 years non-linear**

Harmonization of the ethic boards of the region

Harmonize all the ethics boards of medical centres in Northern Ontario to have one standard allowing multi-centre studies to be carried seamlessly. This will constitute the second core asset of the pan-Northern Ontario Clinical Study Initiative.

- **\$500,000 for the re-organization costs**

Merging the technology transfer offices

Merge the technology transfer offices of Northern Ontario Universities and Colleges. Build a mobile team constituted of specialized, legal, patent agent, and business development resources, working with local representatives in each organization. This will provide a unique portal for private collaborators.

- **\$500,000; for the re-organization costs**

Tele-medicine infrastructures

Based on findings from the tele-medicine program described below, implementation of the best practices along with appropriate infrastructure should be initiated.

- **\$5,000,000 for implementation of best practices**

B. HR

Fellowship program

Create fellowships programs to help attract post-doctoral fellow, graduate students, and summer students.

- **\$500,000 yearly**

MD/PhD Program

Create a MD/PhD program to create a research culture among future physicians and add a highly qualified human resource to research activities.

- **\$500,000 yearly**

C. Capital

Strategic Collaborative Research Fund

Create a fund for multidisciplinary and collaborative research that focuses on one of the local pillars (Cancer, Cancer Diagnostic, mtDNA, Remote Health Delivery, Bio-Prospecting, and Radiotherapy). This fund will be an incentive to bring researchers to work together on strategic themes.

- **\$500,000 yearly**

Local VC funds

Create a \$5 million VC fund dedicated to the Northern Ontario ventures in Medical technologies. This fund should be supporting projects with a clear path to short term revenue, realistic exit strategy, or conditionally pre-committed follow up financing. This fund could be a syndicated fund from several partners public and private.

- \$5,000,000

Commercialization Award

Provide a Commercialization Award to support the Northern Ontario Researcher that has the most commercially promising technology of the year.

- **\$100,000 yearly**

D. Science and Innovation

Research program in best practices in tele-medicine

Create a research program to investigate best practices for the implementation of telemedicine among Northern Ontario communities.

- **\$50,000 yearly**

Joint venture research program between forestry and medicine

Create a joint venture program between Forestry and NOSM, with internal grant available. This would allow collaborative research in bio-prospecting.

- **\$75,000 yearly**

Honorary PhD in Aboriginal Medicine

Create an honorary Ph.D. position for an Aboriginal Medicine Practitioner. This position would be paired with a Principal Investigator in medicinal chemistry to initiate bio-prospecting research endeavor based on the empirical knowledge of aboriginal medicine. This position may also be paired with social studies to allow a capture of the aboriginal culture. Incentives should be provided such as a salary grant, but most importantly equity rights to ascertain that motivation is aligned with the finding of new chemical entities (commercial outcomes should be distributed as following: 40% NOSM, 30% PI, 30% H. PhD). Elective class in aboriginal medicine may be offered to help disseminate the knowledge and stimulate reflection and debates around modern and ancestral medicine.

- **\$100,000 yearly (salary grant and budget for courses, and research support)**

Rural Health Economic Program

Create a program on Rural Health Economics. This research will help the Northern Ontario health stakeholders to build and validate financial models, and when warranted, for lobbying to

governments for investments in remote health delivery programs, telemedicine, outreach initiatives, etc.

- **\$200,000 yearly**

E. Commercialization Process

pan-Northern Ontario Clinical Study Initiative

Create a pan-Northern Ontario Clinical Study Initiative that would be based upon local strengths and be promoted by a specialized business development team. This would allow leveraging of local capabilities in clinical research into an effective and coordinated team that would provide a competitive advantage over other centres. This initiative is tied to the meta-electronic patient registry and the harmonization of the ethic boards.

- **\$200,000 yearly**

Consortium for Medical Research in Northern Ontario

Create a Regional Consortium for Medical Research in Northern Ontario. This consortium would organize a yearly Regional Symposium with researchers, government representatives, and financiers to promote collaboration and provide visibility toward potential funding partners. This consortium could also have a budget to present the regions assets to a selected number of international conferences.

- **\$200,000 yearly (Symposium + delegation to international conferences)**

Incubator space

Incubator space could be made available in all major centres in Northern Ontario and be virtually linked to a service core providing start-ups with the proper business and legal support. The scale of these infrastructures could be adapted to the volume of opportunity and be highly flexible. Infrastructure could be created along side current institutions and could be used for alternative purposes when idle.

