THE NEW HEALTH RESEARCH PARADIGM IN MANITOBA:

IMPLICATIONS FOR

PARTNERSHIPS WITH THE PHARMACEUTICAL INDUSTRY

BY

DAVID M.I. McLEAN

A thesis
submitted to the University of Manitoba
in partial fulfillment of the
requirements for the degree of
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in the
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DEDICATION

"And now, with gleams of half-extinguished thought,
With many recognitions dim and faint,
And somewhat of a sad perplexity,
The picture of the mind revives again;
While here I stand, not only with the sense
Of present pleasure, but with pleasing thoughts
That in this moment there is life and food
For future years."

William Wordsworth, 1798

This thesis represents the crowning achievement of several years of academic endeavor. Coupled with didactic studies, the combination has successfully fulfilled my quest for knowledge providing "life and food for future years". This journey would not have been possible; however, without the collective understanding and patience of both my wife and best friend, Maureen, and my sons, Matthew and Michael. For their love and support throughout the duration of this degree, and for enabling me to harvest this bounty, I recognize them through the dedication of this thesis.

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Given that such a project as this is facilitated through the input of numerous individuals who generously offered data, suggestions, or support, I would like to extend my sincere appreciation to both colleagues, business associates and other private and public sector contributors.

Finally, to my family, for their untiring support, encouragement and love, I shall always be grateful.

ABSTRACT

Health research offers a significant social and economic benefit to Canadians with its outcomes contributing to the betterment of society on a global scale. With fiscal reform occurring at the provincial and federal levels, health research funding has been frozen or reduced over the past few years. In an effort to illuminate the impact of these policies, a clearer understanding of the economic significance of this sector is necessary. An economic model was employed to define the relative economic value of health research, and to thereby substantiate further expenditures in this area. It has been shown that relative to the food processing and communications sectors, and to a pharmaceutical manufacturer in Manitoba, health research has been a robust contributor to GDP and employment in Manitoba. Increasing the value of this sector has therefore been a targetted objective. Surveys of the pharmaceutical industry, the public sector and the academic community have been performed to define obstacles, enablers and critical success factors for enhanced investment by both the public and private sectors. Interviews with a stratified sample of pharmaceutical firms more clearly enunciated decision making criteria for R&D investment. Finally, perspectives on technology commercialization were gained from industry, technology commercialization units throughout North America, and the academic research community in Manitoba. It is apparent that governments should support this activity both through financial resources, and through the development of inter-Ministerial policies that respond to the needs of both health researchers and industry. Manitoba has begun to forge such partnerships in this way, and is, therefore, well-positioned to establish open, communicative, partnerships between the pharmaceutical industry, academia and government.

INTRODUCTION

The recent challenges of fiscal reform have necessitated rationalization of publicly-supported programs. Within this new paradigm, the delivery of health and social services and education, the largest provincial budgetary considerations, face the greatest potential threat of cutbacks. A casualty of this process has been stagnant or reduced funding for academically-based health research. Ironically, recent history has demonstrated, repeatedly, the enormous social and financial impact such research has had on society. Take for a moment, Bethune's work in public health in China, or that of Banting and Best yielding the discovery of insulin. This early work led to more therapeutically significant discoveries such as the two more recent Canadian breakthroughs: Dr. Tak Mak's decryption of a gene critical to the immune system, and Dr. Lap-Chee Tsui's elucidation of the gene responsible for cystic fibrosis. For such work to develop and grow, strategies for enhanced resources are required that highlight both the potential clinical benefits, and the economic value of this enterprise. Cognizant of the provincial and federal fiscal environments in Canada, such strategies must capture and emphasize new opportunities for partnerships with industry, where private sector resources contribute to the development of this activity. This thesis is an attempt to present a rational and comparative argument for the economic value of health research, and to compile data that can be used to develop a health research investment and

commercialization policy that is responsive to all constituencies including industry, academia and government.

LITERATURE REVIEW

1) Health Research

An Historical Perspective:

Attempts have been made throughout human history to thwart the progress of disease through the exploitation of research findings. In relatively recent history, this activity has led to the discovery of the anaesthetic properties of ether (1846), the growing compendium of therapeutic applications for salicylic acid (aspirin) since its discovery (1860), the development of numerous vaccines, and the landmark discovery (1922) that insulin could alleviate the symptoms of diabetes (Gordon and Fowler, 1981). These developments were among the first in what proved to be a myriad of therapeutic breakthroughs that redefined the practice of modern medicine. With the evolution of medicine and healthcare came a concomitant expansion of the health research enterprise involving psychiatry, psychology, sociology, epidemiology and health outcomes research. Health research today, therefore, embraces a multidisciplinary focus of socio-demographic, basic, applied, clinical, epidemiological, and evaluative research.

The Canadian Perspective:

Although many early medical discoveries claimed Canada as their birthplace, it was not until the introduction of Medicare that the inextricable link between universal healthcare and health research was forged. Since the establishment of the Medical Research Council of Canada (MRC) in the early 1960s, federal support for health research has risen from modest beginnings to its current level of $260 Million annually, or about 17% of the total expended in this field. Complementing this figure are estimated contributions from provinces (13%), other federal sources (7%), private research foundations (11%), post-secondary education (24%), and the private sector (28%) (MRC, 1994). The latter, exceeding $400 Million annually, represents the largest source of funds for health research in Canada. In total, the Canadian health research enterprise is supported by over $1.5 Billion, and employs several tens of thousands of professionals.

The Manitoban perspective:

With expenditures representing approximately 2.3% of the national total, Manitoba's health research enterprise has experienced a relatively flat growth curve, with new recruits essentially replacing those lost through normal attrition. Unlike that found in the national statistics, Manitoba's revenue sources are largely dependent upon private provincial foundations (22%), federal granting agencies (43%), provincial support (10%), other local sources (13%), university/hospital support (5%), and to a much lesser extent, the private sector (1%) (Association of

Colleges of Medicine of Canada, ACMC, 1991). It is estimated that about 760 individuals, along with a contingent of research operational support staff, are directly employed as a consequence of this activity (Ronald, 1995).

The retarded growth of this enterprise is dramatically manifested in the slide in ranking of Manitoba health research expenditures from fourth of sixteen medical schools in 1977-78, to the current rank of eleventh of sixteen (ACMC, 1994). Although these figures should not be considered in isolation when rating Manitoba's performance, they are suggestive of a trend towards decreasing competitiveness relative to other jurisdictions. In recognition of this, a Health Research Task Group represented by leaders in the health research community from academia, industry and government was assembled to develop a strategic approach to managing health research in the province. The approach taken by this group over the past eighteen months has been consultative, involving numerous stakeholders, and has identified four mandates for a renewed research and development authority including the following: 1) grants and awards; 2) communications and programming; 3) business development; and 4) technology commercialization (August, 1995). It is presumed that the newly defined structure with intensified provincial government support will spark new life into health research activities in the province. Recent announcements of a new provincial program for research infrastructure, a critical area identified by the task force, suggests the provincial government is committed to developing this area into the

new millenium (Appendix 7). Fundamental to further development of public sector resources for this activity, however, will be a necessity for more sophisticated economic valuation of health research.

2) Core Competencies:

Integral to the rational use of precious health research resources is the identification of core competencies from which a development strategy can emerge. Core competencies, as defined by Prahalad and Hamel (1990), are the collective learning in the organization which when coordinated into harmonious streams of technology, serve as the engine for an organization's new business development. Within health research, the inventory of existing core technologies, coupled with complementary R&D activity, combine to serve as technological assets. To truly approximate the core competencies of an organization, however, consideration of creativity, pragmatism, managerial skills, entrepreneurship, intergroup cooperation, and marketing ability must also be considered along with the technological strengths (Durand, 1988).

Defining and evaluating core competencies is critical to the successful management of a health research organization. In fact, Durand's model (1988), might best be implemented through an iterative approach that considers both market and academic perceptions of competency, the human resource potential of the R&D program, and complementary business and managerial skills. The

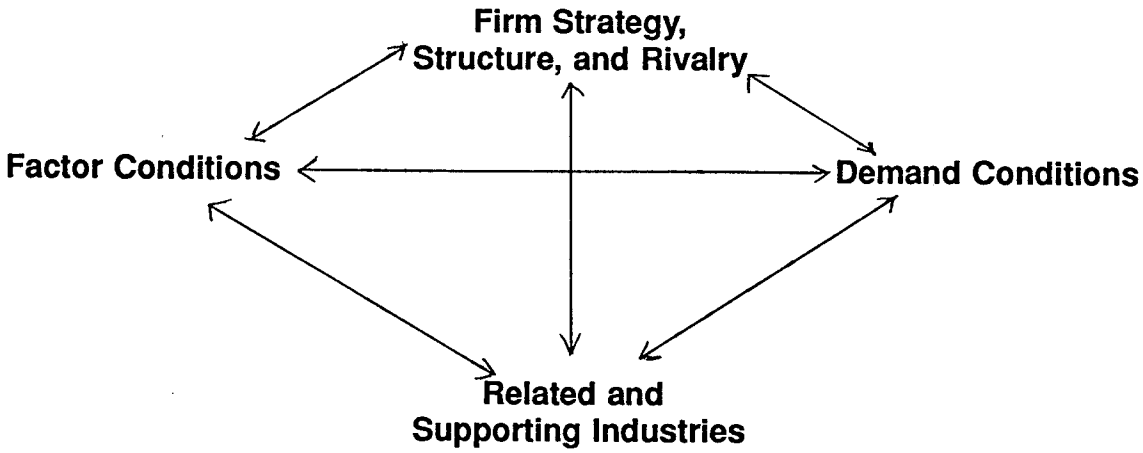
rewards of developing a strategic architecture, will be found through efficiency of management, the rational use of resources, and a capacity to change-attributes essential to an organization that wishes to attract new business development opportunities and to grow in the long term (Prahalad and Hamel, 1990).

3) Socio-Economic Underpinnings of Health Research:

Analagous to the level of research and development found in other industrial sectors of Canada's economy, overall support for Canada's health research enterprise suffers from a relatively low level of investment. In short, Canadian expenditure on research and development as a percentage of GDP throughout the 1980's ranged between 1.15% and 1.36%, or essentially half of that expended in the United States, Japan or Germany (Clarke and Reavley, 1988). Presently, Canada's investment in research and development accounts for about 1.5% of GDP, lagging behind that of all Group of 7, G-7, countries except Italy (Industry Canada, 1994). Porter (1990) argues that one of the attributes that characterize a nation's playing field for industry is the establishment of infrastructure critical to the strategic, technical and training needs of industry. In his "Diamond of National Advantage" (Figure 1), Porter (1990) contends that federal investment in research that is accessible to domestic industries will facilitate acts of innovation and commercialization thereby spurring economic growth.

FIGURE 1

THE DIAMOND OF NATIONAL ADVANTAGE



Factor Conditions: The nation's position in factors of production, including skilled labor, or infrastructure.

Demand Conditions: Domestic demand for industry's product or service

Related and Supporting Industries: Presence of internationally competitive supplier or other related industries.

Firm Strategy, Structure and Rivalry: Conditions in the country governing the creation, organization and management of an industry, and the nature of local rivalry.

From: **The Competitive Advantage of Nations** by Michael E. Porter, 1990.

The New Paradigm:

Having been faced with repeated budget restriction, and the promise of continued attrition, the Medical Research Council of Canada is seeking to identify innovative sources of revenue. Working with industry organizations such as the Pharmaceutical Manufacturer's Association of Canada, PMAC, partnership funds such as the MRC/PMAC fund, have been successfully established, and marry the benefits of association with Canada's premiere health research granting agency, with significant industry support (MRC Communique, 1994). Elsewhere, several provincial jurisdictions have developed university/industry programs in an effort to demonstrate risk-sharing (Manitoba Health Research Council, British Columbia Health Research Council-1995). Infrastructure support programs have also emerged as potential catalysts to investment (Province of Manitoba-1995, Fonds de la Recherche en Sante du Quebec-1995). Coupled with these grant programs are federal and provincial tax credits for industrial research and development which have enabled Canada to achieve status as the most cost effective nation amongst the OECD in which to conduct research and development (Conference Board of Canada, 1994). Porter (1990) endorses such activities which improve the competitive advantage of a nation, and facilitate industrial innovation.

The Value of Health Research:

Facilitating the recent evolution of the health research enterprise in Canada, and consequential paradigm shift, has been a recognition of the value of this activity

to the Canadian public enumerated from both a social and immediate economic perspective, as well as the more recent recognition that health research is of strategic importance for industrial development.

Social Value:

As described previously, the annals of health research refer to a disproportionate number of Canadian discoveries that have profoundly changed the face of medicine. Whether one considers the discovery of vaccines and therapeutics, improved disease management, or health outcomes data that appropriately rationalizes resources, the enormous social benefit to health research is clearly evident. In fact, public support for this activity might be seen as trivial relative to the millions of lives saved or improved through such research. Unfortunately, given today's fiscal realities, and the ever pressing need to demonstrate appealing benefit to cost ratios for programs supported by public dollars, it has become necessary to also consider health research from an economic perspective.

Direct and Indirect Economic Value:

There are at least three levels of sophistication used to quantify the economic value of health research. The most common of these, mentioned earlier, involves a tabulation of all employees directly involved in health research activity along with a similar accounting of funds supporting this activity from all sources.

A more comprehensive analysis of the economic value of health research investment is that made possible through the Manitoba Bureau of Statistics, MBS. The Bureau is able to provide economic assessments of Manitoba capital projects, or ongoing operations through the use of algorithms for each of 600 commodities, supplemented by Statistics Canada data. Through this approach, the relative value of both employment and other operational costs of health research can be assessed. In doing so, the various commodities used in health research such as disposable plastics, research animals, electronics, chemicals, etc., are identified, and an economic algorithm is assigned to each based upon the presence of the relevant industries in Manitoba, and the laboratory's use of such local product. For example, if plastic labware were manufactured in Manitoba, and used within one of the research laboratories in the province, then this commodity would be associated with a stronger economic multiplier than that for labware bought from a non-Manitoba based manufacturer. By subjecting the health research enterprise to such scrutiny, it is possible to generate a reasonable approximation of the macroeconomic multiplier effect for health research in Manitoba, the direct and indirect employment, and the tax generation at the three levels of government (Falk, 1995).

Finally, maximizing strategic advantages including health research infrastructure, a competent pool of skilled researchers, and an environment that fosters innovation is critical for the development of indigenous health industries. Porter

(1990) argues that through such development, globally competitive enterprises can emerge and thrive. Only then will Gordon and Fowler's (1981) depiction of Canada as a marketplace for foreign high technology manufactured product be dispelled in favour of one served by domestic industries. Facilitating the development of such industries should, therefore, be a cooperative focus of federal and provincial governments when considering funding programs (Porter, 1991).

4) Technology Commercialization and Industrial Development:

Capitalizing on the indirect economic benefits of health research has become commonplace amongst industrial nations since the emergence of the 'new' biotechnology industry twenty years ago. Pearson, Brockhoff and von Boehmer (1993) acknowledge that biotechnology R&D collaboration has emerged as a global competitive tactic involving universities and public laboratories. Indeed, government too has resolved to focus further attention on reaping industrial benefits from academic research. Senker and Faulkner (1992) have characterized this as 'government excitement over the economic and social potential of biotechnology'. Accounts from Silicon Valley in Northern California, the Golden Triangle in North Carolina, and developments in southern Texas attest to the potential economic benefits to be realized (McMullan and Melnyk, 1988). In addition, management leaders such as Michael Porter (1987, 1990, 1991) have emphasized the need to strengthen this focus. As an instrument of regional industrial development, it is, therefore, commonly held that serendipitous

byproducts of publicly-supported health research may be marketable inventions which if successfully developed can engender manufacturing activity, employment, and a tax base that could provide handsome returns to the public purse. Due to the variability of success in this field, however, a clearer understanding of the challenges faced, and potential benefits obtained is required.

In the present context, technology commercialization is defined as the process of orchestrating the successful identification, marketing assessment, intellectual property protection, prototype development, licensing, financing and manufacture of inventions arising out of academic health research facilities. This holistic process is thereby distinguished from simple technology transfer whereby ownership of innovative processes or products is transferred from the academic environment to the private sector, where it is subsequently commercialized. The differences are clearly articulated here to highlight the fact that control of the commercialization process will serve as a necessary, although not sufficient, condition to regional industrial development. Indeed, McMullan and Melnyk (1988) suggest that many universities have failed in this area for a number of reasons including the fact that economic benefits tend to be taken out-of-state by the sponsor firm.

To protect the essential values of the university, internal controls must be assured (Wade, 1984). This would suggest that alternative mechanisms for assuring

mutual corporate-academic benefit would be preferable. In attempting to establish a best practice for technology institutes active in industrial liaison, Rush et.al., (1995) define several critical success factors including appropriate leadership, a flexible organizational structure, technical competence, project managment skill, a defined strategy, superior communications and an effective human resource strategy. Since such an organization's long term success will presumably be dictated by its ability to emulate best practices in technology commercialization, models for defining benchmarks in this area are critical.

5) The Pharmaceutical Industry:

The pharmaceutical industry could be described as an aberration given its unique statistics:

* Over 7000 firms worldwide prosper;
* None of the moderate or larger size firms go out of business;
* This despite the fact that the top 50 firms spend 10 -20% of sales annually on R&D of a high risk nature, and
* This industry has outperformed other sectors for 40 years (James, 1994).

It is also noteworthy that this industry is defined by two tiers, whereby the top 50 firms enjoy roughly 50% of sales, and account for the majority of R&D investment, and no single firm secures more than 5% of the market (Sapienza, 1989).

Despite the apparent buoyancy of this sector, high barriers to entry relating to technology, marketing and distribution, patent protection and the regulatory climate prevail (Sapienza, 1989; Taggart, 1991). For example, the costs associated with developing a new compound from inception to market are currently approaching $360 million (US$) (Boston Consulting Group, 1993), a process that typically can take 10-12 years. With 8 - 10 years of effective patent protection, firms must then attempt to secure market access by ensuring the inclusion of the product on public or private formulary[1] listings.

The Canadian Pharmaceutical Scene:

Consisting of some 119 firms with sales in Canada of $11.8 billion annually , $6.3 billion of which represents prescription sales (Health Canada, 1994), Canada's pharmaceutical industry is dominated by foreign-owned branch operations, with the exception of two Canadian generic firms which have significant market share.

Access to the Market: The Principal Challenge

Perhaps the greatest single challenge facing the Canadian pharmaceutical industry today, is successfully accessing the marketplace with existing, and new pharmaceutical compounds (MPAC, 1995; CPIC, 1994). Global pressures on rationalization of drugs have resulted in the introduction of formularies, and have

[1]Formularies are listings of drugs which have been approved by an insurer for benefit reimbursement. They are common in both public sector managed healthcare, and private pharmaceutical benefit management firms.

focussed renewed attention on superior cost to benefit ratios, and quality of life (KPMG, 1995). Future growth of this industry, and the concomitant investments in R&D will, therefore, be predicated on success in this area. Already, firms have commenced product development rationalization proceedings to ensure that new compounds currently being developed will most definitely offer the marketplace substantial benefits (van Amersfoort, 1995). This challenge will undoubtedly translate into a substantial new opportunity for partnerships with those centres that possess recognized skills in pharmacoeconomics and health outcomes research.

Canadian Pharmaceutical Investment in Research and Development:

When considering both capital and operational expenses, this industry likely exceeded $700 million in research investment in 1994 (PMPRB, 1995, Research Money, 1995). With Canada accounting for less than 2% of the global market (James, 1994), it appears likely that the country has been the recipient of a greater proportion of global R&D expenditure than its market share would justify.

Attractive R&D tax credit inducements (Conference Board of Canada, 1994), an improved patent environment for brand name manufacturers (PMAC, 1994), hospitable reimbursement policies for generic manufacturers, and an established public health research infrastructure have each contributed to increased private sector R&D spending in this country. This represents a significant, 180 degree shift from the environment in 1983 where R&D investment in Canada was deemed to compare poorly with other jurisdictions (Thompson, 1983). Despite the

improvements at a national level, considerable effort must still be expended in addressing regional investment shortcomings targetted to regional strengths (PMAC, 1994; MPAC, 1995).

Strategic Alliances: New Opportunities for Partnerships

Much of the R&D currently invested in Canada by this industry is being carried out in Ontario and Quebec (89%; PMPRB, 1994), largely due to the presence of significant intramural research conducted in some of the firm's Canadian Head Offices. Trends toward increasing extramural or externally contracted R&D are on the rise, representing new opportunities for Canada's publicly supported health research enterprise. Increasing costs associated with researching new products and bringing these to an ever-changing and challenging market, has led the pharmaceutical industry to actively pursue such strategic alliances (Whittaker and Bower, 1994). Generally, these alliances are one of three types:

1) Technology development: designed to expand the firm's R&D know-how;
2) Commercialization alliances: to provide the firm with manufacturing and marketing skills; and
3) Financial alliances: to provide the firm with money needed for commercialization activities (Forrest and Martin, 1992).

One of the most important, and most frequent, types of strategic alliance undertaken by the pharmaceutical industry is technology development alliances with biotechnology firms, universities, and research institutes (Forrest and Martin, 1992; Sapienza, 1989; Whittaker and Bower, 1994). A rationale for this increasing trend has been provided by Atuahene-Gima and Patterson (1993) who surveyed engineering, pharmaceutical and chemical firms, and found that gaining competitive advantage, accessing markets quickly, diversification into new product areas and gaining technical knowledge quickly each ranked higher than any perceived cost savings associated with this activity. Similarly, others have suggested that access to technology, lower costs, credibility of association, and facilitation of market penetration are key added value benefits to such alliances (Shaw, 1988). Given the ongoing needs of the pharmaceutical sector, and the recognized value of such activity by Canadian universities and government, such strategic partnerships in health research should continue to characterize the landscape in Canada. Defining the criteria used by industry for making such investments, and identifying ways of inducing industry to invest should, therefore, prove to be key catalysts to increased private sector support of this activity.