- **\$200,000 yearly; core services; \$5,000,000 infrastructure**

4. Major Milestones

A. Years 1 & 2

- Bring people together to form the Regional Consortium for Medical Research Discovery in Northern Ontario
- Create the pan-Northern Ontario Clinical Study Initiative
- Initiate the planning for implementing a meta-electronic patient registry for Northern Ontario
- Initiate discussions on harmonization of all ethics boards for medical centres in Northern Ontario.
- Initiate the creation of the honorary Ph.D. in Aboriginal Medicine
- Initiate discussion about merging the technology transfer offices of Northern Ontario Universities and Colleges
- Initiate discussion with stakeholders to create a collaborative research fund
- Initiate discussion with funding agencies to partner in the joint venture funding program for forestry and medicine collaboration in bio-prospecting
- Initiate discussion with financial partners for creation of Fellowships programs for graduate students and post-docs

- Initiate discussion with financial partners for the creation of the Commercialization Award
- Initiate discussion with financial partners for the creation of a \$5 million VC fund
- Initiate the planning of the development of incubator space and virtual services
- Apply for the research program on best practices in telemedicine
- Apply for the program on Rural Health Economics

B. Years 3 – 5

- Implementation of the meta-electronic patient registry for Northern Ontario
- Conduct clinical research seamlessly across Northern Ontario
- Have an established fund for multidisciplinary and collaborative research on strategic themes
- Have ongoing joint venture research projects between mining, forestry and medicine
- Initiate the planning for implementation of tele-medicine technologies across Northern Ontario
- Exploit results from the research on Rural Health Economics to guide health care programs and initiatives
- Have research combining aboriginal medicine and bio-prospecting
- Have recruited several post docs and host several graduate students
- Initiate a MD/PhD program
- Merging technology transfer offices of Northern Ontario Universities and Colleges.
- Deliver the first Commercialization Award
- Have incubator space available and virtual services on-line
- Open the \$5 million VC fund

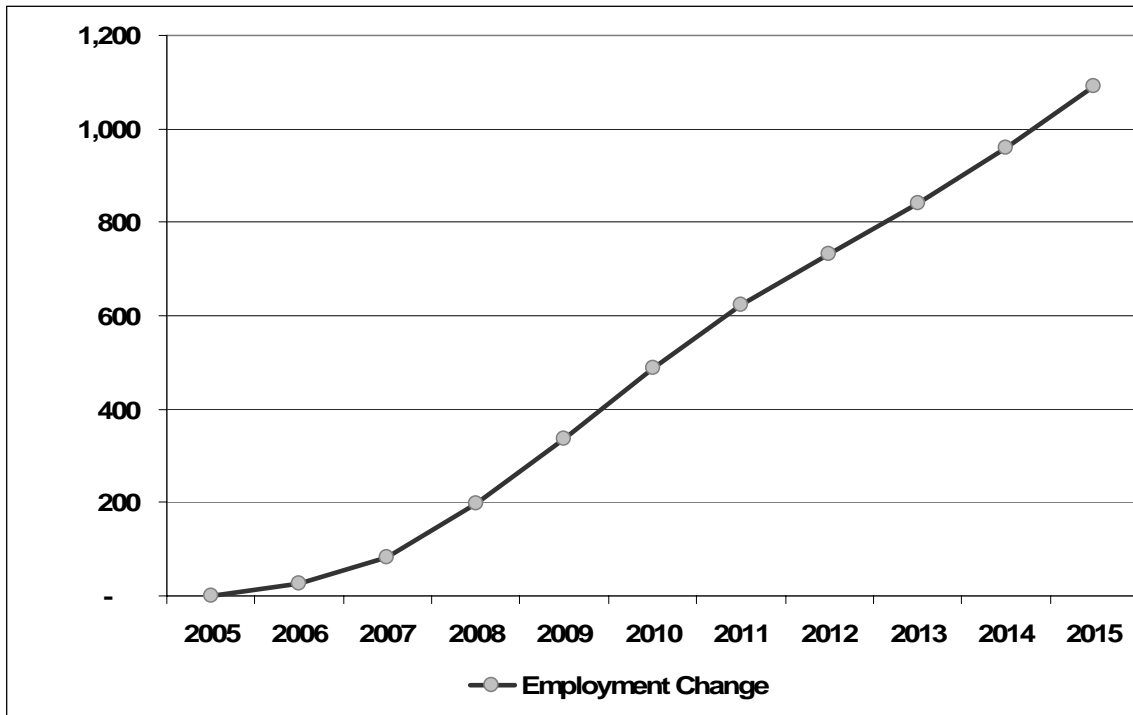
C. Years 6 - 10

- Be a favorite site for clinical research contracts
- Have a fully implemented meta-electronic patient registry for Northern Ontario
- Have built strong multidisciplinary and collaborative research teams on strategic themes
- Have discovered some promising drug leads from any joint venture programs between mining, forestry and medicine
- Have fully implemented best-practices in tele-medicine; and be a model region for other communities.
- Have discovered some promising drug leads from aboriginal medicine knowledge
- Have MD/PhD researchers contributing the health research of the region
- Have successfully funded start up companies