6) The Impact of Organizational Contexts on Structure:

Arguments extending over several decades have been made concerning the impact of a variety of organizational contexts (firm size, ownership, origin, charter, technology, location and dependence) on organizational structure (including

structuring activities, concentration of authority and line control of workflow). A sample of this literature and conclusions drawn from it are summarized in Table 1. For example, if one wished to study the extent of formalization (structuring of activities) in North American manufacturing firms, then one would consider firm size, in light of literature that suggests firm size correlates positively with extent of formalization. By providing a better understanding of the factors influencing decision making, specifically health research investment decisions, these organizational contexts validate survey approaches to the pharmaceutical industry.

Table 1

The Impact of Organizational Contexts on Organizational Structure

#	Author(s)	Study Conclusions
1	Woodward et.al.	**Management and Technology,** 1958, Some technical changes have more impact on the organization than others, depending upon the extent that the technology creates new situational demands. No relationship between size and structure was found.
2	Pugh et.al.	**The Context of Organization Structures,** 1969, A multivariate analysis of organizational structure and the context in which it functions revealed size, dependence and the charter-technology-location collective largely determine structure, where size is related to structuring; dependence to concentration of authority; and integrated technology to line control.
3	Hickson et.al.	**Operations Technology and Organization Structure: An Empirical Reappraisal,** 1969, Compared to size, operations technology is accounting for a relatively small proportion of the total variance in structure.
4	Inkson et.al.	**Organization Context and Structure: An Abbreviated, Replication**, 1970, A replication of the study published in 1969 (2). This study supported the previous findings that structuring was primarily related to size, and to some extent technology; concentration of authority was related to dependence.
5	Child, J.	**Organization Structure and Strategies of Control: A Replication of the Aston Study,** 1972, Using a more geographically diverse and larger industrial sample than that of the original Aston study, with fewer branch offices, otherwise using the same study design, the author suggests centralization of decision making relates negatively to structuring in conformation with Weber's historic work. That is, in organizations with high structure (hierarchy) there will exist an environment conducive to delegation of decision making.
6	Horvath et.al.	**The Cultural Context of Organizational Control: An International Comparison**, 1976, The importance of size, technology and internal dependence (the dependence of the subject on the parent organization) as predictors of structure is supported both within countries and across societies.

RESEARCH QUESTIONS

The foregoing suggests that geopolitical strategies throughout North America have acknowledged the obvious social benefits of health research. The promise of future knowledge-based industrial development, and concomitant economic windfalls have likewise appealed to policy makers. One might presume that federal and provincial policies supporting industry investment will catalyze growing investment by the pharmaceutical industry. By identifying criteria for industry investment in extramural health research, policy makers will be better equipped to respond with programs of mutual benefit to academia, industry and government.

The following questions have served as a framework for the present project:

1) **What are Manitoba's core competencies in research areas relevant to the pharmaceutical industry?**
2) **How is a benchmark technology commercialization unit structured?**
3) **Which publicly supported health research programs, if any, serve to induce private sector investment?**
4) **What are the criteria used by the pharmaceutical industry for investments in extramural health research?**
5) **What is the economic value of health research in Manitoba?**

METHOD

1) Survey Design

Survey Research:

As a method of evaluating a population subset, survey research is frequently used. In survey research, subjective responses provided in questionnaires or interviews can provide useful data concerning decision making (Veney and Kaluzny, 1984).

Bias, Reliability and Validity:

To ensure that data collected from survey research is accurate, the research design must attempt to minimize both **random error**, or the inherent variation between a sample mean and that of the population under study, and **systematic error or bias.** Various sources can be attributed to bias including the interviewer, the measurement instrument (i.e.,: the survey), nonrespondents, and processing. (McDaniel and Gates, 1993). The extent to which a measurement is free from error, or is consistent under conditions in which error might be introduced, then it is said to be **reliable** (Cascio and Thacker, 1994). Finally, by minimizing error and ensuring the data collected is consistent, stable, and dependable, it is then essential to determine whether the evidence provided by testing is valid, or supports the inferences that were initially investigated (Cascio and Thacker, 1994).

Surveys:

To solicit critical subjective data on research decision making, perceptions of Manitoba's core competencies, and critical factors to commercialization success in Manitoba, descriptive surveys were used (Appendices 1-5). Answers to research questions 1-4 have been sought, using both questionnaires and interviews.

General Industry Survey:

Research question number 1 was addressed through distribution of a general one page survey (Appendix 1) sent to 62 firms in Canada's pharmaceutical industry. The survey was faxed to the chief executive officer within each firm, accompanied by a description of the research project, and a request that the survey be forwarded to the senior research officer in the firm. This approach was taken since empirical evidence collected over the years has suggested that the research officers would be more likely to respond to their C.E.O.s than to an external request, directly, and that response rates from C.E.O.s to external requests have usually been quite reasonable. The firms surveyed included all of the PMAC membership, given their propensity to conduct innovative extramural research, and to develop research alliances with the public health research centres throughout the country. In addition, the two largest CDMA members were likewise included, given their history for supporting public health research, and their more recent foray into the development of innovative patented compounds. Other Canadian pharmaceutical firms were excluded due to their presumed focus on intramural

research activities. To establish a list of Manitoba's health research core competencies, a list of 18 disciplines was provided. The respondent was invited to identify any well-regarded research areas, to rank them relative to one another, and to add any additional strengths not found in the list provided. A three week response deadline was indicated, following which phone and fax were used.

Survey of Manitoba's Health Research Community:

In addition, research question number 1 pertaining to Manitoba's core competencies, was addressed through a questionnarie sent to twenty health researchers in Manitoba (Appendix 2). This survey instrument sought to define both academic perceptions on Manitoba's core competencies, and obstacles and enablers to attraction of additional private sector research support. A selection of twenty-two disciplines was provided. Respondents were invited to add others at their discretion, and to rank each of the chosen areas relative to one another. The greater number of research areas on the academic survey compared with the industry survey simply reflected supplementary centres identified by industry which were then added to the academic list. The twenty surveyed were not a random sample, but rather chosen specifically owing to their seniority, and familiarity with health research in Manitoba, in general. It was this depth and breadth of experience that was deemed to be most critical to the collection of credible data. Indeed, ten of the twenty surveyed maintained a level of administrative duty, each of whom also had been involved or were concurrently involved in discipline specific

research. Fourteen disciplines were represented in the surveyed sample. Again, a three week deadline was imposed on respondents. Phone and fax were both used as follow-up to non-respondents after the deadline period had passed.

Technology Commercialization Survey:

As outlined above, research question number 2 seeks to define best practices for establishment of a technology commercialization centre that could serve the health technology commercialization needs of all relevant constituencies in Manitoba. To this end, a questionnaire was developed and faxed to the directors of twenty-four technology commercialization, technology transfer, industrial liaison, or patents and licensing offices throughout North America (Appendix 3). The questionnaire sought to define various organizational models, to elucidate policies and procedures for such organizations, to understand the extent of involvement of affiliates with these centres, to define standards of performance, and to understand major impediments to success. Twelve sites in Canada and twelve in the United States were chosen in an attempt to assemble a geographically diverse pool of both private and public organizations. Three week deadlines were given for responding, following which each non-respondent was followed up by phone and fax.

Survey of Provincial/State Health Research Support Programs:

To encourage private sector investment in health research, several jurisdictions have developed research support programs designed to induce such investment. Responding to research question 3, an effort was made to determine which, if any, of these would be perceived by the pharmaceutical industry as an inducement. A comprehensive inventory of available programs was therefore required. To this end, each province and territory in Canada, and two U.S. states were solicited by fax (Appendix 4a and 4b) for information addressing this question. Respondents were provided a three week deadline for responses, following which non-respondents were phoned and faxed.

In personal interviews, a sample of pharmaceutical firms were then asked to rate the inventory of potential programs on a scale of 1 to 10 where 1 would represent a program of no interest to the firm, 5 would be of marginal interest, and 10 would represent a program in which the firm is extremely interested.

2) Sampling

With appropriate consideration given to precision, accuracy, and validity within the study design, sampling can then be used to more efficiently examine a specific parameter of a study population. The sample must be valid both externally, in that what is observed in the sample is true of the whole population, and internally, in that the conclusions drawn from data collected in the sample actually exist for that

sample (Veney and Kaluzny, 1984). In the present context, both the academic and technology commercialization surveys were conducted on non-probability samples, based on personal judgement and response to some predetermined demographic quota that includes the selection of specific characteristics of the study population (McDaniel and Gates, 1993). Alternatively, a probability sample, in which every characteristic of the population has a known, non-zero probability of selection, was used to select an industry sample for interviews.

3) Stratification

To address research question 4, criteria for stratification were developed with regard to precedent publications, specifically those of Woodward (1958), Child (1972), Horvath (1976) and Pugh, Inkson et.al. (1969, 1969b, 1970). Consideration was made of several contextual parameters that might exert influence on decision making in the organization, specifically the degree of autonomy of domestic research management (Figure 2). Given that 31 of 34 respondents to the initial survey reported to large multinational parent firms, with numerous locations throughout the world, and with stock that is publicly traded, it was presumed that the sample would be normalized with respect to these organizational contexts, and therefore representative of the study population. Two of the remaining repondents were small firms, domestically traded, but otherwise independent. The final firm was a larger independent, privately held Canadian company. Finally, technology has been found to exert an impact on organizational structure (Woodward, 1958),

but more so on line control than on organizational decision making (Pugh et.al, 1969), the key concern in this stratification process.

With these considerations in mind, stratifying the industry sample was accomplished based on (1) a firm's current (1994) R&D investment in Manitoba as a percent of Manitoba sales, and (2) their respective potential to invest in the province's R&D enterprise as determined by firm size (national sales revenue)[2]. An analysis of research outcomes as perceived by each stratum was prescribed as a means to facilitate further investment through resolution of obstacles identified by industry. Given this intention, a reasonable weighting was assigned to the two stratifying criteria. The basis for this formula emerged from an attempt to assess perceptible differences in decision making criteria between firms. Therefore, it was deemed to be important that the significance of current R&D investment in Manitoba was not overwhelmed in the stratification design by a firm's ability to invest, or firm size. The following formula was, therefore, developed for this purpose, and applied to each firm:

$$a + 2b = c$$

whereby a = National sales of firm,

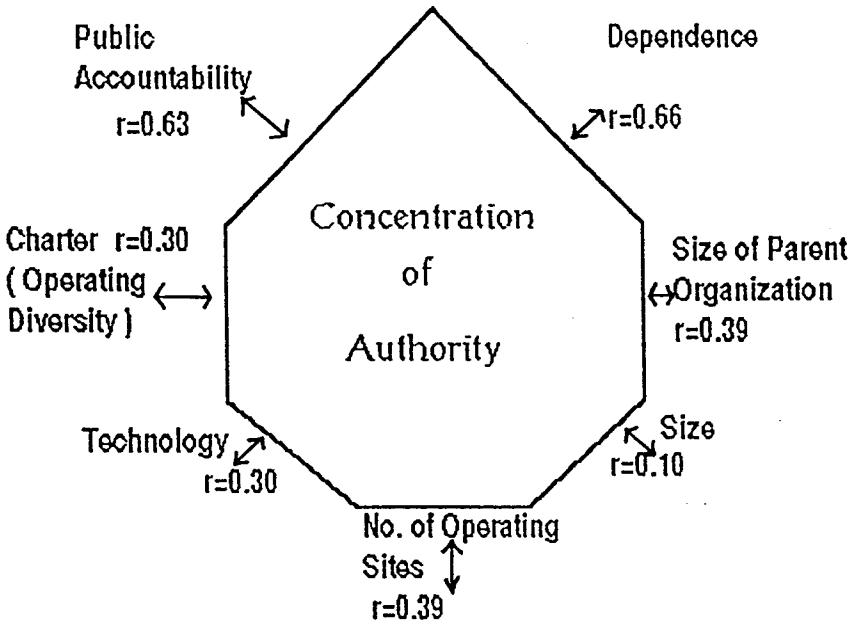
b = R&D in Manitoba as a percent of Manitoba sales

c = total firm value

[2]Firm size and potential to invest are legitimate correlates in light of a legislated commitment under The Patent Amendment Act, Bill C-22 to invest 10% of National sales in R&D in Canada by 1996. This commitment was retained under the Patent Amendment Act of 1992 (Bill C-91) during which time the PMAC members also committed to further regionalization of R&D investment in the country.

FIGURE 2

THE RELATIONSHIP OF VARIOUS ORGANIZATIONAL CONTEXTS ON CONCENTRATION OF AUTHORITY



Three cohorts or strata were developed according to the following limits:

Sales ($MM)		**R&D as a % of MB Sales**		**Value**	**Strata**
$400 MM	= 5	12%+	= 5	15 - 11	A
$300 - 399MM	= 4	9-11.9%	= 4	10 - 7	B
$200 - 299MM	= 3	6 - 8.9%	= 3	6 - 3	C
$100 - 199MM	= 2	3 - 5.9%	= 2		
< $100MM	= 1	<3%	= 1		

Based on this stratification of 34 firms, 8 were rated A, 7 were rated B, and 19 were rated C. A random sample of three firms was then selected from each strata, for the purpose of interviews. The firms selected for each strata are identified by the numbers assigned to them in Table 4. They are as follows:

Stratum A	**Stratum B**	**Stratum C**
No. 26	No. 23	No. 30
No. 27	No. 24	No. 31
No. 28	No. 25	No. 32

Interviews were conducted with each of the nine pharmaceutical firms representing the three defined strata. Each stratum is generally defined below:

Stratum A was represented by two firms with national sales between $100 -199 MM annually and investing large amounts in R&D in Manitoba, and one very large firm ($400MM+ sales) investing a moderate amount in R&D within the province. Each of these firms asserted their firm's commitment to regionalization of R&D investment in Canada, and articulated strategies in support of this policy. On average, the three firms sampled invested 12.8% of Manitoba sales in R&D in the province, or over $1.6 million in 1994. This research investment was dedicated to both clinical trials and post-marketing research.

Alternatively, **Stratum B** was comprised of one very large firm ($400MM+ sales) investing a small (<3%) amount in R&D in the province, one mid-size firm between $100 and $199 million in Canadian sales, and one mid-size firm with between $200 and $299 million in Canadian sales, both of which invested moderately in R&D in the province. These firms averaged an R&D investment of 4.7% of sales in Manitoba, (over $620,000) in basic, pre-clinical, clinical and post-marketing research. Again, each firm confirmed the presence of a strategy for regionalization of R&D in Canada.

Finally, **Stratum C,** with on average 2.4% R&D investment/sales ratio or about $300,000., is characterized by two mid-size firms with between $100 and $199 million in annual Canadian sales and low (<3%) or moderate (3-5.9%) levels of investment, and one mid-size firm with sales of $200 - $299 million and low (<3%)

investment in R&D in Manitoba. Two of three firms in this cohort expressed implementation of a strategy for regionalization of R&D in Canada. Clinical trials was the only area of research selected for investment in Manitoba by this sample.

4) Interviews

Equipped with a pre-designed survey questionnaire (Appendix 5) as a general guide with which to address research questions 1, 2, 3, and 4 personal interviews of 1 to 1.5 hours duration were conducted with research management within each of the sampled firms. Each interview took place in the firm's Canadian head office in either Toronto or Montreal. Responses were transcribed during the course of the interview with all respondents blinded to the stratification design. Where possible, positive and negative controls were included in the question design, so as to counter response bias. Controls were based upon empirical evidence, supplemented by published data, and included criteria such as scientific excellence (recognized publicly as the top consideration for investment) as a positive control, and proximity to Canadian head office (regarded publicly as irrelevant to investment) as a negative control.

Included within this process were questions designed to understand those benefits commonly sought by the pharmaceutical industry in conducting extramural research anywhere in Canada. To this end, respondents were asked to rate six criteria on a scale of 1 to 10 whereby 1 denoted the criterion was of no importance

to the firm, 5 was of marginal importance, and 10 of critical importance. Similarly, to understand the extent to which Manitoba's researchers were perceived to be responsible for the research outcomes, such a question was posed with a rating of 1 denoting that the scientist had nothing to do with the outcome, 5 suggesting marginal involvement, and 10 denoting definite dependence on the capability of the researcher. Finally, with respect to technology commercialization units, industry respondents were asked a series of questions pertaining to their impressions in dealing with technology commercialization offices, their perceptions on obstacles for success of technology commercialization offices, and their thoughts on factors to improve such units.

5) Manitoba Bureau of Statistics Economic Evaluation

The Manitoba Bureau of Statistics, MBS, a branch of the provincial department of Industry, Trade and Tourism, maintains an Economic Impact Assessment Model based on Statistic's Canada's Input-Output Table for Manitoba. Through this electronic model, the Bureau is capable of producing estimates of the economic impact of a project or activity on the Manitoba economy; specifically Gross Domestic Product (GDP), labour income, and employment with outputs from the model being used to determine potential tax benefits through a Manitoba Tax Revenue Impact Assessment Model (MBS, 1994).

MBS Evaluation:

In an attempt to address the final research question, economic analysis of a comprehensive, public health research operation was conducted. Research centre staff were directed to provide employment numbers for each category of employment (eg. directors, scientists, technologists, janitorial, etc.) in addition to mean salaries for each category. A global operational budget was also required along with itemization and valuation of each type of product used in the operation. For example, $57,000.00 of reagent grade chemicals, or $28,000.00 worth of laboratory mice. For this purpose, a template of 600 possible commodities was provided (Appendix 6). Exceptions that did not correspond were noted, and MBS staff worked with research management, and the author to best approximate the product's economic algorithm. Site of manufacture and procurement was also necessary to allow for a triaging of variances in economic impact ranging from the impact of a product manufactured in Manitoba, relative to one manufactured elsewhere, but sourced in Manitoba, versus one manufactured and sold in another jurisdiction altogether.

With a complete summary of products used annually in health research operations over six consecutive years (1986/87 to 1991/92), the Bureau translated all items to correspond with MBS Commodity Codes. Economic impacts were determined for Manitoba including the impact on GDP, labour income, employment and tax generation at the three levels of government.

RESULTS

1) Survey Research

Having solicited information from various sources through both questionnaires, phone inquiries, and faxed requests the following data can be reported:

A) General Industry Survey:

The general industry survey was sent to each of 62 pharmaceutical firms with the intention of determining the extent to which this industry invests in extramural health research in the public research facilities in Canada, and to acquire an indication of their current commitment to such activity in Manitoba. Finally, the survey attempted to address research question 1 by defining the research groups in Manitoba which would be perceived to be internationally competitive from an industry perspective, and to rate each of those identified relative to one another. Thirty-four firms responded to this survey with completed responses (55%). Indeed, among the non-respondents were several smaller firms with more parochial research interests, a pharmaceutical packaging firm, and pharmaceutical contract research firms. All respondents (100%) answered in the affirmative to extramural health research investment in Canada in 1994. With an average of 61% of the respondents' global research budget being invested in extramural sources, and on average 76% of this, or 46% of their global budgets being committed to public research centres in Canada (Table 2). The value of

Table 2

Summary of Extramural Health Research Investment in Canada and Manitoba

Firm	Strata	% Extramural (a)	% Public Extramural (b)	MB R&D ($) (c)	R&D as % of MB sales (d)	Inc. % (e)	Dec. % (f)
1	C	75	100	93,500	2	1268	
2	B	N/A	N/A	0	0	N/A	
3	C	100	100	30,000	5	100	
4	C	90	90	27,400	.7		15
5	C	N/A	N/A	0	0	N/A	
6	C	38	62	17,000	.6		68
7	C	5	100	0	0	N/A	
8	C	80	60	0	0	N/A	
9	C	95	90	3,750	.4	100	
10	C	20	N/A	0	0	N/A	
11	C	20	60	0	0	N/A	
12	C	80	80	0	0	N/A	
13	A	100	85	61,000	24	50	
14	A	55	30	190,000	N/A	100	
15	C	11	N/A	50,000	N/A	28	
16	A	15	100	62,000	16		53
17	C	100	95	41,000	.95	N/A	
18	B	40	95	344,000	6	54	
19	B	24	86	130,000	2.5		17
20	A	73	N/A	139,000	14.6	23	
21	B	50	100	309,075	6	150	
22	C	100	75	15,000	N/A	N/A	
23	B	20	100	120,000	1	N/A	

24	B	45	47	426,279	7.2	102	
25	B	100	75	75,000	6		10
26	A	77	69	358,574	17.6		51
27	A	N/A	N/A	508,000	7.8		N/A
28	A	80	90	600,000	13	5	
29	A	32	15	540,000	10	6	
30	C	73	10	35,495	1.2	223	
31	C	60	56	131,000	1.5	N/A	
32	C	55	75	137,000	4.6		5
33	C	100	100	N/A	0	N/A	
34	C	70	80	40,000	2	25	
Σ	8A, 7B, 19C			$4.434M			
μ		1883/31 μ = 60.7%	2125/28 μ = 75.9%				

Legend:

a) % of firm's total R&D expenditure invested in research performed outside the firm by scientists who are not permanent employees of the firm.

b) % of extramural R&D (a) that is invested in Canada's public universities, hospitals and research institutes.

c) Total sum of R&D investment made by a firm in Manitoba in 1994.

d) A percentage representation of the ratio of R&D investment in Manitoba by a firm relative to the firm's sales in this province.

e) % increase of 1994 R&D expenditure relative to that in 1993.

f) % decrease of 1994 R&D expenditure relative to that in 1993.

investment in such activity in Manitoba for 1994 as reported by 25 respondents exceeds $4.4 million. In addition, 28 of 34 respondents identified one or more health research groups as operating at an internationally competitive level. When asked to rate each discipline relative to another, whereby a rank of 1 would denote the top centre, and all others would be rated in descending order, the 28 previous respondents identified 21 different research areas. The mean response for each discipline was taken, and the means were then ranked from lowest mean (best centre) to the highest (worst centre). These data are summarized in Table 3. Due to the presence of some outliers that tend to distort the appraisals of some research groups, a 10% trimmed means was also calculated.

B) Survey of Manitoba's Health Research Community

To further address research question number 1, pertaining to Manitoba's core competencies, a survey was sent to a judgement sample of 20 senior academics, to which 15 responded (75%), representing 12 different health research disciplines.