5. Economic Impacts

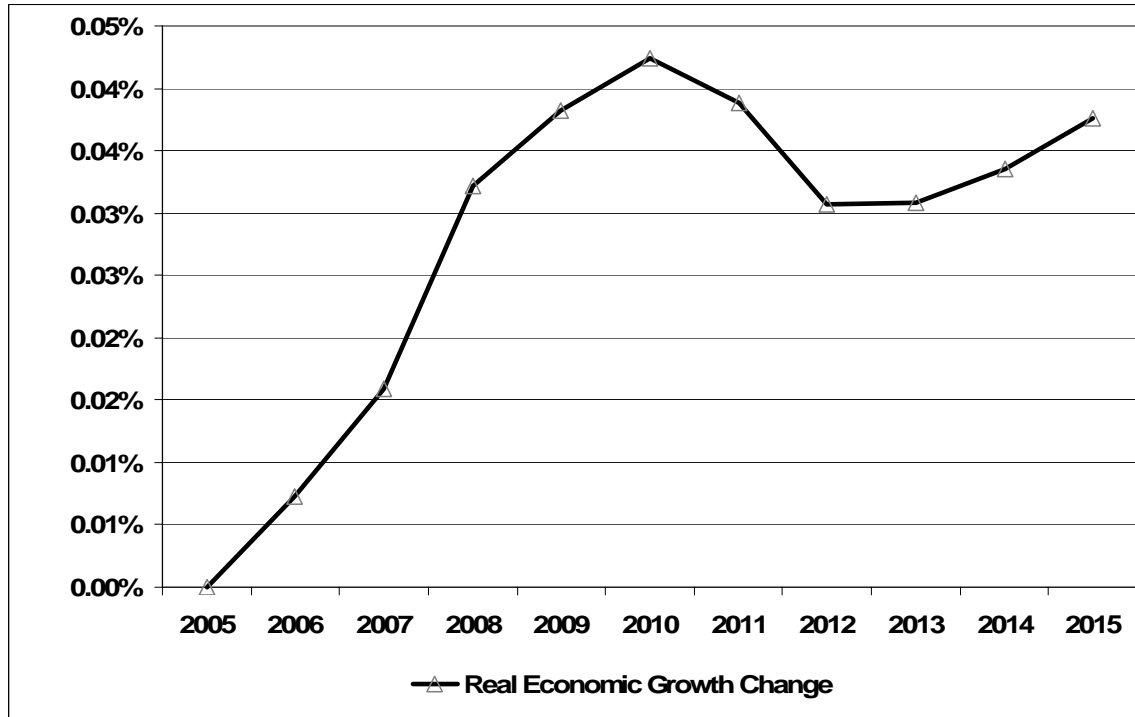
Employment Change

The 'Leveraging Current Assets' scenario will create a modest employment growth relative to the previous scenario. However, in proportion to the capital raised, it provides the highest ratio of employment. Since most of the initiative revolves around research grants, employment occurs early after investments. Horizontal job creation is relatively minor; i.e. the scenario provides only marginal cross sector employment. By 2010, this scenario would have generated about 500 jobs. Of importance is that such an initiative will build the reputation of the medical school through visibility beyond the region.



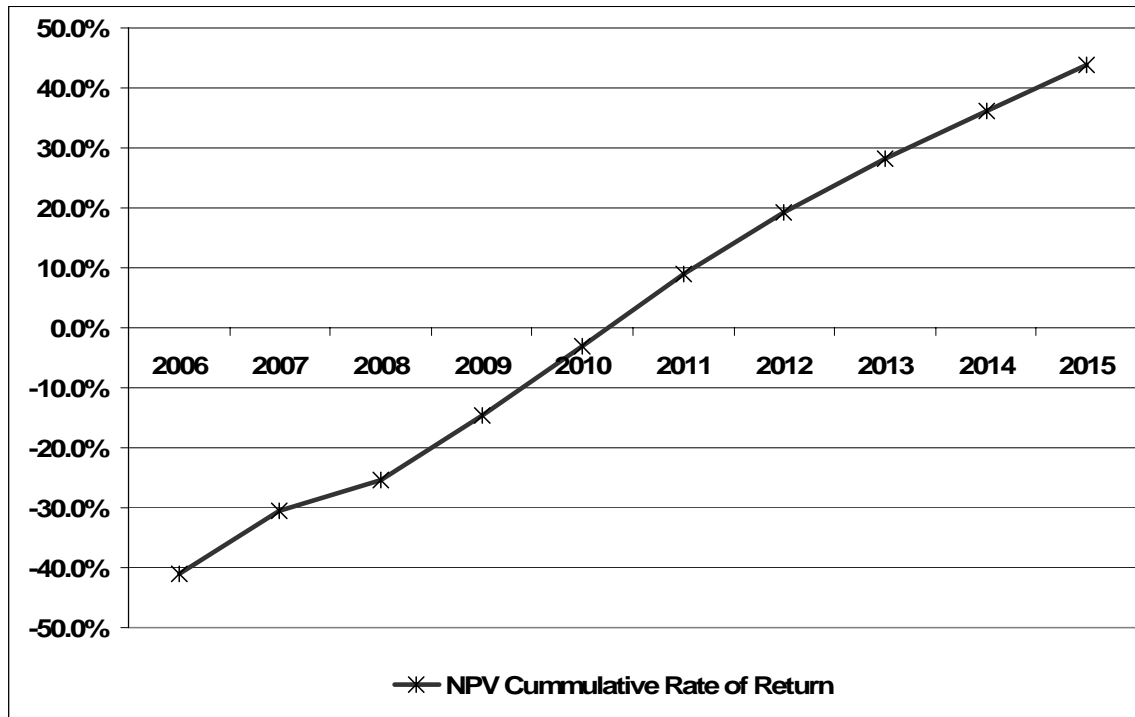
Real Economic Growth Change

The 'Leveraging Current Assets' scenario has a biphasic real economic growth. From 2006 to 2010, growth is related to the initial investments and the reward stage begins in 2008. However in 2010 this is where the second cycle is to begin. The success at this stage is highly dependent on the scenario's ability to renew itself. This is the most risky period of this strategy and the quality of the management will determine the long term success of this strategy. By 2012, the strategy should demonstrate its sustainability. The economic growth in this scenario is steep and this is due to the high weighting towards human resource expenditure.