Defining the Goal:

Most respondents (14/15) believed that Manitoba receives less than its reasonable share of research support from the pharmaceutical industry. One respondent was of the opinion that Manitoba currently receives an amount equal to its share. For those suggesting that pharmaceutical industry investment in R&D in Manitoba is lower than it should be, the question was posed as to what measure would be

Table 3

Manitoba's Health Research Core Competencies: An Industry Perspective

Centre	Mean	T- Mean, 10%	S.D.	Min.	Max.	Valid N
ID	1.79 (1)	1.75 (1)	0.97	1.00	3.00	14
Cardio	2.35 (2)	2.35 (3)	1.22	1.00	5.00	17
Onc/Cell	3.20 (3)	3.0 (4)	2.66	1.00	9.00	10
MRIspc	3.22 (4)	2.29 (2)	3.67	1.00	12.00	9
Endocrin	3.75 (5)	3.50 (6)	2.12	1.00	8.00	8
Aging	3.80 (6)	4.0 (8)	1.92	1.00	6.00	5
Respir	3.80 (7)	3.3 (5)	3.03	1.00	8.00	5
Allergy	4.10 (8)	3.625 (7)	3.31	1.00	11.00	10
Diabetes	4.33 (9)	4.0 (8)	2.52	2.00	7.00	3
Immun	4.83 (10)	4.25 (10)	2.71	2.00	10.00	6
Neuroph	5.17 (11)	5.75 (12)	1.83	2.00	7.00	6
Pophlth	5.75 (12)	4.50 (11)	2.87	4.00	10.00	4
Rheumds	6.13 (13)	6.16 (13)	3.09	2.00	10.00	8
Pharmac	6.57 (14)	6.60 (14)	4.12	1.00	12.00	7
Dermatol	1.00	N/A	N/A	1.00	1.00	1
Preclin	1.00	N/A	N/A	1.00	1.00	1
Gastro	2.50	N/A	2.12	1.00	4.00	2
Hepatol	7.00	N/A	N/A	7.00	7.00	1
Transpln	9.00	N/A	N/A	9.00	9.00	1
WomHlth	9.67	11.0	3.21	6.00	12.00	3
Urology	10.0	N/A	N/A	10.00	10.00	1

* All Centres with two or fewer respondents will not be considered in the ranking.

N/A Not Applicable due to insufficient data

appropriate to define a reasonable level. Nine respondents felt that the goal should be set at a level consistent with Manitoba's per capita share (4% of total national). Fewer (4) felt that a defined percentage of Manitoba's global health research budget should be used, whereas others felt a percent (10%) of industry's total Manitoba sales was appropriate. Fewer still felt that the benchmark should be established at the same per capita level as the MRC, or that the benchmark should be the province that is performing the best in this regard (i.e., Quebec).

Enablers:

When asked to define enabling mechanisms to help Manitoba's health research community achieve this goal, nine respondents felt that attacking deficiencies related to scientists' lack of marketing/promotional skills, and the mechanisms for securing industrial support were most critical. Publication of health research capabilities was likewise deemed an essential ingredient to success with 8 supportive of this type of endeavor. Many others supported ongoing health research fairs (6), and research missions to industry offices. When provided the opportunity to suggest other mechanisms, some respondents suggested, "delisting drugs unless companies provide support", securing solid "indications by Deans, Department Heads, and other senior university officials that industry collaboration is worthwhile and will be recognized", or "advising the federal government of geographic disparities in distribution of R&D funds, the subject of C-91".

Obstacles to Further Industry Investment:

Each respondent offered subjective perspectives on potential impediments to developing Manitoba's level of pharmaceutical industry support. Each of these thoughts (n = 1) have been captured below in one of four categories as indicated:

Geographic Obstacles:

"Lack of pharmaceutical head offices, or research developments in Manitoba"

"Distance from head offices with a resultant lack of scientific contact"

"Remote from the centres of power in the pharmaceutical industry"

"We are a small market"

"Manitoba's poor image-climate, mosquitoes, small town image"

Marketing Obstacles:

"Failure to advertise research potential"

"Mainly lack of focus, plan and targets"

"Lack of appropriate partnership mechanism between research institutions"

"Lack of promotion of Manitoba's research capabilities and achievements at biotech meetings in USA"

"Research ought to be written up in a few pages and collated in a volume"

Policy/Regulatory Obstacles:

"Pharmacare program - some firms feel they are not being treated fairly and decisions are being made without consultations"

"Lack of a cohesive, consistent, and sustained strategic and tactical approach involving a real partnership between university and government"

"Perception that Manitoba is PMAC averse"

Business Development Obstacles:

"Industrial liaison office must play a cardinal role in facilitating interactions between researchers and industry and must respond quickly and professionally"

"Absence of competitive start-up company support comparable to that in place in other provinces.

"Need a big push to show that Winnipeg is not a Small Town"

Manitoba's Health Research Core Competencies: An Academic Perspective

Finally, each respondent was asked to identify health research disciplines of relevance to the pharmaceutical industry, and in which Manitoba possesses international recognition. The mean and 10% trimmed mean for each discipline identified was then calculated, along with the number choosing the specific discipline. These findings, which help to address research question 1, have been summarized in Table 4.

Core Competencies: Establishing the List

Unfortunately, establishment of a list of disciplines which are to be promoted over and above all others can be a rather contentious exercise, and disconcerting to those not recognized through this process. In an attempt to define such a list both industry and Manitoba academics independently identified disciplines in Manitoba of relevance to the pharmaceutical industry which were deemed to be of

Table 4

Manitoba's Health Research Core Competencies: An Academic Perspective

Centre	Mean	T- Mean, 10%	S.D.	Min.	Max.	Valid N
ID	89.3 (1)	90.8 (1)	11.9	60.0	100.0	14
Cardio	87.3 (2)	88.2 (2)	11.1	65.0	100.0	12
Onc/Cell	86.0 (3)	87.8 (3)	16.2	40.0	100.0	9
PopHlth	82.1 (4)	84.6(4)	19.5	35.0	100.0	14
MRIspc	81.7 (5)	80.9 (6)	14.0	70.0	100.0	10
Endocrin	76.8 (6)	81.0 (5)	16.5	50.0	95.0	4
Respirol	76.3 (7)	79.3 (7)	19.1	25.0	100.0	11
Neuroph	73.9 (8)	77.1(8)	20.1	30.0	95.0	9
Pharmac	73.0 (9)	72.0 (11)	13.2	60.0	90.0	6
Allergy	72.5 (10)	73.4 (10)	18.1	40.0	95.0	13
Pharmdv	72.3 (11)	75.0 (9)	9.2	60.0	82.0	3
HumGen	66.0 (12)	65.0 (15)	15.9	40.0	85.0	5
Aging	65.6 (13)	66.0 (16)	13.2	50.0	80.0	5
Immunol	64.7 (14)	68.3 (13)	24.5	20.0	95.0	6
Diabetes	64.1 (15)	68.0 (14)	23.1	15.0	90.0	8
Hepatol	62.5 (16)	70.0 (12)	25.9	20.0	90.0	4
Transpln	54.0 (17)	61.7 (17)	28.2	5.0	80.0	5
Rheumds	70.0	N/A	N/A	70.0	70.0	1
Gastro	80.0	N/A	N/A	80.0	80.0	1
WomHlth	39.0	N/A	21.0	19.0	60.0	2
Urology	50.0	N/A	N/A	50.0	50.0	1

* All Centres with <= 2 respondents will not be considered in the rankings.

N/A Not Applicable due to insufficient data

international stature (Tables 3 and 4, respectively). A simple visual review of the two lists showed that strong homology is evident. To ascertain the level of correlation between the two lists, it was necessary to convert the interval data provided from the academic survey to ordinal data as found in the industry survey. This was performed simply by taking the highest ranked discipline as the top rank 1, the next highest value as rank 2, and so on until each value had an assigned ranking. Following this the top thirteen disciplines common to both lists were compared. This results in the exclusion of centre number 13 from the industry ranking, and centres 11 and 12 from the academic list. A Spearman correlation of the two lists was then performed using the following formula:

$$Rs = 1 - \frac{(6 \sum di^2)}{(n^3 - n)}$$

where di = difference in ranks of the two variables
n = number of items ranked

Table 5 summarizes these industry and academic rankings, and their variances. Applying these data to the Spearman correlation formula, the following is revealed:

$$Rs = 1 - \frac{(6 \times 140)}{13^3 - 13}$$

$$Rs = 1 - 840/2184$$

$$Rs = 1 - .38$$

$$\mathbf{Rs = 0.62}$$

A Spearman correlation value of 0.62 is yielded.

Table 5

A Comparative Perspective of Manitoba's Core Competencies in Health Research

Discipline	Industry Rank	Academic Rank	di	d
ID/Med.Micro	1	1	0	0
Cardiovascular	2	2	0	0
Onc./Cell Bio.	3	3	0	0
MRI/Spc.	4	5	-1	1
Endocrinology	5	6	-1	1
Aging	6	11	-5	25
Respirology	7	7	0	0
Allergy/Asthma	8	10	-2	4
Diabetes	9	13	-4	16
Immunology	10	12	-2	4
Neurophysiology	11	8	3	9
Population Health/Outcomes	12	4	8	64
Pharmacology	13	9	4	16
Total				Σ=140

di: Difference between industry rank and academic rank
d: Square of the difference (di^2)

C) Survey of Technology Commercialization Units

Twenty-four surveys were sent to a sample of technology commercialization units throughout North America to address research question 2. Given that the this was intended as a benchmarking exercise, the group selected was not taken at random. Rather, a judgemental sample was taken in an attempt to ensure structurally disparate and geographically diverse organizations were included in the sample. Eight of twelve Canadian centres provided data along with seven of twelve U.S. centres for a 63% response rate.

Organizational Structure:

Respondents generally shared a common mandate, that being to seek research contracts, protect intellectual property, and to license technologies to industry in an attempt to create wealth for the inventor and the organization. A few private organizations also expressed a goal to form new business enterprises thereby contributing to regional economic development. As summarized in Table 6A, 60% of respondents were public sector entitites, the balance being private sector, incorporated firms. Only two of the private organizations were for-profit, with the balance (4) being not-for-profit. Most of the organizations were hierarchical in that a chain of command and accountability existed. This appears to have been a product of the academic environment from which most of these organizations emerged. Affiliations with universities, hospitals, and /or research centres were

Table 6A

Organizational Structure of Surveyed Technology Commercialization Centres

Org.	Public	Private	Profit	Non-profit	# Staff	Hierarchy	Affiliat Organ.	Affiliate Govern. Role
1	Y			Y	7	Y	Y	Y
2	Y			Y	N/R	N/R	Y	Y
3	Y			Y	7	Y	Y	Y
4	Y			Y	7	Y	Y	Y
5		Y		Y	5	N/R	Y	Y
6	Y			Y	6	Y	Y	Y
7	Y			Y	2.25	Y	Y	Y
8		Y	Y		8	N	Y	N
9	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
10	Y			Y	7	Y	Y	Y
11	Y			Y	N/R	N	Y	N
12		Y		Y	23	Y	Y	Y
13		Y		Y	5	Y	Y	Y
14		Y	Y		7	N	Y	Y
15		Y		Y	7	Y	Y	Y
16	Y			Y	N/R	Y	Y	N
Total	9	6	2	13	μ=7.60	10Y, 3N	15Y	12Y, 3N

N/R: Denotes no response given

common amongst all respondents with 80% (12/15) affirming that the affiliates were active in the policies and governance of the technology commercialization entity.

Policies and Procedures:

Thirteen of fifteen centres (87%) serve the commercialization needs of cross-appointed affiliates (Table 6B). Given that serving affiliate members does not necessarily discount the organization from serving its immediate constituency, the commitment to these affiliates had to be more clearly defined. This point is addressed in the question of cost-sharing among affiliates for operational expenses incurred where 5/12 respondents did implement policies for cost-sharing while 7/12 did not. Likewise, with respect to control of the potential purse realized from this activity, various approaches were found. Intellectual property may be owned by the university and/or the inventor along with any relevant affiliates.

Performance:

On the basis of thirteen respondents (from a sample size of 24), eight (62%) reported a net operating income, with the remaining 38% varying in their respective abilities to cover operating costs. On average, 56 inventions were reviewed in 1994 resulting in over 23 patents being filed, over 11 issued and licenses secured on over 28 inventions (Table 6C). These results were generated on average by

Table 6B

Policies and Procedures of Surveyed Technology Commercialization Centres

Org.	Cross-Appointees Served	IP Ownership	Op.Cost Sharing
1	Y	University/Inventor	N/R
2	Y	University	None
3	Y	University/Inventor/ Hospital	University & Case-based Negogiations
4	Y	IP-Inventor, 50% if options exercised	50/50 with affiliates
5	Y	IP-Inventor, no obligation, options	None
6	Y	University/Inventor	University & Affiliates
7	Y	IP-Inventor, options	N/R
8	N	N/R	N/R
9	N/R	N/R	N/R
10	Y	University, pays Inventor 1/3	None, Office is self-supporting
11	Y	University	None
12	N	University	None
13	Y	University, 40% to Inventor + 20% R&D	None, Office is self-supporting
14	Y	Equity based on fixed formula	None
15	Y	Varies depending on pre-defined terms	University & Affiliates
16	Y	IP-Institution	Institution/Affiliate Agreements
Total	13Y, 2N	Varied	5 Yes, 7 No

N/R: Denotes no response given
IP=Intellectual Property; Op.Cost= Operational Cost Sharing

Table 6C

Performance of Surveyed Technology Commercialization Centres

Org.	N.O.I.	# Inventions Reviewed	Patents Filed	Patents Issued	#Licenses	$ Royalties	R&D (1)
1	Y	77	10	4	30	N/R	8.5
2	N	25	3	0	12	N/R	N/R
3	N	20	4	4	2	N/R	20
4	N	38	9	0	4	N/R	0.3
5	N/R	38	19	14	9	N/R	N/R
6	N	N/R	3	3	12	N/R	N/R
7	Y	12	N/R	N/R	N/R	1.9 MM	N/R
8	Y	43	7	4	44	N/R	N/R
9	N/R	N/R	N/R	N/R	N/R	N/R	N/R
10	Y	145	46	25	44	1.94 MM	N/R
11	N	6	4	2	0	N/R	N/R
12	Y	165	154	60	150	37.7 MM	N/R
13	Y	35	10	5	10	N/R	N/R
14	Y	65	12	8	23	1.869 MM	N/R
15	Y	61	24	21	32	5.4 MM	N/R
16	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Total	8Y,5N	μ=56.2	μ=23.5	μ=11.5	μ=28.6	μ=9.8	μ= 9.6

N/R Denotes no response given

(1) Contract R&D investment attracted ($MM)

about 7-8 staff (Table 6A). Considerable variability existed amongst respondents with private entities tending to review more innovation, and generate more patents, licenses and royalty income. Of interest was the fact that of five organizations reporting royalty income, about $10.0 million on average was obtained. This figure was distorted by one respondent who reported royalties of over $37 million.

Although most centres recognized sourcing contract research as a considerable function, only three reported on success in this regard. Again, high variability occurred with an average of $9.6 million being reported with a range from $300,000 to $20 million.

Impediments to Future Objectives:

Fourteen of sixteen centres (88%) responded with similar sentiments regarding the need for more resources, both human and financial. Support for early development work, including prototype assemblance was identified as a factor critical for success. Among the private establishments, further venture capital, more receptive industrial partners, and more marketable inventions were noted.

D) Survey of Provincial/State Support Programs for Health Research

In response to research question 3, data from 8 provinces, 1 territory and 5 U.S. states have been summarized in Table 7 demonstrating the value some governments place on health research as translated through the support provided.

Table 7

Publicly Supported Health Research Programs

Location / Program	BC	AB	SK	MB	ON	PQ	NB	NS	PE	NF	YK	NW	KT	UT	WY	TX	OK
									*	?		?		*	*		
UI Programs	x	x		x	x	x											
Career Awards	x	x		x	x	x											
Educ. Grants	x	x	x	x	x	x											
Infra. Sup.-inc.				x													
Infra. Sup.-n/i		x			x	x											
Tax Credit-prov.				x	x	x	x	x									
Tax Holidays						x											
Secondments	x	x		x	x	x											
Op. Grants-p.r.	x	x	x	x	x	x	x	x			x		x			x	x
Mrkt. Asst.	x	x		x	x	x											

? No data made available.

* No programs to support health research are offered at this level.

Several jurisdictions including British Columbia, Alberta, Manitoba, Ontario and Quebec have initiated a series of health research programs designed to foster the growth of this enterprise. Obvious variances in the amounts each government has appropriated for these programs is found with Alberta and Quebec far exceeding other jurisdictions on a per capita basis. In short, historical forms of support including peer-reviewed operational grants, career awards, and educational grants are the most common programs offered. More innovative use of funds as demonstrated through university/industry matching programs, secondments between academia and industry, marketing assistance for innovations and industrial support, and incentive-based infrastructure support have more recently emerged and offer opportunities to lever private investment. In addition, the provision of provincial tax credits for industry conducting R&D within a province has been found in five provinces, apparently to entice both research and research-intensive industries. With respect to the United States, few state-supported programs exist. In the data collected, the wealthier states, namely Kentucky, Texas and Oklahoma have recently implemented peer-reviewed operational grant support programs for academic projects pertaining to health and other high technology sectors. Utah and Wyoming do not offer such state assistance for health research (Faubion, 1995, personal communication). Generally speaking, federal sources, including the National Institutes of Health and the Centers for Disease Control are responsible for the majority of public support to health research in the United States.

2) Pharmaceutical Industry Criteria for Extramural Investment:

Extramural Investment Trends:

Levels of R&D expenditure in public health research facilities in Canada today relative to that of five years ago are higher (μa=7.0, μb=6.7, μc=8.3; μoverall=7.3) based on sample responses from each of the three cohorts. This trend has also been foreseen to continue over the next five years. (μa=8.3, μb=6.3, μc=8.67; μo=7.76). In light of these data, feedback to research question 4 that identifies the criteria used by the pharmaceutical industry for such investment, is important.

Criteria for Extramural Research Investment:

Prior to making decisions regarding potential public sector partners for health research investment in Canada, the pharmaceutical industry considers several criteria. Below, Table 8 represents a summary of the mean cohort ranking for each suggested criterion, whereby an interval scale of 1, representing a criterion of no importance to 10 where the criterion is of critical importance was employed. The ranking of each of these decision making criteria is found in the list below:

1) Scientific Excellence	(9.43)
2) Scientist's precedent record with firm	(8.20)
3) Value for Money	(7.76)
4) Unique Scientific Capabilities	(7.63)
5) Reputation of University/Hospital	(7.10)
6) Conducive Provincial Environment	(6.67)
7) Prospect for new cmpd. development	(6.63)
8) Regional Investment considerations	(5.43)
9) Contributions from other sources	(5.20)
10) Company Profile / P.R.	(4.53)
11) Proximity to Canadian Head Office	(2.30)

Table 8
Relative Importance of Various Criteria for Extramural R&D Investment

CRITERION	STRATA	MEAN WT. VALUE
Scientific Excellence	A	10.0
	B	9.0
	C	9.3
		μ=9.43
Conducive Provincial Environment	A	7.7
	B	6.0
	C	6.3
		μ=6.67
Regional Investment Considerations	A	3.7
	B	7.0
	C	5.6
		μ=5.43
Unique Scientific Capabilities	A	9.0
	B	7.3
	C	6.6
		μ=7.63
Company Profile / P.R.	A	4.3
	B	5.3
	C	4.0
		μ=4.53
Value for Money	A	9.0
	B	7.3
	C	7.0
Contributions from Other Sources	A	5.0

	B	5.3
	C	5.3
		μ=5.20
Scientist's Precedent Record w/ firm	A	8.3
	B	7.3
	C	9.0
		μ=8.20
Proximity to Canadian Head Office	A	1.0
	B	4.0
	C	2.0
		μ=2.33
Prospect for New Cmpd. Development	A	8.3
	B	7.6
	C	4.0
		μ=6.63
Reputation of University/Hospital	A	7.0
	B	6.3
	C	8.0
		μ=7.10

Other criteria raised by industry which might be considered by a firm included the parent firm's perception of the researcher, and the research network's ability to recruit patients for clinical trials in a timely way. Seven of nine firms sampled indicated that they were not predisposed to assign spending for one type of research (ie: basic, pre-clinical, clinical and post-marketing) to one area of the country, and other types to other areas. In this same vein, the same seven respondents indicated that they also did not associate any region of the country with any one discipline (ie: infectious diseases, cardiovascular sciences) to the exclusion of other similar groups working elsewhere.

Degree of Spending Autonomy:

A further consideration which must be given to understanding pharmaceutical industry investment in Canada is the level of autonomy the firm has in allocating funds for basic, preclinical, clinical and post-marketing research. Respondents reflected the heterogeneity that exists in this regard with two firms indicating full authorization required by corporate superiors prior to R&D spending in any area, one firm suggesting that it was authorized to spend to a specified limit in all four areas, and the balance of six sampled firms displaying a variegated pattern of spending authorization dependent upon the area of research. In this latter group, each firm had a large degree of autonomy over post-marketing studies.

Research Inducements:

Further to research question 3, Table 9 shows industry's perceptions regarding the potential appeal of various public sector health research programs. Two additional comments made with respect to research inducements included (1) that industry would fund good research irrespective of any inducement, and (2) that a well-developed infrastructure for performing research in a way that is responsive to industry's needs would be as valuable as any of those listed.

Research Assessment:

With respect to the criteria industry uses to assess funded research projects, the strata means, and cumulative survey means are summarized below in Table 10. Two firms acknowledged that the particular centre's track record for productivity is of critical importance. Timliness of research, and cost effectiveness were also recognized as parameters for measurement.