Net Present Value Cumulative Rate of Return

The cumulative rate of return anticipated suggests that the investment will break even in 2010. However, there are two risk periods: 1) the spending period 2006-2009, and 2) the renewal period 2010-2012. This strategy represents a good growth option as it is estimated to provide a return on investment of 46% by 2015.



VI. Scenario 4: Continuing with the Status Quo

1. Strategy: Overview

The status quo strategy assumes that no additional action would be taken but to carry on current engagement toward the medical school and its mandate to train 56 medical students annually.

The status quo scenario is a baseline scenario that permits the assessment of investing energy in building a health research cluster could create value.

The medical school have faculty members in three divisions to provide teaching to the 56 medical students register for 2005:

- Human Sciences
- Medical Sciences
- Clinical Sciences

There are also current biomedical research activities in Northern Ontario. Within the status quo scenario, the School of Medicine would remain a passive actor in regard to research as opposed to being an enabler as in the previous strategic scenarios.

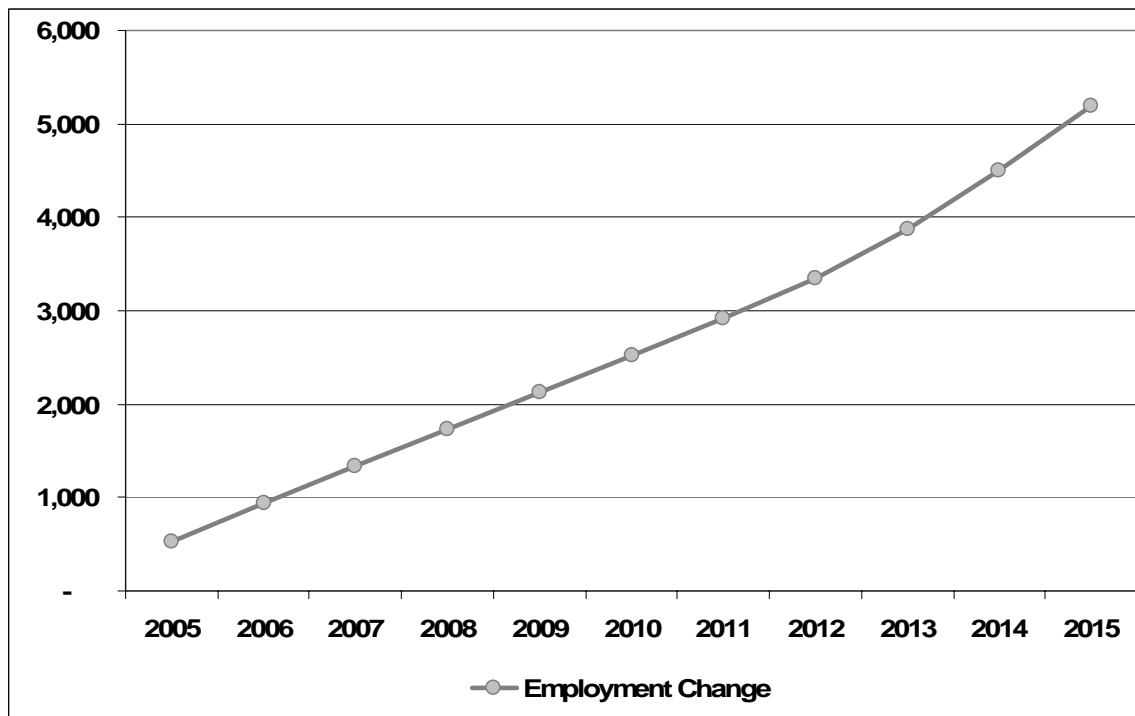
- population health/public health issues
- diseases/disorders greatly affecting northern populations
- occupational health
- evaluation of health and health education delivery approaches
- healthy aging

The school activities have a budget of \$22,000,000 on a yearly basis. This investment alone will contribute to economic growth in the region, through job creation, student attraction/ retention, and economic activity related to the additional staff and teaching activities. Furthermore, the opening of a Medical School may have indirect effects in attracting people to the retention or retaining people that would have emigrated; it was stated by several benchmark stakeholders, that access to quality health care is an important concern for people establishing themselves in a new region.

2. Economic Impacts

Employment Change

Presence of the Medical School's spending in the economy generates employment. Ideally by 2009 or 2010 one wants to create a 'tipping point' at which excitement is created and an undertaking becomes a 'must do'. This is why it is worth building a health research industry on top of this platform. The momentum of employment creation is then built upon the effect of one of the other scenarios and can act as an addition to this.