Manitoba Outcomes:

On the basis of applying those assessment criteria described above, respondents evaluated Manitoba research investments for 1994. Relative to expectations, overall satisfaction was rated quite good ($\mu o=7.3$; $\mu a=8.7$, $\mu b=7.0$, $\mu c=6.3$) on a scale of 1 to 10, where 1 corresponds with dissatisfaction, 5 with satisfaction, and 10 with an exceptional rating. Obviously, the type of research that each firm was having performed would influence the response to this question, but nevertheless

Table 9

Inducements to Pharmaceutical R&D Investment:

Inducement	Strata A Mean*	Strata B Mean*	Strata C Mean*	Sample Mean	Rank
1	4.0	7.0	4.0	5.0	6
2	3.7	8.5	3.3	5.2	4
3	n/a	4.0	3.7	3.8#	9
4	4.5	7.0	2.3	4.6	7
5	8.0	7.0	6.7	7.2	1
6	5.0	4.5	6.0	5.2	4
7	6.0	7.3	6.0	6.4	2
8	6.0	4.0	2.3	4.1	8
9	6.0	6.5	4.67	5.7	3

*** means were calculated from two or more respondent firms**

 # sample means is based upon the means of two responding strata

List of Possible Inducements:

1) Peer-reviewed operational grants to academic scientists
2) University/Industry Programs, peer-reviewed
3) Career Awards
4) Educational Grants and Awards (Grad Students, Post-Docs)
5) Incentive-based (predicated on industry contributions) Infrastructure Support
6) Non-incentive based infrastructure support
7) R&D Tax credits, provincial, non-transferable
8) Personal Provincial tax holidays for new immigrant scientists
9) Secondment programs from Academic sits to Industry and vice-versa

the sample mean was 6.3 (μo=6.3; μa=8.3, μb=7.0, μc=3.7). Strata C respondents tended to believe that the outcomes observed were not predicated on the capability of the researcher. This group also was the only one to express homogeneity in the type of research being conducted, in this case clinical trials. To determine if administration or communication deficiencies were responsible for depressing the overall outcomes, the same scale was applied to such a question. Respondents indicated a marginal improvement in outcomes may have been

Table 10

Overview of Research Assessment Criteria:

Criterion	Strata A Mean	Strata B Mean	Strata C Mean	Survey Mean	Rank
1	6.0	4.7	5.0	5.2	5
2	9.7	8.3	9.0	9.0	1
3	8.0	7.0	6.3	7.1	3
4	5.3	6.0	3.5	4.9	6
5	8.3	8.0	5.5	7.3	2
6	8.3	6.0	6.5	6.9	4

Criteria for Assessment:

1) Contributes to Net Income
2) Will prove useful in gaining HPB/FDA approval
3) Beneficial for marketing/formulary purposes
4) Improves company image (public relations value)
5) Reasonable potential to add to firm's pipeline
6) Research infrastructure not currently available elsewhere

possible through improved administration or communication on the part of the researcher (μo=4.8; μa=6.0, μb=3.0, μc=5.3). Due to the presence of a large volume of clinical research, relative to other types being supported by the private sector, the question was posed as to whether a more comprehensive network of clinical scientists able to review more patients for study protocols would have improved the outcomes achieved. In using the same scale as that defined above, the respondents suggested that a marginal improvement in outcomes would probably be achieved through the presence of such a network (μo=6.3; μa=5.7, μb=4.5, μc=8.7). Finally, relative to other jurisdictions in Canada performing research in the same areas for the respondent's firm, Manitoba's outcomes were rated on a scale of 1 (poor) to 5 (satisfactory) to 10 (exceptional). Overall, Manitoba's relative outcomes reflected a good rating (μo=7.1; μa=8.0, μb=6.3, μc=7.0).

Private Sector Perspectives on Technology Commercialization:

Point of Contact:

To supplement the data gathered to address research question 2, the nine sampled pharmaceutical respondents were questioned on their preferences in dealing with either academics directly or with technology commercialization offices. Two respondents indicated little knowledge of the latter (Respondents C-1, and C-3). Another two respondents suggested that both should be dealt with simultaneously (Respondents A-2 and C-2), while the remaining seven of nine

preferred dealing directly with the investigator citing that the scientists are the experts in the subject area, and that dealing with technology transfer offices can be time consuming. Inter-strata differences in responses failed to be detected.

Critical Success Factors:

When asked to identify the characteristics that define the best technology transfer units in Canada, all respondents identified the need for such officials to be knowledgeable of licensing, of the subject matter, and of business practices generally. Five respondents indicated that such centres should be customer-oriented enterprises that are "run as a business as opposed to another university department". Private sector experience was a common success factor amongst six respondents. In addition, the use of clear standardized guidelines for dealing with industry, coupled with an inherent flexibility in negotiating terms and conditions were further critical points. Inter-strata differences in responses were not detected.

Obstacles to Success:

Four respondents suggested insufficient resources, both human and financial, account for many of the shortcomings in technology commercialization units in Canada. A failure to be business focussed, coupled with a bureacratic approach was a common obstacle identified by five respondents. A lack of understanding of the client, poor response times, rigidity and arrogance were further problems noted. Inter-strata differences again were not noted.

Prescription for Change:

Given that evidence of success in such units is abundant, two respondents felt that one only needs to copy those organizations that have been successful. Three firms felt that adequate resources need to be made available to these centres, and that "universities have to take this function seriously". A blend of technical competence and business knowledge, preferably that obtained from having worked in the pharmaceutical industry is what is needed for ensuring success in such organizations according to three respondents. Inter-strata differences in responses were not identified.

3) Economic Analysis of Health Research Operations

Having collected the relevant information from a comprehensive health research facility in Manitoba, the Manitoba Bureau of Statistics subjected these data to its economic impact assessment, and tax revenue assessment models. In response to research question 5, general estimates of tax generation, impact on GDP, and employment are summarized in Table 11. It is important to note that the economic impacts presented are in 1992 dollars, unless otherwise noted, and are reflective of the estimated impact on the Manitoba economy only.

Table 11 **Economic Impact of Health Research Operations in Manitoba (per dollar of direct expenditure)**

Impact per Dollar of Direct Expenditure	Average Yearly Impacts 1986/87 - 1991/92 (1)	Impacts 1992/93
Direct MB Expenditures	1.000	1.000
Gross Production (2)	2.630	2.670
GDP at Factor Cost (3)	1.267	1.290
Employment per $1.0MM		
Direct Jobs	19.9	21.4
Non-Direct Jobs	13.2	11.6
Total Jobs (4)	33.1	33.0
Provincial Taxes (5)	0.164	0.165
Federal Taxes	0.192	0.193
Municipal Taxes	0.044	0.044
Total Taxes	0.399	0.402

Legend:

1) Average Yearly Impacts are based on dollar values for each respective year. Otherwise, all impacts are based on 1992 dollars.

2) Gross Production refers to the gross benefit expected to the Manitoba economy as a result of direct operational spending levering additional investment dollars from outside of Manitoba for support of this activity within the province.

3) GDP at Factor Cost refers to the net benefit to the Manitoba economy. It is the total value of goods and services produced by Manitoba industries net of indirect taxes and subsidies.

4) Total jobs are measured in terms of "person-years", or one person being fully employed for a period of one year.

5) Provincial Taxes include income, other direct (retail, gasoline, tobacco, etc.) and indirect (insurance corporation tax, land transfer tax, corporation capital tax, etc.)

These data have also been depicted relative to a Manitoba pharmaceutical operation, and to operations in the communications and food manufacturing sectors. (Table 12).

Table 12 Relative Economic Impacts of Health Research to Other Sectors

Impact per dollar of direct expenditure	Health Research	Commun.	Food Mfg.	Pharmaceuticals
Direct MB Spend	1.000	1.000	1.000	1.000
Gross Production	2.670	n/a	n/a	1.290
GDP at Factor Cost	1.290	1.112	0.5843	0.477
Total Jobs	33.0	20.2	14.5	11.9
Total Taxes	0.402	n/a	n/a	0.208

DISCUSSION

1) General Industry Survey: What is Disclosed?

In light of the positive economic implications of health research activity in Manitoba, strategies to encourage further private sector expenditures in this area have been implemented over the past three years. To assess the fruits of this activity, and to provide direction for future developments in this regard, the extent of extramural investment in health research occurring in Canada, and the amount expended in Manitoba specifically, has been defined. Data collected through the general industry survey suggest that the pharmaceutical industry continues to be

a potential source of funding for health research in Canada's universities, hospitals and institutes. Unfortunately, the data do not reflect whether the level of such investment represents an increase or decrease of resources relative to previous years, nor do they suggest that this level of spending will continue. In fact, interviews with this industry over the past year would suggest an increase in frequency in contracting private clinical research organizations to perform extramural work. This is largely due to the emergence of more of these operations in Canada, and the pharmaceutical industry's interest in working with research organizations that operate in a business manner empathetic to this industry's need for expedient, quality work. The ante has, therefore, been raised. Those wishing to continue to provide research services to this industry must evolve to meet these elevated expectations or risk obsolescence.

R&D Investment:

Respecting investment in R&D in Manitoba in 1994, the fraction of known patentee R&D investment was 90% of that reported for this year in the PMPRB report (PMPRB, 1994). To illuminate this investment picture further, 1994 R&D investment was compared with that of 1993. When actual dollar increases were compared with dollar decreases, the trend was a positive one towards more investment than in 1993. Certainly this concurs with the industry-wide published data which indicates overall patentee expenditures up roughly $900,000.00 in Manitoba in 1994 (PMPRB, 1994). The fact that the 28 firms not accounted for

collectively only amount to $700,000.00 in R&D may be one reason for their failure to respond. Although the total amount of pharmaceutical industry-supported R&D reported in 1994 represented an increase over previous years, absolute investment by this industry nationally has likewise grown. Indeed, as a percent of total expenditures, Manitoba's level of investment has remained relatively stable over the past five years around 1.0 - 1.3% of the national patentee total. With 4.0% of Canada's population, about 4.5% of the Medical Research Council's national expenditures (MRC Annual Report, 1994), and roughly 4.0% of the ethical (prescription) pharmaceutical market, Manitoba appears to be characterized by an anemic amount of pharmaceutical industry R&D investment. Defining a goal for industry investment in R&D in Manitoba is necessary for one to assess performance of business development activity targetted in this area. If a per capita share were the barometer used, a target of $20.5 Million annually, or an additional $13.2 Million annually would be appropriate. Likewise, if the same level of expenditure as that of the MRC in Manitoba were to be used as a goal, then the target would be elevated to $23 Million annually. Based on the public commitment made with the passage of Bills C-22 and C-91, (Acts to Amend the Patent Act) by the membership of the Pharmaceutical Manufacturer's Association of Canada, (PMAC), Manitoba could establish a target of 10% of Manitoba sales for industry R&D investment. Adherence to this algorithm by all pharmaceutical suppliers to Manitoba would yield investment of $25 Million annually. Regardless of the formula, it appears that Manitoba's level of private sector investment in health

research falls far short of any one of several proposed targets. Indeed, recent discussions with the Board of Directors of the PMAC, and with individual firms has acknowledged this discrepancy, and has led to a PMAC orchestrated plan of action designed to identify opportunities. Analysis of mechanisms to increase this level of investment is therefore obviated.

2) Manitoba's Core Competencies: Conjoint Perspectives

One of the basic tenets of marketing is promotion. However, before this can be applied in the context of Manitoba's health research capabilities, the product being marketed must be defined. In any academic health centre, research may be conducted in dozens of disciplines. Identification of core competencies, as set out in research question 1, is therefore essential to target scarce resources. Table 6 depicts an attempt at defining these core competencies in Manitoba. Two of the greatest sources of variance found between industry and academic rankings exist for the aging research and the population health/outcomes research programs. With respect to the former, it is conceivable that due to heightened awareness of this centre over the past year made possible through the assistance of a professional consultant promoting the group, and through strong promotional efforts at the recent Manitoba Pharmaceutical Fair[3], this centre may have gained

[3]The Manitoba Pharmaceutical Fair is a provincially sponsored event designed to bring the Canadian pharmaceutical industry, government and academic health researchers in Manitoba together to discuss opportunities for research partnerships. The Third Manitoba Pharmaceutical Fair was held June 12-14, 1995.

credibility in industry beyond that bestowed upon it by the academic community. Respecting population health/outcomes research, this area although relatively mature as an academic discipline, has only gained recognition by the pharmaceutical industry in the past few years. This has been the result of increasing prominence placed upon evaluating the outcomes of various new pharmaceuticals relative to existing therapies. Industry's relative unfamiliarity with pertinent research infrastructure in this area throughout Canada might explain why relative to other Manitoba centres, this discipline ranks 12/13. Conversely, among academic researchers in Manitoba, familiar with this centre's performance record and stature internationally, a rank of 4/13 is shown. Similarly, with the diabetes and pharmacology comparative rankings, awareness, or a lack thereof, presumably has had an impact on industry's ranking. Again, events such as the Manitoba Pharmaceutical Fair, where diabetes was featured, and pharmacology not, may have had an impact on industry perceptions, which, of course, is the intent of such events.

Despite these few larger differences in rankings, these data would suggest that development of a promotional strategy centered on Manitoba's health research core competencies might include the thirteen disciplines listed. Obviously, exposure of scientific capabilities has a significant impact on industry perceptions, and, therefore, other disciplines not included in this list of thirteen should be examined objectively for potential industry appeal. Should a strategy be adopted

that proposes a phased-in marketing approach, then the top five disciplines listed (Rs = 0.90) should form the nucleus of such an approach. This would include the following:

1) Infectious Diseases/Medical Microbiology
2) Cardiovascular Sciences
3) Oncology/Cell Biology
4) Magnetic Resonance Imaging and Spectroscopy, and
5) Endocrinology

For a group of firms intent on investing more in health research in Manitoba, but perhaps not being familiar with the opportunities herein, such a list should serve to catalyze additional private sector activity in Manitoba.

3) Technology Commercialization Best Practices:

In an attempt to address research question 2 by defining best practices for technology commercialization in Manitoba, a judgemental sample was taken of organizations throughout North America. Although the sample was not random, and therefore perhaps not truly representative of the population, the intent was to define best practices from a group of units affiliated with either private or public academic centres, and to ensure representation from geographically diverse areas of Canada and the United States. An effective response rate of 63% was realized

(15/24), which again was perceived to be relatively positive. In total, 87% described their organizations as not-for-profit. Although not asked in the survey design, perhaps this status reflects the preferential tax treatment afforded not-for-profit organizations. Alternatively, the high risk, protracted recovery attributes that characterize this type of venture do not necessarily lend themselves to an expectation of annual net income, and hence a for-profit status. Ten of thirteen (77%) respondents also suggested that their organizations were enshrouded in the administrative structure of their academic affiliate, and were therefore hierarchical in nature. Upon reviewing several performance parameters including number of patents filed, number of patents issued, number of licenses obtained and amount of royalties secured, it was determined that structural dynamics may have an impact on subsequent performance. Given the raison d'etre of all units surveyed, was described as being a licensor of technologies, the ratio of valid licenses to inventions reviewed appears to be a reasonable benchmark for appraisal. In the case of grouping A of 8 public, not-for-profit entities, the ratio was 37%. With respect to grouping B, the four private, not-for-profit entities indicated the ratio of licenses to inventions was 66%. Grouping C, with two private, for-profit respondents, reported a license to invention ratio of 63%. The overall sample averages reported from all fifteen entities, included a license to invention ratio of 52%. From this analysis it appears that technology commercialization organizations' performance is not inhibited by hierarchical structure, such as that found in academic centres. However, general trends obviated from respondent's

data suggest that public, not-for-profit centres have a poorer record of achieving a net operating income, and a poorer license/invention ratio of only 37% compared with 66% for group B, 63% for group C, and 52% for the overall sample. Indeed, all respondents in groups B and C reported a net operating income. Caution is necessary in interpreting these data due to the small data sets. However, these differences in performance may be attributed to privatization, and the concomitant independence this may bring the organization. Given that both groups of respondents, the pharmaceutical industry and academic researchers, each identified flexibility as a key critical success factor, perhaps this flexibility, engendered through a more business-like focus reflected in incorporation, and subsequent operational autonomy not found in public academic departments, is the reason for the superior performance being found amongst private technology commercialization units. The fact that flexibility has been identified as a prime factor in successful pharmaceutical inter-firm strategic alliances (Forrest and Martin, 1992), and among firms in this industry considering locational decisions for international R&D activities (Pearson, et.al., 1993) supports this conclusion.

Respecting ownership of intellectual property, operational cost-sharing and support for affiliates, in general, most organizations served affiliate constituencies, with 42% sharing operational costs with these affiliates. As a general rule, flexible arrangements were embraced with respect to ownership of intellectual property. Finally, and not surprisingly, when asked to define obstacles to the future growth

of technology commercialization entreprises, 93% (14/15) indicated the need for more resources, both financial and human. Interestingly, this point was raised by both academics and the pharmaceutical industry also who felt that appropriately trained staff, perhaps those with pharmaceutical industry experience, supported with sufficient financial resources would address the deficiencies found in Manitoba and elsewhere.

4) Provincial/Territorial/State Funded Health Research Programs:

Many jurisdictions have implemented health research support programs designed to either improve upon the domestic research infrastructure, or to lever industry support for research operations. Having surveyed all provinces, both territories and five states for the presence of such initiatives, a range of activity was uncovered in this first step towards addressing research question 3. Summarized in Table 7, it is obvious that the historical types of support such as peer-reviewed operational grants and educational grants to graduate students and post-doctoral fellows are the most common forms of assistance. Also shown is an emergence of other more innovative programs designed to maximize resources and lever investment. Included in this category would be infrastructure support, tax credits for private sector research and development, and secondment programs. Within the United States, where federal support is generous, state-level programs are scarce with only the wealthier states (including Texas, Kentucky and Oklahoma)

recently implementing operational grant support for peer-reviewed projects in medical and other high technology disciplines (Faubian, 1995).

Perhaps not as evident from this broad inventory of support programs is the success of such ventures, especially for those geared towards levering industry resources. Table 9 attempts to quantify the inducement value of each of the available programs through the use of weighted averages. Through this exercise, it is evident that the newer more innovative approaches to health research support including the infrastructure support programs, tax credits, secondments and matching university/industry support programs are rated superior to historical grants and awards. These findings are in agreement with those of Schwartz and Vertinsky (1980) who reported in a survey of executive preferences that inducements including tax credits for R&D, and infrastructure support that facilitated the probability of project success rated very high. Scarce industry research dollars must be apportioned prudently. Industry may, therefore, perceive a need to have a cost-sharing mechanism in place such as that offered in a university/industry program to rationalize support for academic-based research, which may be of higher risk than in-house research with added coordination concerns. In addition, industry has recognized the value in supporting academic research irrespective of any provincial health research inducement program. However, many added that the presence of a strong research infrastructure that would enable the efficient conduct of clinical research, or that might reduce the

research costs to industry would catalyze further industry investment. Such sentiments are confirmed in the Table 9 rankings where Manitoba's incentive-based infrastructure support program garnered the top rating. Industry reaction to traditional modes of support such as grants and awards failed to elicit any positive responses. It was suggested that "such support is nice to have, but it serves only baseline expectations." In summary, the data suggest, that respecting research question 3, industry as a whole expresses only moderate interest in the value of public supported research programs as inducements for private investment. However, there does appear to be evidence that industry could be enticed to invest in R&D in jurisdictions where public sector support for research infrastructure is apparent.

5) Industry Criteria for Investment:

Extramural Investment Trends:

Due in part to the responsiveness of provincial jurisdictions to establish such critical infrastructure, along with risk-sharing support programs for health research, pharmaceutical industry investment in extramural research as a proportion of total research spending has increased over that of five years ago, and is foreseen by all cohorts sampled to continue to increase over the next five years. Little variance was observed amongst cohort averages. Indeed, in their recent study designed to determine if outsourcing of innovation in the pharmaceutical industry is a mere fad, or is an entrenched strategy, Whittaker and Bower (1994) reported that drug

firms are in fact becoming more dependent on external invention. It is also worthy of note that some respondents in this study noted that although the total extramural spending is expected to continue to increase, the level of these funds being apportioned to the private sector clinical and basic research organizations is likewise expected to increase. This may, in fact, reduce the amount of funding for such research being conducted at public centres in Canada. At minimum, these public health research centres will soon be exposed to a new intermediary in the business of contract research. Relationships with such organizations should, therefore, begin to be cultivated to ensure ongoing clinical research involvement, and as noted earlier, public research establishments must continue to evolve to ensure they maintain their competitiveness in the marketplace.

Criteria for Extramural Research Investment:

In response to research question 4, empirical evidence collected from discussions with this industry over the years, along with PMAC publications (PMAC Annual Review, 1994) has identified scientific excellence as the top criterion considered prior to making an investment in health research in Canada. Indeed, this criterion, previously acknowledged in public statements by this industry served as a positive control for criterion ranking. The selection of this criterion as number one by all firms was, therefore, expected. Similarly, the scientist's precedent record of performing research for a firm was also rated very highly. Again, this perhaps reflects industry's desire to reduce risk through repeated use of known performers.

Value for money ranked as the third most important criterion for research investment. This reflects industry's recognition of the availability of superior science within public facilities that can be contracted in a cost-effective way due to the existence of competitive infrastructure that ensures the efficient delivery of data at reasonable cost to sponsoring firms. Continuing on these themes of minimizing risk to the firm, and maximizing value, the fourth and fifth considerations for investment included the contribution by the site of unique scientific capabilities, not available elsewhere, and the reputation of the partnering organization. Again, inter-strata variation in mean responses was minimal. Developing a conducive provincial environment was assigned approximately the same value as that of funding research that might potentially yield a new compound. This suggests that these disparate points are of intermediate importance, with the quality, recognition and cost effectiveness taking priority in decision making. Once more this is consistent with industry remarks which suggest that assuming superior science is available in two centres of national repute, and both centres boast records of cost effective performance, then the differentiating factor would be one pertaining to the provincial investment climate (PMAC, CDMA member firms). Specifically, that jurisdiction which reflects in its drug reimbursement policies a willingness to work with the industry in partnership is preferable to one that does not. Of lesser importance still are regional investment considerations, contributions from other sources and investments that raise the firm's profile in an area; each of which receive moderate consideration

in investment decisions. In light of the fact that these criteria are more incidental to the principal motivation behind the research, it is understandable that respondents would characterize these criteria as "nice to have qualities" rather than essential attributes. Further evidence suggests that many firms in this industry do not bias themselves towards placing various types of research (ie.basic, preclinical, clinical, etc.) in one region versus another, or towards placing all of the research support for one discipline in one area to the exclusion of all others. Although an incomplete representation of total industry investment, patentee R&D investment and anecdotes from CDMA and other firms suggest that indeed dissemination of research investment by both type and discipline occurs throughout Canada. Finally, proximity to the firm's Canadian head office ranked last amongst all respondents. Given public industry statements denouncing this criterion as one of significance in this era, proximity to head offices was used as a negative control for the exercise, and yielded the expected results.