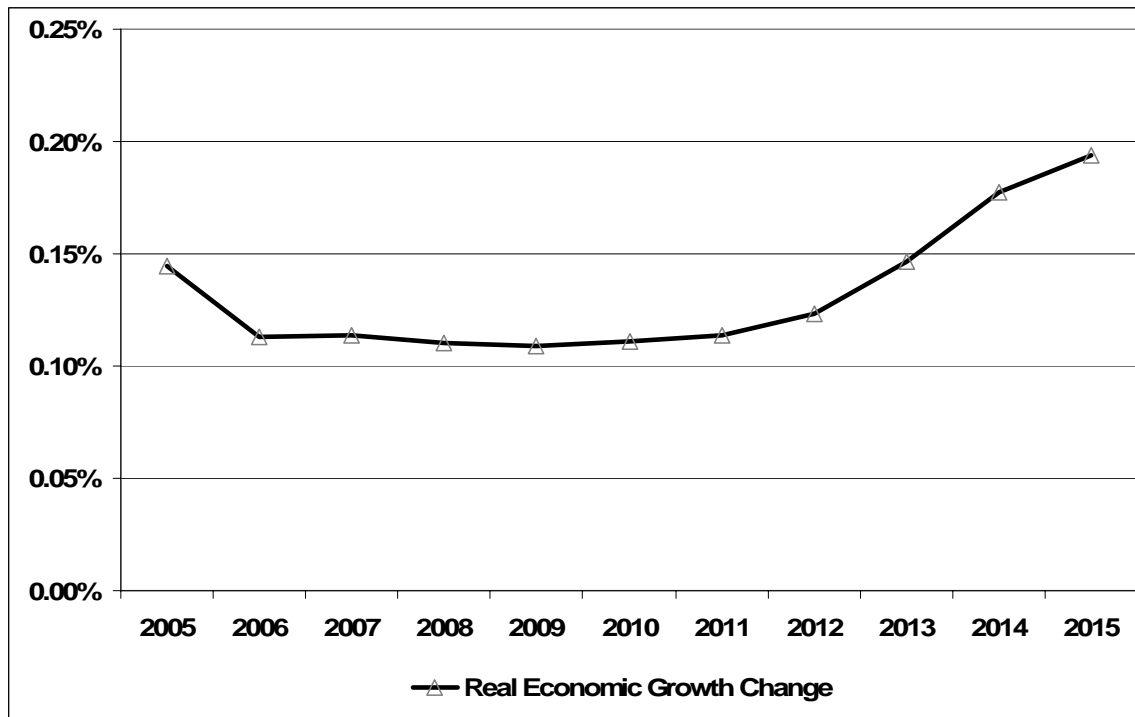
Real Economic Growth Change

In 2005, the effects of the construction work of the new medical school and the new employees cause a small increase in the economic growth.

The outcome of this analysis is dependent upon the premise that the investment in the school is managed as well as the average management of the economy.

2006 to 2010 demonstrates the baseline economic growth generated by the spending of the medical school. From 2011 onwards, this starts to cycle through to the rest of the economy, but this effect begins to lose momentum in 2015. Beyond 2015, it will plateau because the spending is no longer new to the economy.

This demonstrates the importance of such forward looking analysis as this strategy project to have initiatives that will be implemented in addition to the medical school to build on the momentum of economic growth.



Net Present Value Cumulative Rate of Return

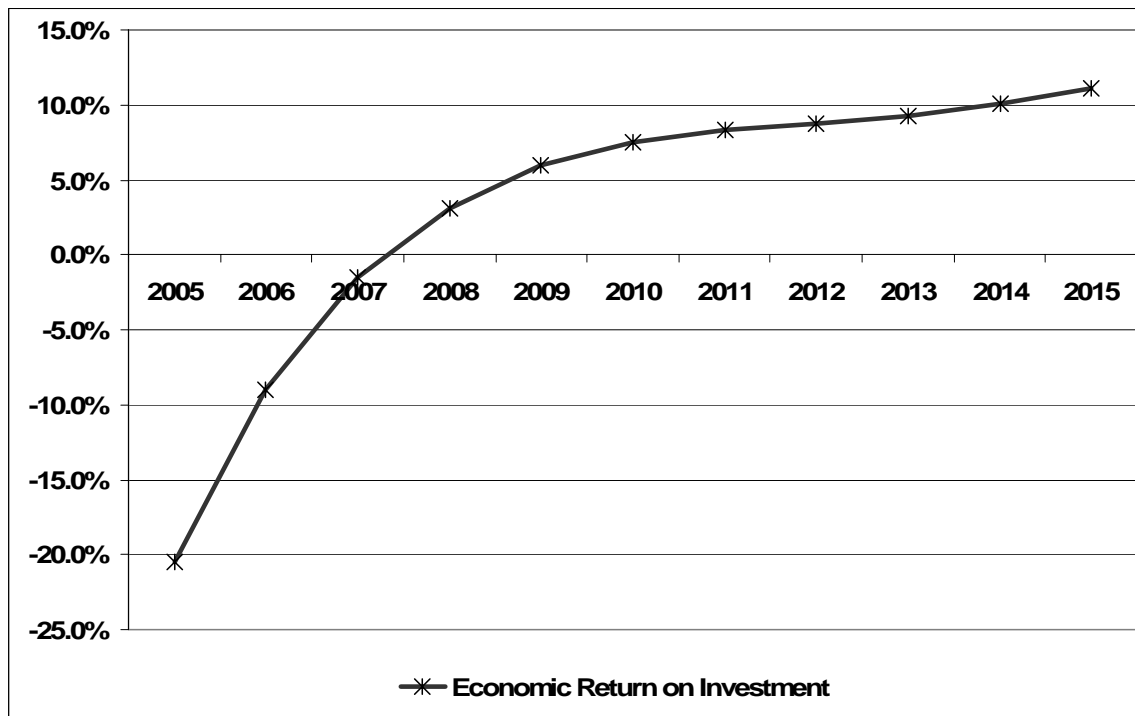
This graph looks at the effect on the economy of Northern Ontario as a whole of the return on capital invested for the medical school. This is not the return on capital just for the medical school itself.