Of interest, is the comparison of these ranked criteria for extramural investment, and those obstacles perceived by Manitoban academics as inhibitors to additional industry investment. For example, health researchers identified Manitoba's distance from the pharmaceutical industry, and lack of contact with industry researchers as a critical obstacle to success. Given that physical geography is an immutable fact of life, it was of interest to confirm that proximity to head office is probably an inconsequential factor in such investment decisions for most firms.

Two firms in Stratum B had placed moderate importance on this factor. This suggests that there still exists a cohort of firms that continues to adhere to the tired, old paradigm of investing in one's own backyard because it is easiest, rather than as a consequence of conducive policies or a regionalization strategy that recognizes the strategic value in investing in several regions to assist in the development of new human and physical resources throughout the country for long term partnership opportunities. Finally, the perceived deficiency in marketing Manitoba's research potential in a focussed and planned way is encumbering future development of industrial research support. Given that industry has regarded scientific merit and unique capabilities as critical, it is obviously critical to convey regional capabilities to this industry, especially those in which a region is at a unique advantage. Industry would, therefore, concur with academia on this point. Indeed, the impact of promotional activities on industry's perception of top research areas appears to be evident in the core competency rankings.

In summary, scientific excellence, reputation, unique scientific capabilities, precedent performance and a research infrastructure that assures value for the money are critical criteria under consideration by much of the pharmaceutical industry today. In tandem with these, consideration of provincial drug reimbursement policies is often given to decisions, as is distribution of R&D throughout the regions of Canada. It appears that private sector management is becoming increasingly aware of the value of regionalizing research investment in

jurisdictions with favourable market accessibility. To capitalize on the goal of increased regional pharmaceutical R&D investment, therefore, such factors as those above must be addressed in both provincial policy formation, and in marketing strategies focussed on highlighting provincial core competencies to this industry.

Research Inducements:

Given that the pharmaceutical industry respondents attached relatively modest weight to the value of health research inducements in the decision making process, and indeed were quoted as saying they "would fund good research irrespective of any inducement", it is not suprising that those programs which were weighted highest, also responded to the industry's higher order needs for delivery of efficient infrastructure that would provide value for the money. Responding to research question 3, it has been determined that the incentive-based infrastructure funding formula (Appendix 7) which provides research facilities with support for operational expenses predicated on the level of industry and external granting agency investment attracted, was rated as the preferred model for public investment in health research. Again, because this program proposes to provide the funds necessary to improve research efficiency and perhaps to reduce costs to industry, both of which are prime private sector motivators, it is not surprising that this program was rated highest. Likewise, tax credit programs that ultimately reduce the firm's exposure, secondment programs that engender information

exchange, and university/industry programs that also minimize corporate risk in funding academic research projects are the preferred ranking of inducements available. The difference observed in the means between strata, specifically in the weightings for peer-reviewed operational grants, university/industry peer-reviewed programs, educational grants and awards, and personal tax holidays are not readily interpretable. It appears that Stratum B firms have rated each of the three peer-reviewed programs higher than the other Strata. Perhaps this reflects a preference by moderate sized companies with moderate investment or those of larger size and smaller investment to pursue science subjected to the peer-review process. The fact that all firms interviewed expressed a desire for scientific excellence, which is often validated through the scientist's ability to attract peer-reviewed funding, would refute the conclusion that Strata B firms are more predisposed that others to the peer-review process. Alternatively, it could simply be a sampling error in this instance whereby the data are reflective simply of the three respondents, and not of the population they represent.

Research Assessment:

With an appreciation of the criteria used for research investment, and the underlying desire to minimize risk, it is reasonable to expect that assessment of research performance would be premised on practicalities. Indeed this is the case, with such criteria as the usefulness of the research in gaining regulatory approval, the potential to add to the firm's product pipeline, and the potential for assisting in

obtaining formulary listings as the top three assessment considerations. Obviously, industry investment in R&D will reflect these practicalities through identification of those investigators throughout the country capable of assisting the firm in realizing these goals. As expected, no material differences between strata responses were noted.

Manitoba Outcomes:

Given that firms currently involved in sponsoring research in Manitoba have presumably identified research groups that they deem to be of an internationally competitive stature, it is understandable that, relative to expectations, the samples showed positive results. When determining the impact of researcher capability on outcome, Stratum C suggested that the researcher was very marginally involved in impacting the outcome of the research. This observation may have simply been a product of the type of research conducted. In fact, Stratum C respondents only conducted clinical trials in Manitoba as opposed to other types of research contracted by firms in the other strata. Perhaps the respondents were inclined to believe that the data collected would be a product of the drug/patient interaction, rather than something that could be alterred by the researcher. Also of interest was the fact that despite positive experiences in conducting research in Manitoba in 1994, respondents felt that marginal improvement in administration or communication on the part of the researcher could still be achieved. Perhaps future strategies could address this issue through the provision of specialized

training for researchers in study administration and communications. In a similar vein, respondents also noted that a marginal improvement in outcomes may have been achieved through the presence of a clinical trials network that involved the capture of additional patients into clinical trial protocol reviews. Finally, relative to other jurisdictions performing research in the areas in which Manitoba was contracted in 1994, Manitoban researchers generated a good rating overall, indicative of marketable skills that could be improved for the betterment of the research project, and the attraction of further research support.

Private Sector Perspectives on Technology Commercialization:

Further to research question 2, for the most part, if industry could exercise its preference, it would deal directly with researchers rather than with technology commercialization offices. Given that research managers were being interviewed this was not surprising, as familiarity with subject matter would predispose an industry research officer to working with an academic scientist directly thereby saving time, and avoiding potential misrepresentations of the research. Not surprisingly, therefore, was the fact that all respondents indicated that if technology commercialization units are to be successful then staff need to be knowledgeable in licensing, the subject matter, and in business practices, generally. Private sector experience, and the use of clear standardized guidelines were also noted as desirable. This would probably be due to the fact that industry finds it easier to relate to like-minded officers, than those overwhelmed by the bureacracies of

academia. Flexibility within such organizations was a key condition amongst all strata surveyed. Presumably, this is prescribed given the acknowledged differences in organizations, and the heterogeneity in innovations and projects that can emerge. Indeed, without such flexibility respondents felt that a clash of organizational philosophies might occur engendering mistrust. For this reason, adequate resources, both human and material, must be provided. Particular attention to the types of candidates selected to steer such organizations was seen as an important determinant of success with several respondents suggesting pharmaceutical industry experience as a prerequisite. A clear indication that universities and hospitals need to take this function seriously was conveyed, suggesting that industry's approach to such units might be more frequent and productive for all concerned if appropriate resourcing was considered. If given similar opportunities then, industry will gravitate towards those jurisdictions with organizations that are both flexible, knowledgeable, and efficient. A few respondents agreed that defining a model for such an organization would be possible through copying those that have experienced success. A recent attempt to define "best practices" among an international collection of research and technology institutes yielded critical success factors for industrial development. These factors concur with those above, and include decisive leadership, technical and project management competence, good communications and a flexible structure (Rush et.al., 1995)

6) The Economics of Health Research in Manitoba:

With respect to research question 5, investment by Manitoba sources of $1.00 towards health research results in the leveraging of an additional $1.67 from sources external to the province such as the pharmaceutical industry and national granting agencies. Owing to a substantial proportion of this gross production ($2.67) being expended upon products or services that originate outside of Manitoba, and for the most part, outside of Canada, economic leakage results. Consequently, the GDP at Factor Cost, or the total value of goods and services on the Manitoba economy realized from $1.00 of health research operations is $1.29.

Generalizability of Outputs to Other Jurisdictions:

This economic multiplier effect is predicated on goods and services produced in the provincial economy and procured by the local health research community. Since health research operations throughout Canada are rather homogeneous with respect to procured goods and services, it is reasonable to presume that this multiplier would be fairly accurate for most jurisdictions in Canada. Exceptions to this, may be Ontario and Quebec where more production of health research goods and services may be occurring in these local economies, thereby increasing the multiplier effect. Since Manitoba's health industry ranks third in the country in size (number of firms, dollar volume of sales), unless other provinces possessed firms providing a specific commodity or service relevant to health research, and procured

by the local research enterprise in significant quantity, the economic impact would be essentially the same as that experienced in Manitoba. Table 11 also illustrates the fact that for every million dollars of health research being performed in Manitoba, 33 jobs are generated either directly or indirectly. Direct employment would be those involved in the day to day operation of health research, whereas their respective salaries spent in the economy yield employment for a cross-section of individuals, the indirect beneficiaries. Tax generation for this activity amounts to 40.2% of every dollar expended. Employment and tax revenues found here would likewise be legitimate benchmarks for other jurisdictions.

These data cannot be fully appreciated in isolation. Consequently, a comparison of the economics of health research to three other sectors including a pharmaceutical manufacturing firm, the communications industry and the food manufacturing sector was prepared (Table 12)(MBS, 1994). In this portrayal of four operations' economic impacts, it is apparent that health research contributes more to the economy than the other sectors illustrated. Relative to one specific pharmaceutical manufacturer for example, it is obvious that the leverage effect witnessed for health research is much inferior for this pharmaceutical operation, and that pharmaceuticals demonstrated greater leakage of economic benefit with 37% of gross production retained in the local economy versus 48% for health research. This may be attributed to the fact that a large proportion of every health research dollar spent is allocated to relatively high salaries. Since the majority of

these salaries are reinvested in the local economy, leakage is avoided. With pharmaceutical manufacture, the proportion of each operational dollar expended on salaries is lower, leaving a greater percent of each dollar spent on goods and services that may be originating elsewhere, hence resulting in leakage and a lower economic impact. Due to the lesser impact in the local economy, fewer jobs are generated per dollar expended by pharmaceutical manufacture versus health research. It becomes apparent in reviewing these comparative data, that health research has a relatively strong economic impact on the Manitoba economy, which presumably translates to as great if not greater an impact elsewhere in Canada. In times of fiscal prudency, such economic analyses are essential. These data would suggest that investment in health research would yield greater economic returns than equivalent investments in a pharmaceutical manufacturing operation, communications firms or those in the food manufacturing business in Manitoba. Public policy directed at preserving, and indeed enlarging this enterprise should therefore be considered by all jurisdictions in Canada. Conversely, the private sector would be interested in such data primarily for two reasons: 1) It could serve as a subject of discussion with the federal government specifically with respect to the tangible impacts demonstrated by R&D investment enabled through extended patent protection, an argument that becomes increasingly poignant as the federal review of the Patent Amendment Act draws near (1997); and 2) The data could help to demonstrate to both federal and provincial governments the value of

regional industry R&D commitments, thereby encouraging both market accessbility, and support for continuation of current levels of patent protection.

CONCLUSIONS

This study attempted to answer five questions pertaining to the ongoing conduct of health research in Manitoba. Specifically, the following were addressed:

1) What are Manitoba's core competencies in research areas relevant to the pharmaceutical industry?
2) How is a benchmark technology commercialization unit structured?
3) What public supported health research programs (if any) serve to induce private sector investment?
4) What are the criteria used by the pharmaceutical industry for investment in extramural health research?
5) What is the economic value of health research in Manitoba?

In response to these inquiries, surveys of the pharmaceutical industry, technology commercialization centres, the public sector, and Manitoba health researchers were performed to, in brief, yield direction for the development and implementation of a marketing approach to government and the pharmaceutical industry for

increased investment in this area. Interviews with a stratified random sample from this industry were likewise performed to define obstacles, enablers, and critical success factors for such a strategy. Finally, an economic model for health research has been generated to provide a comparative benchmark to the value of health research in Manitoba. Given the contributions of this sector to the economy, it has been presumed that its further development is warranted.

Conclusive Findings:

This study suggests the following:

1) Relative to other sectors (pharmaceuticals, communications, food manufacturing) health research has a stronger positive impact on the economy of Manitoba. This presumably translates to similar, if not greater, impacts in each of the other provincial economies in Canada.

2) The favourable economic profile for health research should substantiate increased public sector investment in this area, as has been witnessed recently in Manitoba.

3) Industry derived data support the contention that Manitoba currently receives less than an equitable share of R&D investment from the PMAC-member pharmaceutical firms.

4) Manitoba should target between $20.5 and $25.0 Million in private sector extramural R&D annual investment.

5) Manitoba's core competencies as defined by both industry (preceding #), and academia (proceeding #) include the following:

1) I.D./Med. Micro. (1)	2) Cardiovascular Sciences (2)
3) Oncology/Cell Biology (3)	4) MRI/Spectroscopy (5)
5) Endocrinology (6)	6) Aging Research (11)
7) Respirology (7)	8) Allergy/Asthma (10)
9) Diabetes (13)	10) Immunology (12)
11) Neurophysiology (8)	12) Pop. Health/Outcomes (4)
13) Pharmacology (9)	

6) Strategies designed to promote Manitoba's health research capabilities should include at minimum the first five areas (Spearman Correlation = 0.90). Disciplines not included in this list of 13 should be objectively evaluated prior to consideration of inclusion in the core competency listing.

7) Decision making criteria for pharmaceutical investment in extramural R&D are focussed on the scientific excellence of the researcher, the researcher's precedent experiences with the firm, unique scientific capabilities,

reputations of the researcher and institution, the value for money of the research and the provincial environment for investment.

8) Levels of autonomy for R&D spending exhibit great heterogeneity amongst firms in this industry, dependent upon the degree of dependence exhibited by the company on its parent firm.

9) Most firms possess a high degree of autonomy over post-marketing studies.

10) Incentive-based infrastructure support, R&D tax credits, and secondment programs top the list with respect to serving as inducements for pharmaceutical industry investment. Provincial support programs for health research should reflect this fact.

11) The pharmaceutical industry assesses extramural research based on its usefulness in gaining HPB/FDA approval, its potential to add to the firm's pipeline, and by its benefit to gaining marketing/formulary access.

12) The outcomes of private sector supported research in Manitoba in 1994 suggest marginal improvements could be achieved through development of the infrastructure required to conduct such research in a timely way.

Manitoba's new infrastructure support program should begin to address this issue.

13) In the conduct of contract pharmaceutical research, Manitoba's health researchers performed relatively well compared with other similar centres.

14) Technology commercialization should be well-resourced, with government playing a lead role.

15) Management of technology commercialization units would benefit from private sector (pharmaceutical industry) experience.

16) Best practices suggest that privately incorporated technology commercialization units may instill a more flexible and business-minded approach to commercialization thereby accounting for their relatively superior performance.

17) Manitoba researchers have identified a need for a variety of promotional approaches to the pharmaceutical industry including trade fairs, visits to industry offices and promotional materials.

18) Manitoba researchers recognize the need for learning more about the private sector, and developing a more business focus to their research.

19) Public policy directed at the development of the health research enterprise should strive to promote an interdepartmental strategy involving departments of Health, Economic Development and Advanced Education.

20) Governments should focus efforts on enhancing health research, especially through programs that lever industry investment.

21) Funding for health research infrastructure is critical to maintaining excellence and to forging new industry partnerships.

22) Development of a provincial marketing strategy for health research should be founded on an inter-Ministerial policy that responds to each department's concerns along with industry's defined criteria for investment.

23) Little inter-strata variance in responses was found suggesting that, for the most part, criteria for investment, evaluation of investment, and inducements for investment are similar throughout this industry regardless of firm size or precedent R&D investment record.

24) Those firms currently investing will probably continue providing a stable environment that meets the defined criteria is maintained. Firms investing little or not at all, at present, could conceivably invest significantly more.

25) Future investment strategies for Manitoba should not be based solely on firm size (national sales), current investment practices, or absence of intensive Canadian intramural research activities.

26) Private sector allocation of R&D resources, following the criteria identified, will tend to be regionalized whereever possible to maximize the value of such investments with respect to research quality, provincial market access leverage, and positioning with the federal government during patent legislation reviews.

IMPLICATIONS

Implications of the Data for Industry:

As noted earlier, the ability to articulate to government the actual economic impact of health research activity supported throughout the country is critical. At a time when provincial market access for existing and new therapeutics is being challenged, industry continues to seek better evidence to support its arguments. By demonstrating how the sale of products enable the firm to continue new product

R&D within a province, with the concomitant economic byproducts realized from conducting this research, a more compelling case will be possible. Similarly, with the federal review of the Patent Amendment Act in 1997, the PMAC members will be able to point to the economic benefits of its activities on a national and provincial level as they seek continuation of the existing levels of patent protection. A fact, largely dismissed until recently, has been that the PMAC member firms have a relatively weak case to make in Manitoba. Industry investment in R&D has been traditionally very low despite Manitoba's success at responding to this industry's criteria for investment. With the development of a list of core research strengths, an opportunity exists to increase awareness amongst decision makers in this industry to address these deficiencies. Finally, having completed the benchmarking exercise to define 'best practices' for technology commercialization, industry could come to appreciate the benefits of a flexible and responsive organization in Manitoba committed to working with this industry.

Implications of the Data for Academia:

Given the relatively strong economic value to health research operations in Manitoba and elsewhere in Canada, public support for this activity presumably will be maintained, and may possibly be increased should these data be effectively communicated to policy makers. Indeed, this has been the case in Manitoba where development of a new infrastructure program will provide significant new resources for this activity. Also, should industry respond to the challenge facing

them, then Manitoba's health researchers will be the beneficiaries. Presumably, though there will also be those researchers involved in disciplines that are not identified in Manitoba's list of core competencies. For those individuals willing to adapt, contingency plans must be considered whereby they can assume new research programs directed at the development of new research opportunities, or provide supportive infrastructure for the core groups. For those unwilling or unable to adapt, traditional sources of support will be available. Similar to industry's support for a responsive technology commercialization office, Manitoba's health researchers could be long term beneficiaries of an organization dedicated to commercializing their innovation, and seeking industrial research support for their projects.

Implications of the Data for Governments:

Relative to other sectors, health research has demonstrated favourable economic indices. These are coupled with additional opportunities for new industrial development availed through commercialization of health innovations. Together these factors have sparked renewed public sector interest in the growth of the health research enterprise. In light of shrinking public sector resources being apportioned to this activity, however, an inquisition of public policy is warranted. Governments should first reassess current budgetary silos, and consider interdepartmental approaches to health research involving Ministries of Health, Economic Development and Advanced Education to ensure acting at cross

purposes between departments is minimized, and efficiencies are maximized. Manitoba's operational plan for health research concurs with this approach (August, 1995), and limited progress has been made in this direction. Secondly, the economic value of health research must be communicated to government so as to rationalize support programs for this activity versus other projects. Again, Manitoba has encountered some success in this area. By assessing the short, medium and long term outcomes of health research on the delivery of health care resources, governments should recognize the positive net returns realized in health care savings resulting from such investment. These savings could then be used two-fold: 1) since all jurisdictions continue to fight the battle of deficit elimination and debt reduction, 50% of cost savings should be used towards this end; and 2) the remaining 50% should be reinvested in health research directed at projects with short, medium and long term measureable outcomes.

Public expenditure in health research alone is insufficient for long-term success, however. A provincial strategy for sourcing external private sector support is essential. Ideally, such a strategy will successfully lever public resources, and will define marketable strengths, or core competencies. Encased within it will be identification of opportunities, description of promotional events, publication of marketing materials, and a definition of objectives or goals, along with an understanding as to how these goals will be measured. Obviously, success will largely be predicated on the ability of the provincial strategy to meet the investment

criteria of industry, and the ability to communicate this strategy to the private sector. Respecting pharmaceutical investment, such criteria might include a provincial environment amenable to investment as demonstrated by fair, transparent, and equitable policies regulating market access, and support for clinical trial and basic research infrastructure. Consequently, the successful marriage of the needs of Ministries of Health, Economic Development and Advanced Education, as reflected in government policy, will be critical to future success in private/public partnerships.

With the emergence of innovation from the health research activity, strategies to commercialize this innovation through the development of start-up firms should be a focus of government. Technology commercialization should be a provincially endorsed and supported activity. Policy to encourage such activity should include direction towards securing venture capital for start-up enterprises, and should offer marketing, intellectual property, and bridge-funding (ie: prototype development) assistance. If successful, opportunities for joint-ventures, subcontracting, and local industrial development may emerge.

LIMITATIONS

Limitations of Research Findings:

The resulting data from these studies have not been subjected to statistical analyses to any extent due to the presumption that small data sets coupled with

numerous inter-related questions could introduce statistical contamination into the process. Rather, it has been contended that the data may be of managerial significance by providing empirical evidence to support subsequent developmental strategies for health research by both industry, academia and government. Despite limited sample sizes for each of the surveys, the outputs appear to concur with empirical evidence collected anecdotally over the past several years. Although the study design intended to provide a mechanism to identify inter-strata differences in responses, few conclusions could be drawn in this regard since responses tended to be homogeneous. Although the economic model was specific for Manitoba outputs, it is reasonable to conclude that these data are generalizable throughout Canada, with Ontario and Quebec having perhaps a slightly larger economic multiplier relative to that in the rest of Canada. With respect to all other survey data, except that defining Manitoba's core competencies and specific research investment levels, these have applicability throughout the country.

FURTHER RESEARCH

Suggestions for Further Research:

In this study, thirteen core competencies in health research were identified, the first five of which should be included in any subsequent marketing strategy. Further study should attempt to elaborate upon this list of five considering data on human and financial resources, management skills, infrastructure and market need. In addition, further analysis of technology commercialization units might supplement

these findings with information on appropriate structure, governance, and funding models. Substantiation of the economic model in other jurisdictions should also be performed. Finally, implementation of these findings as a component of a comprehensive strategic plan for health research should be a priority for Manitoba.

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APPENDIX 1

Manitoba

Industry, Trade and Tourism

Health Industry Development Initiative

824-155 Carlton Street
Winnipeg, Manitoba
CANADA R3C 3H8
Fax: (204) 945-3977
Tel: (204) 945-7206

Facsimile

Date: May 17, 1995

To:

Name: _____

Company: _____

City: _____

Phone: _____

Fax: _____

From:

Name: David McLean

Branch: HIDI

Phone: _____

Number of Pages 2 (including this one)

Comments/Remarks:

URGENT! YOUR ATTENTION TO THIS REQUEST IS GREATLY APPRECIATED.

As you may know, I have maintained a close working relationship with the health research community in Manitoba over the past several years. In this capacity, I have sought new approaches to funding health research activities involving both the public and private sectors in partnership. In light of the current paradigm of increasing strategic alliances between industry and academic research centres, it has become increasingly important to accurately define the criteria used by industry for research investment decisions, and ways to establish further partnerships.

As a part time MBA student approaching the end of the program, I have an opportunity to study this subject through the preparation of a thesis. I would, therefore, ask for your assistance in this regard.

Please find attached a brief, general questionnaire which I would ask that you forward to your research vice-president/director. All information supplied will be maintained commercial confidential with specific company names not being disclosed. Given the rather compressed timeline for gathering data, I would be grateful for a faxed response of the attached survey as soon as possible (preferably by June 7, 1995). Responses will be assigned to one of four cohorts, with a random sample from each being surveyed further.

Your assistance in providing data for this project is greatly appreciated.

FAX BACK SURVEY

TO:VICE-PRESIDENTS/DIRECTORS OF RESEARCH

FROM:MR. DAVID MCLEAN, PROVINCE OF MANITOBA

FAX:

RE:PHARMACEUTICAL INDUSTRY SURVEY OF EXTRAMURAL RESEARCH INVESTMENT IN MANITOBA

PLEASE COMPLETE AND RETURN BY JUNE 7, 1995

1) Does your firm currently invest in extramural research in Canada? ___ Yes ___ No.

2) If no, please proceed to question 7.

3) If yes, approximately what percentage of your firm's research budget is spent extramurally?___%.

4) What proportion of your extramural budget would be invested in health research (including clinical trials) with public research centres, universities and hospitals in Canada (all but private sector research organizations).

5) How much, if any, did your firm spend in extramural health research activities in Manitoba in 1994? $_____. Describe this figure as a percent of your Manitoba sales? _____% sales.

6) Does the figure indicated in Question 5 represent a decrease/increase (select one) over 1993? Approximately how much of a decrease/increase? _____%.

7) Please check any of the following disciplines in Manitoba which you would recognize as being internationally competitive? Rank those selected in order of the discipline's strength relative to each other from 1 (strongest) to a possible 18 (weakest).

___Immunology	___ID./Med.Micro.	___Diabetes
___Cardiovascular	___Neurophysiology	___Respirology
___Allergy/Asthma	___Population Health Research	___MRI/Spectros.
___Rheumatic disease	___Aging Research	___Genetics
___Endocrinology	___Pharmacology	___Pharm.Dev.
___Oncology/Cell Bio	___Women's Health	___Transplants

8) Other comments?_____

Thank you for your contribution to this research project. Please fax responses to as soon as possible.

Regards,

APPENDIX 2

Manitoba

Industry, Trade and Tourism

Health Industry Development Initiative

824-155 Carlton Street
Winnipeg, Manitoba
CANADA R3C 3H8
Fax: (204) 945-3977
Tel: (204) 945-7206

Facsimile

Date: _____

To:

Name:

Company:

City:

Phone:

Fax:

From:

Name: David McLean

Branch: HIDI

Phone:

Number of Pages 4 (including this one)

Comments/Remarks:

URGENT! YOUR PROMPT ATTENTION TO THE ATTACHED IS GREATLY APPRECIATED

As you no doubt are aware, a new paradigm of strategic alliances and commercial partnerships has emerged in recent years between academic health research centres, and the pharmaceutical industry. Having worked in both the private and public sectors with this community for the past ten years, I have sought to define new ways of forging such alliances. I believe that critical to Manitoba's future success in such ventures will be an elucidation of our key strengths, coupled with a better understanding of the pharmaceutical industry's criteria for decision making with respect to health research investment.

As a part-time M.B.A. student approaching the end of the program, I have an opportunity to study this subject through the preparation of a thesis. I would, therefore, ask for your assistance in this regard.

Attached please find a brief survey which I would ask you to personally complete. You have been identified as an individual with a broad knowledge of Manitoba's health research community. I would, therefore, ask for your responses to reflect this breadth and depth of understanding. The responses will be used in aggregate to characterize Manitoba's core competencies in this field, and to ascertain both obstacles and enablers for increased industry expenditure in health research in Manitoba. Your responses will be handled in a confidential manner.

When complete, please fax the survey to my attention. If you wish to remain anonymous, then please

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disregard the respondent's name area on the survey. Should you wish to discuss this survey with me, then please feel free to contact me at [redacted] at your convenience. Likewise, should you wish a copy of the final study, please contact me, or indicate on your survey response.

Your anticipated assistance in this regard is greatly appreciated.

Regards,

David McLean

FAX BACK SURVEY

TO: MANITOBA'S HEALTH RESEARCH COMMUNITY

FROM: MR. DAVID McLEAN, PROVINCE OF MANITOBA
FAX:

RE: HEALTH RESEARCH SURVEY

PLEASE COMPLETE AND RETURN ON OR BEFORE JULY 7, 1995

1) In 1993, Manitoba's health researchers attracted approximately $5.7 million in research support from the pharmaceutical industry, about $5.5 million (1.25% of total research expenditures) of which originated from the brand-name, research-based industry. Based upon this level of investment, do you feel that Manitoba currently enjoys an amount a) ____more than, b)____less than, or c) ____ equal to its reasonable share of such research support. If a) or c) please proceed to question 5.

2) If less than its reasonable share, what criteria would you use to assess industry investment performance?

____research investment as a % of the industry's Manitoba sales.
____research investment at a level consistent with Manitoba's per capita share (ie: 4% of total).
____research investment at the same level as that of the Medical Research Council in Manitoba.
____research investment as a defined percentage of Manitoba's total health research support.
____other mechanisms of assessment such as _____.

3) Please indicate mechanisms that might be used to improve the current level of industry investment.

_____Health Research Fairs (eg: Manitoba Pharmaceutical Fair).
_____Publications of Research Capabilities for Marketing purposes.
_____Research missions to the offices of the pharmaceutical industry .
_____Training for scientists to improve their marketing/promotional skills.
_____Training for all health researchers on the mechanisms of securing industrial support.
_____Others, including _____.

4) Please describe any impediments that currently stifle additional health research investment in Manitoba by this industry.

_____
_____
_____

5) Please check any of the following disciplines or research groups in Manitoba that you would recognize as being internationally competitive, and involved in projects, or possessing capabilities of potential relevance to the pharmaceutical industry. Of those selected, please rank them in order of their relative strength to one another whereby the best group would receive a mark of 100 and all others would be rated relative to the best.

____Aging Research
____Allergy/Asthma
____Cardiovascular
____Cell Biology
____Diabetes
____Endocrinology
____Gastroenterology
____Hepatology
____Human Genetics
____Immunology
____Infectious Diseases/Med.Micro.
____MRI/IR Spectroscopy
____Neurophysiology
____Oncology
____Pharmaceutical Development
____Pharmacology
____Population Health/Outcomes
____Respirology
____Rheumatic Diseases
____Transplantation
____Urology
____Women's Health

Others?

____
____

6) Other comments?

_____
_____
_____

_____I would appreciate a copy of the final research project when available (provide mailing address).

_____I do not wish to receive a copy of the final research project.

RESPONDENT'S NAME:_____

Your contribution to this research project is greatly appreciated.

APPENDIX 3

Manitoba

Industry, Trade and Tourism

Health Industry Development Initiative

824-155 Carlton Street
Winnipeg, Manitoba
CANADA R3C 3H8
Fax: (204) 945-3977
Tel: (204) 945-7206

Facsimile

Date: June 15, 1995

To:

Name:

Company:

City:

Phone:

Fax:

From:

Name: David McLean

Branch: HIDI

Phone:

Number of Pages 3 **(including this one)**

Comments/Remarks:

As you no doubt are aware, a new paradigm of strategic alliances and commercial partnerships has emerged in recent years between academic health research centres, and the pharmaceutical industry. Having worked in this area in both the private and public sectors over the past eleven years, I have sought to define new ways of forging such alliances. Throughout this period, it has become evident to me that effective technology commercialization and licensing offices can often mean the difference between success and failure. Understanding the structural dynamics of successful commercialization units is therefore critical for success in this area.

As a part-time M.B.A. student approaching the end of the program, I have an opportunity to study this subject through the preparation of a thesis. I would, therefore, ask for your assistance in this regard.

Attached, please find a brief survey which I would ask you to complete. The responses will be used in aggregate to characterize the critical success factors for development of an efficient and effective health technology commercialization organization. Your responses will be handled in a confidential manner.

When complete, please fax the survey to my attention. Alternatively, if you would like to respond to this survey by phone, then please feel free to contact me between the hours of 8:30 a.m. to 5:00 p.m. (Central Standard Time), Monday through Friday at

Your anticipated assistance in this regard is greatly appreciated.

ITT012-950210

FAX BACK SURVEY

To: Directors of Technology Commercialization Organizations

From: Mr. David McLean, Province of Manitoba
Fax: **Phone:**

RE: Survey of Health Technology Commercialization Organizations

---

PLEASE COMPLETE AND RETURN BY JULY 7, 1995, OR A.S.A.P.

Please briefly outline your organization's mandate or mission.

_____

_____

Organizational Structure:

Is your organization best characterized as private sector____, or public sector____?

Is your organization a for profit enterprise____, or not for profit?____

Please indicate the total number of staff in your organization.____

Please describe the governance structure of your organization.

_____

_____

Is your organization affiliated with a hospital, clinic, or university (if no, please proceed to Policies and Procedures)? ____Yes ____No

If so, is the affiliated organization a private ____, or publicly supported____ organization.

Does this affiliated organization play a leadership role in your organization's governance (ie: does the affiliate contribute to your organization's operational policies)? ____Yes ____No

Policies and Procedures:

Does your organization serve the licensing, contracts and commercialization needs of staff that are cross-appointed between two or more affiliated organizations? ____Yes ____No

---

If so, please describe briefly your approach to intellectual property ownership and/or equity positions of affiliates._____

_____

Please briefly describe your approaches, if any, to operational cost-sharing amongst affiliates._____

_____

Performance:

Does your organization achieve a net operating income? If so, how is this income used?_____

_____

_____

Please indicate the number of inventions reviewed in 1994. _____inventions reviewed
Please indicate the number of patents filed in 1994. _____patents filed
Please indicate the number of patents awarded in 1994. _____patents awarded
Please indicate the number of licenses secured in 1994. _____licenses

Please indicate other indicators of your organization's performance in 1994._____

_____

Major Impediments to Operations:

Please identify any major impediments to successful operations in 1994. If you could alter one feature of your organization in the coming year, what would that be?_____

_____

_____

Thank you for taking the time to complete this survey. Your support is greatly appreciated.

APPENDIX 4A

Manitoba

Industry, Trade and Tourism

Health Industry Development Initiative

824-155 Carlton Street
Winnipeg, Manitoba
CANADA R3C 3H8
Fax: (204) 945-3977
Tel: (204) 945-7206

Facsimile

Date: June 15, 1995

To:

Name:

Company:

City:

Phone:

Fax:

From:

Name: David McLean

Branch: HIDI

Phone:

Number of Pages 1 **(Including this one)**

Comments/Remarks:

Having worked in varying capacities with the health research community in Manitoba over the past several years, I have developed an appreciation for the need for partnerships between industry and academia. In my current position, I have sought to define ways of forging such alliances. Understanding the criteria used by industry for making research investment decisions is therefore critical.

As a part-time M.B.A. student approaching the end of the program, I have an opportunity to study this subject through the preparation of a thesis. I would, therefore, ask for your assistance in this regard.

To enable an industry evaluation of health research partnership programs, I would be grateful to receive from you, a description of all health research funding and incentive initiatives offered in your province/territory. Information on tax credit programs, industry/academic grants, scientific operating support, and other such awards and incentives, along with a few words on the performance of such programs is sought. If printed materials are available, then these accompanied by a few words on their relative success would be gratefully received.

Please fax, mail, or email ( ) your contribution to my attention at your earliest convenience (preferably by June 30, 1995). Your assistance in providing data for this project is greatly appreciated.

APPENDIX 4B

Manitoba

Industry, Trade and Tourism

Health Industry Development Initiative

824-155 Carlton Street
Winnipeg, Manitoba
CANADA R3C 3H8
Fax: (204) 945-3977
Tel: (204) 945-7206

Facsimile

Date: June 15, 1995

To:

Name: _____

Company: _____

City: _____

Phone: _____

Fax: _____

From:

Name: David McLean

Branch: HIDI

Phone: _____

Number of Pages 1 **(Including this one)**

Comments/Remarks:

Having worked in varying capacities with the health research community in Manitoba over the past several years, I have developed an appreciation for the need for partnerships between industry and academia. In my current position, I have sought to define ways of forging such alliances. Understanding the criteria used by industry for making research investment decisions is therefore critical.

As a part-time M.B.A. student approaching the end of the program, I have an opportunity to study this subject through the preparation of a thesis. I would, therefore, ask for your assistance in this regard.

To enable an industry evaluation of health research partnership programs, I would be grateful to receive from you, a description of all health research funding and incentive initiatives offered in your state. Information on tax credit programs, industry/academic grants, scientific operating support, and other such awards and incentives, along with a few words on the performance of such programs is sought. If printed materials are available, then these accompanied by a few words on their relative success would be gratefully received.

Please fax, mail, or email ( ) your contribution to my attention at your earliest convenience (preferably by June 30, 1995). Your assistance in providing data for this project is greatly appreciated.

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APPENDIX 5

ANALYSIS OF

HEALTH RESEARCH INVESTMENT DECISIONS

IN

CANADA'S PHARMACEUTICAL INDUSTRY

Conducted by David McLean

Firm Surveyed:
Cohort:
Respondent/Title:

Date: July , 1995

INVESTMENT DECISION ANALYSIS SURVEY

COMPANY BACKGROUND

Company Name:

Country of Incorporation:

Corporate Level of R&D (as a % of corporate sales): _____%

Canadian Pharmaceutical Sales ($Cdn): $_____

$400 Million+ _____
$300 - 399 Million _____
$200 - 299 Million _____
$100 - 199 Million _____
$< 100 Million _____

Canadian Level of R&D (as a % of Canadian sales): _____%

Does your firm have a strategy in place for regionalization of R&D spend in Canada? ___Yes ___No

If yes, please briefly describe.

_____

_____

Level of R&D spend in Manitoba in 1994 (as a % of Manitoba sales): _____%

Please describe the type of research (if any) conducted in Manitoba during 1994:

Basic Medical Science _____
Preclinical Research _____
Clinical Trials (Phases 1-3) _____
Post-marketing Studies _____

Please describe in which discipline(s) this research was conducted:

1) 3)
2) 4)

In which discipline(s), do you feel Manitoba is at an internationally competitive level? Please rank.

Good					Better					Best
	1	2	3	4	5	6	7	8	9	10

1) 3) 5)
2) 4) 6)

RESEARCH ASSESSMENT:

1) As with any investment, all benefits realized by the organization as a result of health research must be carefully measured periodically. Please identify those benefits which are commonly sought by your organization in conducting such extramural research anywhere in Canada, and assign a value to its relative importance to your firm using the scale below:

-contributes to net income ____
-will prove useful in gaining HPB/FDA approval ____
-beneficial for marketing/formulary purposes ____
-improves company image (public relations value) ____
-reasonable potential to add to firm's product pipeline ____
-research infrastructure not currently available elsewhere ____
-others _____

Not important				Marginally					Critical
1	2	3	4	5	6	7	8	9	10

2) With respect to your investment in this area in Manitoba in 1994, how would you characterize the outcomes experienced to date relative to your expectations? Circle one:

Dissatisfied				Satisfactory					Exceptional
1	2	3	4	5	6	7	8	9	10

3) Would this outcome have been predicated on the capability of the researcher?

Not at all				Marginally					Definitely
1	2	3	4	5	6	7	8	9	10

4) Could this outcome have been superior through improved administration or communication on the part of the researcher?

Not at all				Marginally					Definitely
1	2	3	4	5	6	7	8	9	10

5) Would this outcome have been improved through a more comprehensive network of clinical scientists resulting in more Manitoba patients being considered for study protocols?

Not at all				Marginally					Definitely
1	2	3	4	5	6	7	8	9	10

6) **Relative to other jurisdictions in Canada performing such research for your firm, how would you characterize your experience with Manitoba over the past year.**

Poor				Satisfactory					Exceptional
1	2	3	4	5	6	7	8	9	10

INVESTMENT DECISION ANALYSIS:

1) **As a research-based firm, this organization's long term success is dependent in large measure upon strategic investments in research. As the costs of conducting such research are rising, prudent use of research funds is necessary. With this in mind, how would you characterize your firm's frequency of contracting public research institutes, universities or hospitals relative to that of five years ago?**

Much Lower				Same					Much Higher
1	2	3	4	5	6	7	8	9	10

Please explain.

_____

2) **How would you describe your firm's strategic intentions towards investing in health research within Canada's research institutes, universities, and hospitals over the next five years relative to today?**

Much Lower				Same					Much Higher
1	2	3	4	5	6	7	8	9	10

Please explain.

_____

3) **When making decisions regarding extramural health research investment in Canada's public facilities, presumably your firm must analyze a prospective site using several criteria. Please indicate which criteria your firm considers when making such decisions, then assign a weight to each to define each criterion's relative importance to your firm.**

Not important				Moderately important					Critical
1	2	3	4	5	6	7	8	9	10

Scientific excellence ____
Conducive provincial environment ____

Regional investment considerations ____
Unique scientific capabilities ____
Company profile/Public relations ____
Value for money ____
Contributions from other sources ____
Scientist's precedent record with firm ____
Proximity to Canadian Head Office ____
Prospect for new compound development ____
Reputation of University/Hospital ____
Others? ____

4) Given that the ability to fund certain types of research is beyond the mandate or scope of some Canadian pharmaceutical firms, please assign an appropriate value from the scale below to reflect your firm's level of autonomy in funding research in Canada.

Authorization Required				Authorized to Specified Limit					Autonomous
1	2	3	4	5	6	7	8	9	10

Basic Medical Science ____
Pre-clinical Research ____
Clinical Trials (Phases 1-3) ____
Post-Marketing Studies ____

Limits to Authority:
$500K+ ____
$250-500K ____
$100-250K ____
$50-100K ____
under $50K ____

5) When considering investment in health research within the public facilities in Canada, does your firm traditionally identify one type of research in one area of the country, and other types in other areas? Yes ____ No ____

If yes, why? What type of research would your firm associate with Manitoba?

_____

_____

RESEARCH INDUCEMENTS:

In an effort to remain competitive in the field of health research, and to attract additional support from the private sector for this activity, several jurisdictions in Canada and the United States have developed publicly supported health research programs at a provincial or state level. Below are a summary of various types of programs that are designed to support health research, and may be perceived by your firm as an inducement for investment. Please indicate which, if any, of the following would be perceived as an inducement, and rank relative to one another using the scale below:

No Interest — Marginal Interest — Extremely Interested

1 2 3 4 5 6 7 8 9 10

Peer-reviewed operational grants to academic scientists _____
University/Industry Programs, peer-reviewed _____
Career Awards _____
Educational Grants and Awards (Grad Students, Post-Docs) _____
Incentive-Based (predicated on industry contributions) Infrastructure Support _____
Non-incentive based infrastructure support _____
R&D Tax Credits-provincial, non-transferable _____
Personal Provincial Tax Holidays for new Immigrant Scientists _____
Secondment programs from Academic sites to Industry and vice-versa _____
Others _____

LICENSING AND INDUSTRY LIAISON:

1) In your activities with academic health research centres, do you prefer dealing directly with the investigator, _____ or with a technology transfer office? ____ Why?

_____

2) In dealing with technology transfer offices in Canada, in your opinion which characteristics define the best units.

_____
_____

3) In your opinion, what would be a common failing of such organizations?

_____
_____

4) What would be your prescription for improvement?

_____
_____

Thank you for taking the time to complete this survey. Your support is greatly appreciated.