Net Present Value is the long-term indicator of the economic health. This graph shows this value cumulatively so that each year adds on to the previous one.

In 2005 to 2007, the economy is still taking up the effect of this investment. It shows how the effect of the investment will slow down over time.

Therefore this investment is not a major growth option to stem the decline in population in Northern Ontario and get the economy onto a higher growth path. Also, this investment is a low risk one, which is why it has less reward.

It is however, a good 'canvas on which to paint', so it is necessary to act on top of this to have a strong effect.



VII. Analysis of Strengths, Weaknesses, Opportunities & Risks

A. Strengths

Scenario	Strengths
1: Dispersed and networked	<ul style="list-style-type: none"> - differentiates Northern Ontario’s research - enables unique niche research programs - collaborations achieves critical mass - large social outcomes better healthcare the community - accesses collaborative funding - links skills within and access skills beyond Northern Ontario - maximum use of existing research strengths - combines existing research to increase value - strong focus on clinical research
2: Developing a niche strategy (eg. cancer)	<ul style="list-style-type: none"> - very focused research allows critical mass to be quickly developed - builds upon the strong cancer assets in Northern Ontario - engages multiple stakeholders under one research umbrella - builds expertise in unique aspects of cancer care delivery - builds on momentum in cancer health research in Northern Ontario
3: Leveraging current assets	<ul style="list-style-type: none"> - empowers local research stars - brings together local research community - maximizes potential for commercialization outcomes
4: Maintaining the status quo	<ul style="list-style-type: none"> - minimizes risk - school remains focused on teaching

B. Weaknesses

Scenario	Weaknesses
1: Dispersed and networked	<ul style="list-style-type: none"> - requires collaboration to succeed - failure to collaborate leads to duplication wasted use of limited resources - less emphasis on basic research
2: Developing a niche strategy (eg. cancer)	<ul style="list-style-type: none"> - may exclude potential researchers in Northern Ontario - remote centres could be less involved - highly global competitive field - difficulties in attracting and retaining highly qualified personnel in cancer
3: Leveraging current assets	<ul style="list-style-type: none"> - high risk in achieving commercial goals due to the relatively small critical mass - centralize activities in two major centers - competes with major urban centres - modest health benefits for local communities
4: Maintaining the status quo	<ul style="list-style-type: none"> - does not exploit potential research role of the school - profile may be reduced if not strongly involved in health research - reduces appeal for clinician scientists to be hired at med school

C. Opportunities

Scenario	Opportunities
1: Dispersed and networked	<ul style="list-style-type: none"> - differentiates Northern Ontario’s research - enables unique niche research programs - collaborations achieves critical mass - large social outcomes: achieves better healthcare in the community - expand research links beyond Northern Ontario - opportunity to market the region - defeat distance with excellent telecommunications infrastructure - accesses specific funds not available to other regions - gains a presence in fast growing economic sector
2: Developing a niche strategy (eg. cancer)	<ul style="list-style-type: none"> - likelihood of partnerships with cancer focused companies - development of remote cancer diagnostic or treatment paradigms that can be exported - create partnerships with global oncology equipment companies - potential for creating a variety of oncology based companies ranging from diagnostic and health services to compounds and drug delivery
3: Leveraging current assets	<ul style="list-style-type: none"> - creating a vibrant research community - imports private and public funds - potential for creating company
4: Maintaining the status quo	<ul style="list-style-type: none"> - further strengthen rural healthcare medical delivery

D. Threats

Scenario	Threats
1: Dispersed and networked	<ul style="list-style-type: none"> - people continue to work in silos - another region implements same strategy and implements it better - get out-competed by other centres for funding and research - fail to attract or retain highly qualified personnel - fail to attract interest from venture capital
2: Developing a niche strategy (eg. cancer)	<ul style="list-style-type: none"> - strong competition from other cancer clusters throughout the world - if successful cancer researchers will be sought after by other clusters - may not be able to gain international cancer reputation in a specific niche market within oncology - cancer programs could become too centralized in Sudbury and Thunder Bay - successful spins-offs may still have to exit Northern Ontario at scale up stage
3: Leveraging current assets	<ul style="list-style-type: none"> - challenges in raising private funds may impede success - challenges in recruiting highly qualified personnel - successful spins-offs may still have to exit Northern Ontario at the scale up stage
4: Maintaining the status quo	<ul style="list-style-type: none"> - other rural practice medical schools developing research capabilities