APPENDIX 6

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O COMMODITIES (602 LEVEL)		TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
00100	CATTLE AND CALVES				
00200	SHEEP AND LAMBS				
00300	HOGS				
00400	POULTRY				
00500	OTHER LIVE ANIMALS				
00700	WHEAT,UNMILLED				
00800	BARLEY,OATS,RYE,CORN,GRAIN,NES				
00900	MILK,WHOLE,FLUID,UNPROCESSED				
01000	EGGS IN THE SHELL				
01100	HONEY AND BEESWAX				
01200	NUTS,EDIBLE,NOT SHELLED				
01300	FRUITS,FRESH, EX.TROPICAL				
01400	VEGETABLES,FRESH				
01500	HAY,FORAGE,AND STRAW				
01600	SEEDS EX. OIL AND SEED GRADES				
01700	NURSERY STOCK & RELATED MAT.				
01800	OIL SEEDS,NUTS AND KERNELS				
01900	HOPS INC. LUPULIN				
02000	TOBACCO,RAW				
02100	MINK SKINS,RANCH UNDRESSED				
02200	WOOL IN GREASE				
02300	SERV.INCIDENTAL TO AGR.&FOREST				
02400	LOGS AND BOLTS				
02500	POLES,PIT PROPS FENCE-POSTS ET				
02600	PULPWOOD				
02700	OTHER CRUDE WOOD MATERIALS				
02800	CUSTOM FORESTRY				
02900	FISH LANDINGS				
03000	HUNTING & TRAPPING PRODUCTS				
03200	GOLD & ALLOYS IN PRIMARY FORM				
03300	RADIO-ACTIVE ORES&CONCENTRATES				
03400	IRON ORES & CONCENTRATES				
03500	BAUXITE + ALUMINA				
03600	METAL ORES + CONCENTRATES N.E.				
03700	COAL				
03800	CRUDE MINERAL OILS				
03900	NATURAL GAS				
04100	SULPHUR,CRUDE & REFINED				
04200	ASBESTOS,UNMFG.,CRUDE& FIBROUS				
04300	GYPSUM				
04400	SALT				
04500	PEATMOSS				
04600	CLAY&OTHER CRUDE REFRACTORY MA				
04700	NATURAL ABRASIVES&INDUST.DIAMO				
04800	CRUDE MINERAL NES				
04900	SAND AND GRAVEL				
05000	STONE,CRUDE				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O	COMMODITIES (100 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
51	FABRICATED STRUCTURAL METAL PR				
52	OTHER METAL FABRICATED PRODUCT				
53	AGRICULTURAL MACHINERY				
54	OTHER INDUSTRIAL MACHINERY				
55	MOTOR VEHICLES				
56	MOTOR VEHICLE PARTS				
57	OTHER TRANSPORT EQUIPMENT				
58	APPLIANCES & RECEIVERS,HOUSEHO				
59	OTHER ELECTRICAL PRODUCTS				
60	CEMENT & CONCRETE PRODUCTS				
61	OTHER NON-METALLIC MINERAL PRO				
62	GASOLINE & FUEL OIL				
63	OTHER PETROLEUM & COAL PROD.				
64	INDUSTRIAL CHEMICALS				
65	FERTILIZERS				
66	PHARMACEUTICALS				
67	OTHER CHEMICAL PRODUCTS				
68	SCIENTIFIC EQUIPMENT				
69	OTHER MANUFACTURED PRODUCTS				
70	RESIDENTIAL CONSTRUCTION				
71	NON-RESIDENTIAL CONSTRUCTION				
72	REPAIR CONSTRUCTION				
73	PIPELINE TRANSPORTATION				
74	TRANSPORTATION & STORAGE				
75	RADIO & TELEVISION BROADCASTIN				
76	TELEPHONE & TELEGRAPH				
77	POSTAL SERVICES				
78	ELECTRIC POWER				
79	OTHER UTILITIES				
80	WHOLESALE MARGINS				
81	RETAIL MARGINS				
82	IMPUTED RENT OWNER OCPD. DWEL.				
83	OTHER FINANCE,INS.,REAL ESTATE				
84	BUSINESS SERVICES				
85	EDUCATION SERVICES				
86	HEALTH SERVICES				
87	AMUSEMENT & RECREATION SERVICE				
88	ACCOMMODATION & FOOD SERVICES				
89	OTHER PERSONAL & MISC. SERVICE				
90	TRANSPORTATION MARGINS				
91	OPERATING, OFFICE, LAB. & FOOD				
92	TRAVEL, ADVERTISING & PROMOTIO				
93	NON-COMPETING IMPORTS				
94	UNALLOCATED IMPORTS & EXPORTS				
95	INDIRECT TAXES				
96	SUBSIDIES				
97	WAGES & SALARIES				
98	SUPPLMENTARY LABOUR INCOME				
99	NET INCOME,UNINC. BUSINESS				
100	OTHER OPERATING SURPLUS				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O COMMODITIES (602 LEVEL)		TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
05100	SERVICES INCIDENTAL TO MINING				
05200	BEEF,VEAL,MUTT&PORK,FRESH&FROZ				
05300	HORSE MEAT FRESH,CHILLED,FROZE				
05400	MEAT,CURED				
05500	MEAT PREP. COOKED NOT CANNED				
05600	MEAT PREP. CANNED				
05700	ANIMAL OILS & FATS & LARD				
05800	MARGERINE,SHORTENING&LIKE PROD				
05900	SAUSAGE CASINGS,NATURAL&SYNTH.				
06000	PRIMARY TANKAGE				
06100	FEEDS OF ANIMAL ORIGIN NES				
06200	HIDES AND SKINS,RAW,NES				
06300	ANIMAL MAT.FOR DRUGS & PERFUME				
06400	CUSTOM WORK MEAT & FOOD				
06500	POULTRY,FRESH,CHILLED,FROZEN				
06600	POULTRY,CANNED				
06700	MILK,WHOLE,FLUID,PROCESSED				
06800	CREAM,FRESH				
06900	BUTTER				
07000	CHEESE,CHEDDAR & PROCESSED				
07100	MILK EVAPORATED				
07200	ICE CREAM				
07300	OTHER DAIRY PRODUCTS				
07400	MUSTARD MAYONNAISE				
07500	FISH PRODUCTS				
07600	FRUIT,BERRIES,DRIED,CRYSTALIZE				
07700	FRUITS & PREPARATIONS CANNED				
07800	VEGET.FROZEN,DRIED & PRESERVED				
07900	VEGETABLES&PREPARATIONS CANNED				
08000	SOUPS CANNED				
08100	INFANT&JUNIOR FOODS,CANNED				
08200	PICKLES,RELISHES,OTHER SAUCES				
08300	VINEGAR				
08400	OTHER FOOD PREPARATIONS				
08500	PRIMARY OR CONCENTRATED FEEDS				
08600	FEED FOR COMMERCIAL LIVESTOCK				
08700	FEEDS, GRAIN ORIGIN, N.E.S.				
08800	FEEDS OF VEGETABLE ORIGIN NES				
08900	PET FEEDS				
09000	WHEAT FLOUR				
09100	MEAL&FLOUR OF OTHER CEREALS&VE				
09200	BREAKFAST CEREAL PRODUCTS				
09300	BISCUITS				
09400	BREAD & ROLLS				
09500	OTHER BAKERY PRODUCTS				
09600	COCOA & CHOCOLATE				
09700	NUTS,KERNELS & SEEDS PREPARED				
09800	CHOCOLATE CONFECTIONERY				
09900	OTHER CONFECTIONERY				
10000	BEET PULP				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O	COMMODITIES (602 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
10100	SUGAR				
10200	MOLASSES,SUGAR REFINERY PROD.				
10300	OILSEED,MEAL & CAKE				
10400	VEG. OILS & FATS, CRUDE				
10500	NITROGEN FUNCTION COMPOUNDS NE				
10600	MALT,MALT FLOUR&WHEAT STARCH				
10700	MAPLE SUGAR&SYRUP				
10800	PREPARED CAKE & SIMILAR MIXES				
10900	SOUPS,DRIED&SOUP MIXES&BASES				
11000	COFFEE,ROASTED,GROUND,PREPARED				
11100	TEA				
11200	POTATO CHIPS&SIMILAR PRODUCTS				
11300	MISC.FOOD NES				
11400	SOFTDRINK CONCENTRATES&SYRUPS				
11500	CARBONATED BEV.,SOFT DRINKS				
11600	ALCOHOLIC BEVERAGES DISTILLED				
11700	ALCOHOL, NATURAL, ETHYL				
11800	BREWERS'&DISTILLERS'GRAINS				
11900	ALE BEER,STOUT & PORTER				
12000	WINES				
12100	TOBACCO PROCESSED,UNMANUFACT.				
12200	CIGARETTES				
12300	TOBACCO MFG EX.CIGARETTES				
12400	FOOTWEAR,RUBBER AND PLASTIC				
12500	TIRES & TUBES,PASSENGER CARS				
12600	TIRES & TUBES,TRUCKS & BUSES				
12700	TIRES & TUBES,N.E.S.				
12800	TIRES,RETREADING				
12900	RECLAIMED RUBBER				
13000	RUBBER BELTS & COATED FABRICS				
13100	RUBBER SHEETING SHOE STOCK ETC				
13200	HOSE & TUBING,MAINLY RUBBER				
13300	RUBBER WASTE & SCRAP				
13400	RUBBER END PRODUCTS NES				
13500	PLASTIC PIPE FITTINGS & SHEET				
13600	PLASTIC CONTAINERS&BOTTLE CAPS				
13700	PREFAB. BLDGS&STRUCTURES NES				
13800	PLASTIC HOSE,PAILS&END PROD.NE				
13900	LEATHER				
14000	FOOTWEAR EX.RUBBER & PLASTIC				
14100	LEATHER GLOVES&MITTENS EX SPOR				
14200	LEATHER BELTING,SHOE STOCK				
14300	LUGGAGE				
14400	LEATHER HANDBAGS,WALLETS ETC.				
14500	YARN, COTTON				
14600	YARNS MIX&BLENDED&COTTON WASTE				
14700	FABRICS, BROAD WOVEN OF COTTON				
14800	TIRE CORD & TIRE FABRICS				
14900	NETS & NETTING				
15000	BLANKETS,BEDSHEETS,TOWELS&CLOT				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O	COMMODITIES (602 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
15100	YARN OF WOOL AND HAIR				
15200	FABRICS,BROADWOVEN,WOOL,HAIR&M				
15300	PAPERMAKERS' FELTS				
15400	MAN MADE FIBRES				
15500	POLYAMIDE RESINS (NYLON)				
15600	YARNS, SILK, FIBREGLASS				
15700	TIRE YARNS				
15800	FABRIC, WOVEN, TEXTILE FIBRES				
15900	FABRICS,BROAD WOVEN,MIX&BLENDS				
16000	RAGS&WASTE,COTTON&TEXTILE MAT.				
16100	WOOL&FINE ANIMAL HAIR,SPINNING				
16200	THREAD,OF COTTON FIBRES				
16300	THREAD, OF MAN-MADE FIBRES				
16400	YARN&THREAD,OTHER VEG. FIBRES				
16500	BALER AND BINDER TWINE				
16600	OTHER CORDAGE, TWINE & ROPE				
16700	NARROW FABRICS				
16800	LACE FABRICS,BOBBINET & NET				
16900	FELT, CARPET CUSHION				
17000	CARPETING&FABRIC RUGS,MATS,ETC				
17100	TEXTILE DYEING & FINISHING SER				
17200	AWNINGS, OF CLOTH & PLASTIC				
17300	TENTS,HAMMOCKS,SLEEP BAGS&SAIL				
17400	TARPAULINS & OTHER COVERS				
17500	TEXTILE CONTAINERS				
17600	VEGETABLE TEXTILE FIBRES NES				
17700	MISC.TEXTILE FAB.MAT.INC. RAGS				
17800	HOUSEHOLD TEXTILES, NES				
17900	LACES AND TEXTILE PROD. N.E.S.				
18000	HOSIERY				
18100	FABRICS,KNITTED&NETTED,ELASTIC				
18200	FABRICS, KNITTED, NES				
18300	KNITTED WEAR				
18400	CLOTHING				
18500	APPAREL ACCESSORIES&OTHER MISC				
18600	FURS, DRESSED				
18700	FUR PLATES, MATS AND LININGS				
18800	FUR APPAREL				
18900	CUSTOM TAILORING				
19000	PULPWOOD CHIPS				
19100	LUMBER & TIMBER				
19200	RAILWAY TIES				
19300	WOOD WASTE				
19400	CUSTOM WOOD WORKING & MILLWORK				
19500	VENEER AND PLYWOOD				
19600	MILLWORK (WOODWORK)				
19700	WOOD FABRICATED MAT.FOR STRUCT				
19800	PREFAB. BLDGS,WOOD				
19900	CONTAINERS,CLOSURES&WOOD PALLE				
20000	CASKETS,COFFINS&OTHER MORT.GOO				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O COMMODITIES (602 LEVEL)		TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
20100	MISC. WOOD				
20200	BARRELS & KEGS OF WOOD				
20300	WOOD END PRODUCTS,NES				
20400	HOUSEHOLD FURN.INCL.CAMP&LAWN				
20500	OFFICE FURN&VISIBLE RECORD EQU				
20600	SPECIAL PURPOSE FURNITURE				
20700	MISC. FURNITURE AND FIXTURES				
20800	PORTABLE LAMPS RESIDENTIAL TYP				
20900	PULP				
21000	NEWSPRINT PAPER				
21100	OTHER PAPER FOR PRINTING				
21200	FINE PAPER				
21300	TISSUE & SANITARY PAPER				
21400	WRAPPING PAPER				
21500	PAPER BOARD				
21600	BLDG.PAPER				
21700	TOWELS, NAPKINS & TOILET PAPER				
21800	VANILLIN				
21900	MISC.IND.PAPER MAT;BY PROD&WAS				
22000	TILES,VINYL-ASBESTOS				
22100	PAPER CARTONS,BAGS,CANS&BOTTLE				
22200	CONVERTED PAPER,GUM,WAX OR PRI				
22300	CONVERTED ALUMINUM FOIL				
22400	FACIAL TISSUES,&SANITARY NAPKI				
22500	PAPER CONTAINERS,NES				
22600	OFFICE AND STATIONERY SUPPLIES				
22700	PAPER END PRODUCTS				
22800	NEWSPAPERS,MAGAZINES&PERIODICA				
22900	BOOKS,PAMPHLETS,MAPS&PICTURES				
23000	BANKNOTES,BONDS,DRAFTS ETC				
23100	OTHER PRINTED MATTER				
23200	ADVERTISING,PRINT MEDIA				
23300	SPECIALIZED PUBLISHING SERVICE				
23400	PRINTING PLATES,SET TYPE ETC.				
23500	FERRO-ALLOYS				
23600	IRON, STEEL INGOTS				
23700	STEEL BLOOMS,BILLETS & SLABS				
23800	STEEL CASTINGS				
23900	STEEL BARS AND RODS				
24000	STEEL PLATES, NOT FABRICATED				
24100	CARBON STEEL SHEETS NOT COATED				
24200	TINPLATE				
24300	GALVANIZED STEEL SHEET & STRIP				
24400	RAILS&RLY TRACK MATERIALS,STEE				
24500	COAL TAR				
24600	NAT.&SYN.GRAPHITE&CARBON PROD.				
24700	MECHANICAL STEEL TUBING				
24800	OIL COUNTRY GOODS				
24900	LINE PIPE,TRANS.NAT.GAS & OIL				
25000	STEEL PIPES & TUBES NES				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O COMMODITIES (602 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
25100 GRINDING BALLS,INGOT MOULDS ET				
25200 CAST&WROUGHT IRON PIPE&FITTING				
25300 NICKEL IN PRIMARY FORMS				
25400 COPPER&COPPER ALLOYS,PRIME.FOR				
25500 LEAD,PRIMARY FORMS				
25600 ZINC&ZINC ALLOYS PRIMARY FORMS				
25700 ALUMINUM&ALUMINUM ALLOYS PRIME				
25800 TIN&TIN ALLOYS PRIMARY FORMS				
25900 PRECIOUS METAL&ALLOYS PRIME.FO				
26000 OTH.NON-FERROUS BASE METALS				
26100 ALUMINUM FLUORIDES&SODIUM ALUM				
26200 INORGANIC BASES&MET.OXIDES,NES				
26300 SCRAP&WASTE MATERIALS NES				
26400 ALUMINUM&ALUMINUM ALLOYS, CAST				
26500 COPPER PROD.CAST,ROLLED&EXTRUD				
26600 COPPER ALLOY PROD.CAST,ROLL,EX				
26700 LEAD&LEAD ALLOY PROD.CAST,R&E				
26800 NICKEL&NICKEL ALLOY FAB.MATERI				
26900 TIN&TIN ALLOY FAB. MATERIALS				
27000 ZINC DIE CASTING&OTH.ZINC MAT.				
27100 SOLDERS INC.BLOCK,RODS,WIRE,ET				
27200 PLATES, STEEL, FABRICATED				
27300 TANKS				
27400 POWER BOILERS				
27500 BOILERS, MARINE TYPE				
27600 BEAMS AND OTHER STRUCT. STEEL				
27700 SCAFFOLDING EQUIP., DEMOUNTABL				
27800 PREFAB.BLDGS&STRUCT.,MAINLY ME				
27900 METAL PRODUCTS NES				
28000 STEEL SHEET&STRIP COATED OR FA				
28100 CULVERT PIPE, CORRUGATED METAL				
28200 METAL BASIC PROD.&RANGE BOILER				
28300 METAL PIPES,FITTINGS & SIDINGS				
28400 METAL AWNINGS,ASH CANS,PAILS E				
28500 KITCHEN UTENSILS				
28600 CONTAINERS&BOTTLE CAPS OF META				
28700 WIRE & WIRE ROPE, OF STEEL				
28800 WIRE FENCING,SCREENING&NETTING				
28900 CHAIN,EX.AUTO TIRE&POWER TRANS				
29000 RODS,WIRE&ELECTRODES,WELDING				
29100 SPRINGS FOR UPHOLSTERY&MISC.VE				
29200 BOLTS,NUTS,SCREWS,WASHERS ETC.				
29300 BUILDERS' HARDWARE				
29400 FITTINGS,FURN.CABINETS&CASKETS				
29500 BASIC HARDWARE,NES				
29600 CUTTING&FORMING TOOLS				
29700 MEASURING,EDGING,MECHANIC'S TO				
29800 SCISSORS,RAZOR BLADES,IND.CUTL				
29900 DOMESTIC EQUIPMENT, NES				
30000 HEATING EQ,HOT WATER&STEAM ETC				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O COMMODITIES (602 LEVEL)		TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
30100	HEATING EQ,WARM AIR EX.PIPES&E				
30200	UNIT&WATER TANK HEATERS NON-EL				
30300	FUEL BURNING EQUIPMENT				
30400	COM.APPLIANCES,COOK&WARMING FO				
30500	CUSTOM METAL WORKING				
30600	FORGINGS OF CARBON&ALLOY STEEL				
30700	VALVES				
30800	PIPE FITTINGS,NOT IRON & STEEL				
30900	GAS METERS AND WATER METERS				
31000	FIRE FIGHT&TRAFFIC CONTROL EQU				
31100	TAXI&PARK METERS,BLOCKS&LADDER				
31200	FIREARMS & MILITARY HARDWARE				
31300	COLLAPSIBLE TUBES,METAL				
31400	TRACTORS, FARM & GARDEN TYPE				
31500	OTHER AGRICULTURAL MACHINERY				
31600	MECHANICAL POWER TRANS.EQUIP.				
31700	PUMPS,COMPRESSORS&BLOWERS ETC.				
31800	CONVEYORS,ESCAL,ELEV&HOIST MAC				
31900	IND.TRUCKS,TRACTORS,TRAILERS E				
32000	FANS,AIR CIRCULATORS&AIR UNITS				
32100	PKG.MACH,LUB.EQ&OTH.MISC.MACH.				
32200	INDUSTRIAL FURNACES,KILNS&OVEN				
32300	MACH.IND.SPECIFIED&SPECIAL PUR				
32400	POWER DRIVEN HAND TOOLS				
32500	METAL END PRODUCTS, NES				
32600	REFRIG&AIR CON.EQ,EX.HOUSEHOLD				
32700	SCALES & BALANCES				
32800	VENDING MACHINES				
32900	OFFICE MACHINES AND EQUIPMENT				
33000	AIRCRAFT, ALL TYPES				
33100	AIRCRAFT ENGINES				
33200	SPECIALIZED AIRCRAFT EQUIPMENT				
33300	MODIFICATIONS,CONVERSIONS,SERV				
33400	PASSENGER AUTOMOBILES & CHASSI				
33500	TRUCKS, CHASSIS, TRACTORS, COM				
33600	BUSES AND CHASSIS				
33700	MILITARY MOTOR VEH, MOTORCYCLE				
33800	MOBILE HOMES				
33900	OTH.TRAILERS&SEMI-TRAILERS,COM				
34000	BODIES AND CABS FOR TRUCKS				
34100	MOTOR VEHICLE ENGINES AND PART				
34200	AUXILIARY ELECTRIC EQUIPMENT				
34300	MOTOR VEH. ACCESS, PARTS&ASSEM				
34400	AUTOMOTIVE HARDWARE, EX.SPRING				
34500	LOCOMOTIVES,CARS&TENDERS,RLY.S				
34600	SELF-PROPEL CARS				
34700	PARTS&ACCESS.FOR RLY.ROLL.STOC				
34800	SHIPS&BOATS,MILITARY&COMMERCIA				
34900	SUB-ASSEMBLIES,PARTS,ETC.SHIPS				
35000	SHIP REPAIRS				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O COMMODITIES (602 LEVEL)		TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
35100	SNOWMOBILES&MISC.NON-MOTOR VEH				
35200	PLEASURE & SPORTING CRAFT				
35300	SMALL ELEC.APPLIANCES,DOMESTIC				
35400	SPACE HEATER,HEATING STOVES ET				
35500	REFRIG,FREEZERS&COMB. DOMESTIC				
35600	GAS RANGES&ELEC.STOVES,DOMESTI				
35700	T.V.,RADIO,RECORD PLAYERS				
35800	TEL&TELEG.LINE APPARATUS&EQUIP				
35900	RADIO&TV BROADCASTING&TRANS EQ				
36000	RADAR EQUIP. & RELATED DEVICES				
36100	ELEC.TUBES&SEMI-CONDUCTORS ETC				
36200	ELECTRONIC EQUIPMENT COMPONENT				
36300	INTERIOR SIGNAL,ALARM&CLOCK SY				
36400	POLE LINE HARDWARE				
36500	WELDING MACHINERY & EQUIPMENT				
36600	ENGINES,MARINE,ELECTRIC TURBIN				
36700	TRANSFORMERS&CONVERTERS EX.T&T				
36800	ELEC. EQUIP. INDUSTRIAL, NES				
36900	BATTERIES				
37000	WIRE AND CABLE, INSULATED				
37100	ALUM. WIRE&CABLE,NOT INSULATED				
37200	ENCLOSED SAFETY SWITCHES ETC.				
37300	ELEC.LIGHT BULBS&TUBES, ETC				
37400	ELECTRIC LIGHTING FIXTURES ETC				
37500	CEMENT				
37600	LIME				
37700	CONCRETE BASIC PRODUCTS				
37800	SAND LIME BRICKS AND BLOCKS				
37900	READY-MIX CONCRETE				
38000	BRICKS AND TILES, CLAY				
38100	INSULATORS&ELEC.FITTINGS,PORCE				
38200	PLUMB.EQ, VITREOUS CHINA,& ETC				
38300	REFRACTORIES				
38400	NATURAL STONE BASIC PROD,STRUC				
38500	STONE,CLAY&CONCRETE END PROD.N				
38600	PLASTERS&OTH.GYPSUM BASIC PROD				
38700	MIN.WOOL&THERMAL INSUL.MAT.NES				
38800	ASBESTOS PRODUCTS				
38900	NON-METALLIC MIN.BASIC PROD.NE				
39000	GLASS, PLATE, SHEET, WOOL				
39100	GLASS CONTAINERS				
39200	GLASS TABLEWRE&HOUSEWRE,END&NE				
39300	ABRASIVE BASIC PRODUCTS				
39400	AVIATION GASOLINE				
39500	MOTOR GASOLINE				
39600	FUEL OIL				
39700	LUBRICATING OILS AND GREASES				
39800	BENZENE, TOLUENE AND XYLENE				
39900	BUTANE,PROPANE&OTH.LIQ.PET.GAS				
40000	NAPHTHA				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O	COMMODITIES (602 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
40100	ASPHALT AND COAL OILS, N.E.S.				
40200	PETROCHEMICAL FEED STOCK				
40300	FERTILIZERS				
40400	PLASTIC RESINS&MAT.,NOT SHAPED				
40500	FILM&SHEET, CELLULOSIC PLASTIC				
40600	ETHANOLAMINES				
40700	ETHYLENE GLYCOL, MONO				
40800	PHARMACEUTICALS				
40900	PAINTS & RELATED PRODUCTS				
41000	VEG. OILS,OTH.THAN CORN OIL,RE				
41100	GLYCERIN, REFINED				
41200	DENTIFRICES, ALL KINDS				
41300	SOAPS,DETERGENTS,CLEANING PROD				
41400	INDUSTRIAL CHEMICAL PREP. N.E.				
41500	TOILET PREPARATIONS & COSMETIC				
41600	CHLORINE				
41700	OXYGEN				
41800	PHOSPHORUS				
41900	CHEMICAL ELEMENTS, NES				
42000	SULPHURIC ACID				
42100	CARBON DIOXIDE (GAS AND DRY IC				
42200	INORGANIC ACIDS&OXYGEN				
42300	AMMONIA, ANHYDROUS AND AQUA				
42400	CAUSTIC SODA (SOD.HYDROXIDE)DR				
42500	CALCIUM CHLORIDE				
42600	SODIUM CHLORATE				
42700	ALUMINUM SULPHATE				
42800	SODIUM PHOSPHATES				
42900	SODIUM CARBONATE (SODA ASH)				
43000	SODIUM CYANIDE				
43100	SODIUM SILICATE				
43200	METALLIC SALTS&PEROXYSALTS,NES				
43300	PHOTOGRAPHIC&INORGANIC CHEM.N.				
43400	ETHYLENE				
43500	BUTYLENES				
43600	BUTADIENE				
43700	ACETYLENE				
43800	STYRENE MONOMER				
43900	CARBON TETRACHLORIDE				
44000	VINYLCHLORIDE MONOMER				
44100	TRICHLOROETHYLENE				
44200	PERCHLOROETHYLENE				
44300	FLUORINATED HALOGEN HYDROCARBO				
44400	HYDROCARBONS&THEIR DERIVATIVES				
44500	METHYL ALCOHOL				
44600	PROPYL AND ISOPROPYL ALCOHOLS				
44700	BUTYL AND ISOBUTYL ALCOHOLS				
44800	PENTAERYTHRITOL				
44900	ALCOHOLS AND THEIR DERIVATIVES				
45000	PHENOL				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O	COMMODITIES (602 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
45100	PHENOLS,PHEN.ALCOHOLS&DERIVATV				
45200	ETHERS,ALCOHOL PEROXIDES,ETC				
45300	METYL-ETHYL,ALDEHYDE-FUNCTIONS				
45400	ACETONE				
45500	ACETIC ACID				
45600	ACETIC ANHYDRIDE				
45700	ADIPIC ACID				
45800	CITRIC ACIDS				
45900	STEARIC AND ORGANIC ACIDS				
46000	HEXAMETHYLENEDIAMINE				
46100	SODIUM GLUTAMATE, MONO				
46200	DICYANDIAMIDE				
46300	ORGANO-INORGANIC COMPOUNDS ETC				
46400	ORGANIC CHEMICALS, NES				
46500	TITANIUM DIOXIDE				
46600	BLACK, ACETYLENE AND CARBON				
46700	PIGMENTS, LAKES & TONERS,PROPE				
46800	IRON OXIDES				
46900	FERTILIZER CHEMICALS				
47000	SYNTHETIC RUBBER				
47100	ANTIFREEZE COMPOUNDS				
47200	ADDITIVES FOR MINERAL OILS,NES				
47300	GLYCERINE, CRUDE				
47400	RUBBER&PLASTICS COMPOUNDING AG				
47500	EXPLOSIVES, FUSES AND CAPS				
47600	AMMUNITION, NON-MILITARY				
47700	AMMUNITION & ORDNANCE, MILITAR				
47800	PYROTECHNIC ARTICLES & FIREWOR				
47900	CRUDE VEG. MATERIALS & EXTRACT				
48000	PHTHALIC ANHYDRIDE				
48100	AGRICULTURAL CHEMICALS				
48200	ADHESIVES				
48300	AUTOMOTIVE CHEM. EX. ANTIFREEZ				
48400	CONCRETE ADDITIVES				
48500	BOILER CHEMICALS				
48600	COMPOUND CATALYSTS				
48700	METAL WORKING COMPOUNDS				
48800	PRINTING AND OTHER INKS				
48900	TEXTILE SPECIALTY CHEMICALS				
49000	POLISHES,WAXES,COMPOUNDS & ETC				
49100	WAXES,ANIMAL & VEGETABLE, OTHE				
49200	ESSENTIAL OILS, NATURAL OR SYN				
49300	TANNING MATERIALS AND DYESTUFF				
49400	FATS AND CHEMICAL MIXTURES				
49500	EMBALMING CHEM.& PREPARATIONS				
49600	MATCHES				
49700	AIRCRAFT&NAUTICAL INSTRUMENTS				
49800	LAB&SCIENTIFIC APPARATUS ETC				
49900	MISC.MEASURE&CONTROL INSTRUMEN				
50000	MEDICAL&RELATED INSTRUMENTS ET				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O	COMMODITIES (602 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
50100	IND.MILITARY&CIVIL DEF.SAFETY				
50200	WATCHES,CLOCKS,CHRONOMETERS ET				
50300	PHOTOGRAPHIC EQ&SUPPL.INCL.FIL				
50400	JEWELRY,FINDINGS,MET.&GEM STON				
50500	PLATED&SILVERWARE,CUTLERY, ETC				
50600	BROOMS,BRUSHES,MOPS&OTH.CLEAN.				
50700	BICYCLES,CHILDREN'S VEH.&PARTS				
50800	SPORTING,FISHING&HUNTING EQUIP				
50900	TOYS AND GAME SETS				
51000	FABRICS,IMPREG.EX.RUBBER-COATE				
51100	TILING, RUBBER, PLASTIC				
51200	ADVERTISING GOODS				
51300	SHADES&BLINDS				
51400	FUR DRESSING & DYEING SERVICES				
51500	CUSTOM WORK, MISCELLANEOUS				
51600	ICE				
51700	ANIMAL HAIR,FEATHERS,QUILLS,ET				
51800	MISC.FAB.MAT.INCL.BRISTLES ETC				
51900	BUTTONS,NEEDLES,PINS&MISC.NOTI				
52000	PHONO RECORDS AND ARTIST MATER				
52100	HOUSEHOLD ORNAMENTAL OBJECTS&A				
52200	REPAIR CONSTRUCTION				
52300	RESIDENTIAL CONSTRUCTION				
52400	NON-RESIDENTIAL CONSTRUCTION				
52500	ROAD,HIGHWAY,AIRSTRIP CONST.				
52600	GAS AND OIL FACILITY CONST.				
52700	DAMS AND IRRIGATION PROJECTS				
52800	RAILWAY TELEPHONE TELEGRAPH CO				
52900	OTHER ENGINEERING CONSTRUCTION				
53000	AIR TRANSPORTATION				
53100	OTHER TRANSPORTATION				
53200	SERV.INCIDENTAL TO TRANSPORT N				
53300	WATER TRANSPORTATION				
53400	SERV.INCIDENTAL TO WATER TRANS				
53500	RAILWAY TRANSPORTATION				
53600	TRUCK TRANSPORTATION				
53700	BUS TRANSPORT,INTERURBAN& RURA				
53800	URBAN TRANSIT				
53900	TAXICAB TRANSPORTATION				
54000	PIPELINE TRANSPORTATION				
54100	HIGHWAY AND BRIDGE MAINTENANCE				
54200	STORAGE				
54300	RADIO & TELEVISION BROADCASTIN				
54400	TELEPHONE & TELEGRAPH				
54500	POSTAL SERVICES				
54600	ELECTRIC POWER				
54700	GAS DISTRIBUTION				
54800	COKE				
54900	WATER AND OTHER UTILITIES				
55000	WHOLESALING MARGINS				
55100	REPAIR SERVICE				