APPENDIX A: Points for Discussion from Leader Interviews

Point 1: Develop niche expertise in clinical research and the provision of health care services

One issue raised by all leaders interviewed was for more remote centres to develop a niche specialty that would be unique to the geographic and demographic nature of the region served by those centres. In addition, it was seen as important to leverage any natural synergies between the present and future foreseeable capabilities of the area and its local geographic, industrial and demographic asset base. The following areas were suggested as potential niche areas:

- First Nations Health Care;
- Environmental/Industrial Medicine;
- Rural and Remote Health Care Delivery;
- Clinical Research; and
- Clinical Trials.

Each leader interviewed suggested that it was more pragmatic for more rural/remote regions to pursue clinical research first over basic scientific research. Reasons for this varied, ranging from duplication of services to funding and relocation issues. The main reason offered however was the need for remote regions to have a mandate that revolves primarily around education of rural physicians and related health care providers combined with health care delivery to the local population. All leaders interviewed viewed Northern Ontario as having its own unique demographic, geographic and industrial characteristics, which in turn were capable of being leveraged in the provision of niche clinical specialties and services that would be less or completely unavailable elsewhere.

Point 2: Take a leadership role in facilitating critical local, regional, national and international partnerships

All leaders interviewed raised the issue of partnering with other organizations in order to ensure success. This was true both with regard to other local and regional health care providers as well as larger provincial and national and international research centres and health care organizations. The following partnering opportunities were raised as possible vehicles to facilitate a sustainable health research industry in Northern Ontario:

- Regional and national academic, health care and health services organizations;
- Regional and national industry partnerships;
- Provincial and federal government funding and technology mentoring institutions;
- Local charitable foundations and grass-root support mechanisms;
- National and international capital sourcing, investment and non-profit partnerships; and
- World Health Organization.

Partnering was seen to be important for success on several levels. First, partnering would help to ensure that resources are harmonized within the Northern Ontario region. It would also provide NOSM with an important leadership opportunity to ensure that the current regional actors are working with rather than against one another. Second, partnering has the potential to produce a self-sustaining a networking process, whereby local, regional and national resources are pooled and leveraged. This was seen to potentially serve NOSM on several important fronts, including

enhancing efficiencies, capabilities and leadership potential. Finally, partnering was viewed as an important mechanism to develop a critical mass on several levels, including, including

- research and health services capabilities;
- ability to attract biotech, pharma and other industrial partners;
- ability to attract venture capital interest and funding;
- ability to attract high level government funding;
- providing high level showcases for technology successes and knowledge-sharing; and
- providing researchers and management with important opportunities to network and collaborate with accomplished people outside of Northern Ontario.

Point 3: Take strong steps to publicly value, promote and implement a technology commercialization focus

Notwithstanding their industry affiliation, all of the leaders interviewed saw the need in more rural/remote regions for significant effort to be put into the development of an integrated well-networked technology commercialization process. A business-minded and non-bureaucratic technology transfer office that was favourable to inventors was seen as a key component for leveraging the commercial potential of technologies resident in these areas. The following points for discussion were raised:

- Create a commercialization culture that is vibrant and strongly promoted by leaders/champions;
- Hire researchers and management that are pro-commercialization;
- Develop intellectual property policies that provide incentives to inventors and technology management;
- Create a Technology Transfer Office that is business-oriented and not bureaucratic;
- Develop a consortium, or partner, with other local and regional technology transfer functions to gain critical mass;
- Partner with provincial and national technology transfer offices and organizations (MaRS, Queen's Parteq, Association of Technology Transfer Offices, Westlink Innovation Network). This will enhance efficiencies and capabilities, and also facilitate interest from VCs, angel investors, incubator labs, and biotech companies;
- Widen the definition of success of technology transfer to include job creation and facilitating health services quality and delivery;
- Build a regional seed fund of \$5M, which could be professionally managed (MDS Capital);
- Work with local and provincial governments to create tax incentives, such as tax credits and economic development zones;
- Leverage new federal funding initiatives aimed at technology transfer e.g., national group and POP grants, funds to build angel networks, and funds for mentorship programs; and
- Develop a technology incubator to support commercialization and encourage investment interest and partnering opportunities.

Additional points for discussion raised by interviewees

1. Efficiencies, working together and reduction of tension
 - Avoid Duplicate services and internal tensions. This will be particularly important for the Thunder Bay-Sudbury split;
 - Choose one major focus per site;

- Ensure that providers of similar services are networked and partnered to the degree possible in order to facilitate long-term working relationships and increase efficiencies; and
 - Work very hard to obtain buy-in from all participating cities and groups.
2. Work to develop NOSM as the nexus of health care in Northern Ontario.
- NOSM can be the major identified public link/nexus between the population and best in class medical services for that unique population; and
 - Marketing, public education and networking with community health centres, high schools, non-profits etc. to ensure this message is heard.
3. Incentives for re-location:
- Provide as large a financial compensation package as possible to attract excellent researchers;
 - This includes salary, lab space and a supportive research, collaborative and commercialization culture; and
 - Provide a positive non-bureaucratic work environment that is collegial and sharing. It will help to offset lack of high salaries found in large urban centres.