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O COMMODITIES (602 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
55200 RENTAL OF OFFICE EQUIPMENT				
55300 RETAILING MARGINS				
55400 IMPUTED SERVICE, BANKS				
55500 OTH REAL EST (NON-RENT)&FIN.SE				
55600 INSURANCE & W.C.B.				
55700 IMPUTED RENT OWNER OCPD. DWEL.				
55800 CASH RESIDENTIAL RENT				
55900 OTHER RENT				
56000 GOVT.ROYALTIES ON NAT. RESOURC				
56100 EDUCATION SERVICES				
56200 HOSPITAL SERVICES				
56300 HEALTH SERVICES				
56400 MOTION PICTURE ENTERTAINMENT				
56500 OTHER RECREATIONAL SERVICES				
56600 SERVICES TO BUSINESS MANAGEMEN				
56700 ADVERTISING SERVICES				
56800 LAUNDRY,CLEANING&PRESSING SERV				
56900 ACCOMMODATION SERVICES				
57000 MEALS				
57100 SERV.MARG.ON ALCOHOLIC BEVERAG				
57200 PERSONAL SERVICES				
57300 PHOTOGRAPHIC SERVICES				
57400 SERVICES TO BLDGS. & DWELLINGS				
57500 RENTAL DATA PROCESSING EQUIP.				
57600 OTHER SERV.TO BUSINESSES&PERSO				
57700 RENTAL OF AUTOMOBILES & TRUCKS				
57800 TRADE ASSOCIATION DUES				
57900 RENTAL AO MACH&EQ.INCL.CONST.M				
58000 SPARE PARTS&MAINT.SUPPL.MACH&E				
58100 OFFICE SUPPLIES				
58200 CAFETERIA SUPPLIES				
58300 TRANSPORTATION MARGINS				
58400 LABORATORY EQUIP. AND SUPPLIES				
58500 TRAVELLING AND ENTERTAINMENT				
58600 ADVERTISING & PROMOTION				
58700 PURCHASED REPAIR SER.FOR MACH&				
58800 COTTON RAW & SEMI-PROCESSED				
58900 NATURAL RUBBER & ALLIED GUMS				
59000 SUGAR , RAW				
59100 COCOA BEANS,UNROASTED				
59200 GREEN COFFEE				
59300 TROPICAL FRUIT				
59400 UNALLOCATED IMPORTS & EXPORTS				
59500 GOVERNMENT GOODS & SERVICES				
59600 COMMODITY INDIRECT TAXES				
59700 SUBSIDIES				
59800 OTHER INDIRECT TAXES				
59900 WAGES AND SALARIES				
60000 SUPPLEMENTARY LABOUR INCOME				
60100 NET INCOME UNINCORP BUSINESS				
60200 OTHER OPERATING SURPLUS				

MBS ECONOMIC IMPACT ASSESSMENT MODEL
CORRESPONDENCE BETWEEN MEDIUM (100) AND WORKSHEET (602) LEVELS

I/O COMMODITIES (100 LEVEL)		I/O COMMODITY CODES (602 LEVEL)
1	GRAINS	7-8
2	LIVE ANIMALS	1-5
3	OTHER AGRICULTURAL PRODUCTS	9-23
4	FORESTRY PRODUCTS	24-28
5	FISH LANDINGS	29
6	HUNTING & TRAPPING PRODUCTS	30
7	IRON ORES & CONCENTRATES	34
8	OTHER METAL ORES & CONCENTRAT	32-33, 35-36
9	COAL	37
10	CRUDE MINERAL OILS	38
11	NATURAL GAS	39
12	NON-METALLIC MINERALS	41-50
13	SERVICES INCIDENTAL TO MINING	51
14	MEAT PRODUCTS	52-66
15	DAIRY PRODUCTS	67-74
16	FISH PRODUCTS	75
17	FRUITS & VEGETABLES PREPARATIO	76-84
18	FEEDS	85-89, 100, 103, 118
19	FLOUR,WHEAT,MEAL & OTHER CEREA	90-91
20	BREAKFAST CEREAL & BAKERY PROD	92-95
21	SUGAR	101
22	MISC. FOOD PRODUCTS	96-99, 102, 104, 106-113
23	SOFT DRINKS	114-115
24	ALCOHOLIC BEVERAGES	116, 119-120
25	TOBACCO PROCESSED UNMANUFACTUR	121
26	CIGARETTES & TOBACCO MFG.	122-123
27	TIRES & TUBES	125-128
28	OTHER RUBBER PRODUCTS	124, 129-134
29	PLASTIC FABRICATED PRODUCTS	135-138
30	LEATHER & LEATHER PRODUCTS	139-144
31	YARNS & MAN MADE FIBRES	145-146, 151, 154-157, 161, 164
32	FABRICS	147-148, 152, 158-159, 167-168, 181-182
33	OTHER TEXTILE PRODUCTS	149-150, 153, 160, 162-163, 165-166, 169-179
34	HOSIERY & KNITTED WEAR	180, 183
35	CLOTHING & ACCESSORIES	184-189
36	LUMBER & TIMBER	191
37	VENEER & PLYWOOD	195
38	OTHER WOOD FABRICATED MATERIAL	190, 192-194, 196-203
39	FURNITURE & FIXTURES	204-208
40	PULP	209
41	NEWSPRINT & OTHER PAPER STOCK	210-216
42	PAPER PRODUCTS	217-227
43	PRINTING & PUBLISHING	228-231, 233-234
44	ADVERTISING,PRINT MEDIA	232
45	IRON & STEEL PRODUCTS	235-244, 247-252
46	ALUMINUM PRODUCTS	257, 264
47	COPPER & COPPER ALLOY PRODUCTS	254, 265-266
48	NICKEL PRODUCTS	253, 268
49	OTHER NON FERROUS METAL PRODUC	246, 255-256, 258-263, 267, 269-271
50	BOILERS, TANKS & PLATES	272-275, 300

MBS ECONOMIC IMPACT ASSESSMENT MODEL
CORRESPONDENCE BETWEEN MEDIUM (100) AND WORKSHEET (602) LEVELS

I/O COMMODITIES (100 LEVEL)		I/O COMMODITY CODES (602 LEVEL)
51	FABRICATED STRUCTURAL METAL PR	276-279
52	OTHER METAL FABRICATED PRODUCT	280-298, 301-313
53	AGRICULTURAL MACHINERY	314-315
54	OTHER INDUSTRIAL MACHINERY	316-329
55	MOTOR VEHICLES	334-339
56	MOTOR VEHICLE PARTS	340-344
57	OTHER TRANSPORT EQUIPMENT	330-333, 345-352
58	APPLIANCES & RECEIVERS,HOUSEHO	299, 353-357
59	OTHER ELECTRICAL PRODUCTS	358-374
60	CEMENT & CONCRETE PRODUCTS	375, 377-379
61	OTHER NON-METALLIC MINERAL PRO	376, 380-393
62	GASOLINE & FUEL OIL	394-396
63	OTHER PETROLEUM & COAL PROD.	245, 397-402, 548
64	INDUSTRIAL CHEMICALS	117, 404-407, 411, 416-470, 473-474, 479-480
65	FERTILIZERS	403
66	PHARMACEUTICALS	408
67	OTHER CHEMICAL PRODUCTS	105, 409-410, 412-415, 471-472, 475-478, 481-496
68	SCIENTIFIC EQUIPMENT	497-503
69	OTHER MANUFACTURED PRODUCTS	504-521
70	RESIDENTIAL CONSTRUCTION	523
71	NON-RESIDENTIAL CONSTRUCTION	524-529
72	REPAIR CONSTRUCTION	522
73	PIPELINE TRANSPORTATION	540
74	TRANSPORTATION & STORAGE	530-539, 541-542
75	RADIO & TELEVISION BROADCASTIN	543
76	TELEPHONE & TELEGRAPH	544
77	POSTAL SERVICES	545
78	ELECTRIC POWER	546
79	OTHER UTILITIES	547, 549
80	WHOLESALE MARGINS	550
81	RETAIL MARGINS	553
82	IMPUTED RENT OWNER OCPD. DWEL.	557
83	OTHER FINANCE,INS.,REAL ESTATE	554-556, 558-560
84	BUSINESS SERVICES	566-567, 575-576
85	EDUCATION SERVICES	561
86	HEALTH SERVICES	562-563
87	AMUSEMENT & RECREATION SERVICE	564-565
88	ACCOMMODATION & FOOD SERVICES	569-571
89	OTHER PERSONAL & MISC. SERVICE	551-552, 568, 572-574, 577-579, 595
90	TRANSPORTATION MARGINS	583
91	OPERATING, OFFICE, LAB. & FOOD	580-582, 584
92	TRAVEL, ADVERTISING & PROMOTIO	585-586
93	NON-COMPETING IMPORTS	588-593
94	UNALLOCATED IMPORTS & EXPORTS	594
95	INDIRECT TAXES	596, 598
96	SUBSIDIES	597
97	WAGES & SALARIES	599
98	SUPPLMENTARY LABOUR INCOME	600
99	NET INCOME,UNINC. BUSINESS	601
100	OTHER OPERATING SURPLUS	602

MBS ECONOMIC IMPACT ASSESSMENT MODEL, DATA REQUIREMENTS

PLEASE SPECIFY UNITS ($'S, $000'S, $000,000'S)

I/O	COMMODITIES (100 LEVEL)	TOTAL EXPENDITURES	NON-MANITOBA EXPENDITURES	MANITOBA EXPENDITURES	MANITOBA PRODUCED %
1	GRAINS				
2	LIVE ANIMALS				
3	OTHER AGRICULTURAL PRODUCTS				
4	FORESTRY PRODUCTS				
5	FISH LANDINGS				
6	HUNTING & TRAPPING PRODUCTS				
7	IRON ORES & CONCENTRATES				
8	OTHER METAL. ORES & CONCENTRAT				
9	COAL				
10	CRUDE MINERAL OILS				
11	NATURAL GAS				
12	NON-METALLIC MINERALS				
13	SERVICES INCIDENTAL TO MINING				
14	MEAT PRODUCTS				
15	DAIRY PRODUCTS				
16	FISH PRODUCTS				
17	FRUITS & VEGETABLES PREPARATIO				
18	FEEDS				
19	FLOUR,WHEAT,MEAL & OTHER CEREA				
20	BREAKFAST CEREAL & BAKERY PROD				
21	SUGAR				
22	MISC. FOOD PRODUCTS				
23	SOFT DRINKS				
24	ALCOHOLIC BEVERAGES				
25	TOBACCO PROCESSED UNMANUFACTUR				
26	CIGARETTES & TOBACCO MFG.				
27	TIRES & TUBES				
28	OTHER RUBBER PRODUCTS				
29	PLASTIC FABRICATED PRODUCTS				
30	LEATHER & LEATHER PRODUCTS				
31	YARNS & MAN MADE FIBRES				
32	FABRICS				
33	OTHER TEXTILE PRODUCTS				
34	HOSIERY & KNITTED WEAR				
35	CLOTHING & ACCESSORIES				
36	LUMBER & TIMBER				
37	VENEER & PLYWOOD				
38	OTHER WOOD FABRICATED MATERIAL				
39	FURNITURE & FIXTURES				
40	PULP				
41	NEWSPRINT & OTHER PAPER STOCK				
42	PAPER PRODUCTS				
43	PRINTING & PUBLISHING				
44	ADVERTISING,PRINT MEDIA				
45	IRON & STEEL PRODUCTS				
46	ALUMINUM PRODUCTS				
47	COPPER & COPPER ALLOY PRODUCTS				
48	NICKEL PRODUCTS				
49	OTHER NON FERROUS METAL PRODUC				
50	BOILERS, TANKS & PLATES				

APPENDIX 7

News Release

April 18, 1995

MORE JOBS THROUGH INCREASED FUNDING FOR HEALTH RESEARCH

WINNIPEG--Manitoba's world class health research centres will get a shot in the arm and be able to maintain and create as many as 800 highly skilled health and medical jobs under a new incentive announced today by Premier Gary Filmon.

The Health Research Initiative will be piloted at the St. Boniface Hospital Research Centre for the first year and involve an estimated $450,000 of new funds in addition to the approximately $625,000 already committed annually by Manitoba Health.

Upon successful completion of the pilot, the program will be expanded to include the Health Sciences Centre/Children's Hospital Research Foundation, Manitoba Cancer Treatment and Research Foundation and the University of Manitoba. Once fully implemented, the provincial contribution is estimated at $4.3 million per year with $3.3 million in new funds, associated with over $26 million in health research investment from external and private sector sources.

"This program will create new economic opportunities through commercialization of innovations and increase the level of research in Manitoba, Filmon said, "It will leverage private sector and out of province health and medical research into Manitoba. This initiative places our world class health research centres in an excellent position to attract a significant share of growing investment from health care companies."

Filmon said the program will contribute a percentage of funds derived from external sources to the designated institute where the research is actually perfomed. The contribution would assist the research centre in meeting its operational expenses associated with the research conducted at the centre.

"We believe this will be a major help to the Manitoba research community in attracting and retaining leading scientists and increasing the competitiveness of Manitoba for health research both nationally and internationally."

Filmon said funding for the initiative will come mainly from the $10 million Health Services Innovation Fund.

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Contact: Filmon Team Communications 989-9659