Appendix B: Points for Discussion from Benchmark Interviews

There are several issues raised for discussion by those people interviewed for this section, including geographic, demographic, capital sourcing, infrastructure, staffing, and leadership issues, that are common to Northern Ontario and each of the selected benchmarked regions.

All of the benchmarked communities faced similar challenges on each of these fronts with varying degrees of success. Those regions that experienced the most success in overcoming these challenges did so through the use of dynamic leadership, strategic planning and implementation on a number fronts simultaneously. The factors listed below were identified as important points of discussion for NOSM in developing its strategy and business plan:

Point 1: Recruiting

The ability to succeed in the life sciences generally and in commercialization of basic and clinical research findings was generally seen to be directly proportional to the quality of people involved. This includes both researchers and management. It is particularly critical to recruit the best quality researchers that a region can afford. This includes provision of excellent compensation packages, substantial participation in revenues generated through commercialization of researcher intellectual property, and excellent laboratory infrastructure.

Point 2: Culture of Commercialization

A culture of commercialization was seen by many leaders to be crucial to their success. Commercialization must be seen to be an important value and promoted as such by senior administrators within the university, research community, and local industry and government officials. Once success begins to materialize, it must be actively harnessed in order to facilitate the development of further interest in commercialization by other researchers. Being realistic about commercialization timelines was also seen as an important element of success, as biotechnology incubation and commercialization is a much longer process than in other industries e.g., information technology.

Point 3: Motivation

Many of the leaders of the benchmark communities assessed viewed success as a function of strong leadership. In particular, the formation of commercialization committees that include leaders/champions from all relevant disciplines was seen to be critical. In these communities such committees optimally included researchers, academic administrators, technology transfer officers, industry leaders, capital sourcing, developers, and politicians at all levels (municipal, regional and provincial/state, federal).

Point 4: Momentum

Once momentum has been gained, for example through institution of new university infrastructure or facilities, biotechnology clusters, research incubators, and new hospitals etc., maintaining momentum was viewed an important component of success for the benchmarked communities. This is best done through active participation of all leaders on the commercialization committee. The goal is to celebrate the organization's successes, and to use this success for recruiting

purposes, to attract higher levels of government funding, to attract interest in industry partnering and funding opportunities, and to encourage both further and new research collaborations.

Point 5: Collaboration

Collaboration is a key determinant of success, particularly for the more remote benchmarked communities. Bringing partners together from other remote but geographically-related areas was very important for the benchmarked regions in developing critical mass, both in terms of developing a regional niche speciality, but also for attracting funding from external capital sources such as venture capital and attracting funding and industry partnering opportunities for clinical trials. Once collaboration has been established, communication between participants is key to facilitating growth and maintaining relationships. Collaboration can be facilitated using new technology, such as video-conferencing.

Point 6: Grass-root Support

Several leaders of the benchmark communities assessed indicated grass-root support has been very important to their success, again particularly in the more remote regions. Communication to the local population of the advantages of supporting biotechnology (increased health care quality, access to specialists, job creation, injection of revenues into local economy), both financially and politically, was integral to obtaining their support.

Point 7: Niche Specialization

Most of the benchmarked communities saw developing niche specialties as critical to their success. Identification and growth of niche specialties is dependent on the quality, critical mass and specialties of the current and prospective researchers associated with the organization and on the geographic and demographic nature of the benchmarked region.

Point 8: Incubator

All of the benchmarked communities had significant success with incubators and research parks. These were seen as integral to the success of the regions, as they facilitated commercialization culture, attracted venture capital and industry partnering opportunities, facilitated opportunities for collaboration with other regions and within a given region, and allowed researchers and management to efficiently commercialize technologies.

Point 9: Infrastructure

The development of world-class research facilities was seen to be critical in order to attract accomplished researchers and technical staff, particularly to the more remote locations.

Point 10: New Technology

Use of new technologies was also an integral component of success for the more remote benchmarked regions. Leaders from those communities all recommended heavy use of such technologies, including tele-health, tele-surgery and video-conferencing in setting up and facilitating the growth of their biotechnology industries. This was seen to be particularly valuable



in facilitating communication with industry partners and potential capital sourcing partners, and between collaborators.

Appendix C: Baseline Key Labour Market Indicators for Northern Ontario

From 1996 to 1997, the population is decreasing in number; however one observes from 1997 to 2003 the phenomenon of resistance; i.e. while the population decreases, the employment rate decreases at a slower rate.

However, by 2003, the ability of the economy to resist the demographic trends is overwhelmed and employment begins to decrease with the demographic trend. As a consequence, labour demand begins to decrease.

The baseline real GDP growth for the economy of Northern Ontario for the projected period of 2005-2015 is 0.67%.

