An Analysis of Winnipeg's Information and Computer Technology Industry Within a Community Economic Development Framework

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ABSTRACT

The objective of this research is to analyze the extent to which the information and computer technology (ICT) industry in Winnipeg contributes to or detracts from the objectives of community economic development (CED). Using survey data supplemented by Statistics Canada data it appears as though the ICT industry does contribute significantly (although undoubtedly unintentionally) to meeting some CED goals, while failing to advance others. Those goals that are not met by the ICT industry, such as community participation, are those that are inevitably difficult for private, for profit firms.

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INTRODUCTION

The research conducted here analyzes the extent to which the ICT industry in Winnipeg contributes to or detracts from the objectives of a community economic development (CED). Although theorists have sought to find consensus on a precise definition of CED, a single accepted definition has, so far, proved illusive. Indeed there are still important debates about such crucial issues as just what constitutes a "community" and what is meant by "participating" in economic decisions. Having said this we will form a definition by extracting various components of the works by Thomas (1974), Griffiths (1974), Batten (1974), Loxley (1986), Lutz and Lux (1988), Perry (1999), and others. CED will be defined here as *placing the community at the centre of economic development—such that the community is both the beneficiary and the prime mover. By matching local resources with local needs, community members are able to realize their higher order non-economic needs, as well as their basic material needs.*

The provincial government of Manitoba recently developed a CED Policy Framework as a vital component of its strategy to "build a more inclusive, equitable and sustainable economy" (CED Initiative, 2001: 1). The policy framework used by the provincial government is similar to the analytical framework that will be set up here for the purposes of analyzing the alignment of Winnipeg's ICT sector with the goals of CED. Numerous non-governmental organizations in the city have also adopted CED principles—including, the Community Development Business Association, SEED Winnipeg, the Jubiliee Fund, Christmas L.I.T.E, the Manitoba Co-operative Council, and Assiniboine Credit Union (CED Initiative, 2001: 1). Many Winnipeg businesses have also incorporated these CED objectives into their business practices—including, Neechi

Foods Co-op., Tall Grass Prairie Bread Company and Deli, Mondragon Bookstore and Coffeehouse, and The Sedentary Nomad.[1]

The Information and Communication Technology Association of Manitoba (ICTAM), formerly the Manitoba Innovation Network (MIN), is a not-for-profit, membership based, industry organization representing the ICT industry in Manitoba. At the organization's inception, they adopted six strategic imperatives that fit within their commitment to building dynamic linkages between community and economic interests through co-operation and commitment from all constituents to ensure the future prosperity of the ICT industry in Manitoba. These imperatives are:[2]

(1) All stakeholders—government, education, and business—need to invest in new technologies and must look to fulfill their needs by turning to Manitoba-based suppliers.
(2) Governments need to foster policies that are conducive to investments in technologies from Manitoba-based companies.
(3) Technology providers and developers need to continue to develop Manitoba-based capabilities and capacity to deliver technology solutions that are second to none.
(4) Information technology is a proven stimulator of economic health. Promotion of local technology companies will enable those businesses to create and sustain Manitoba jobs, increase economic wealth, and build a robust tax base in Manitoba.
(5) Educational institutions acting in their capacity as developers of human capital and users of technology need to foster the use of Manitoba-based suppliers.
(6) Educators need to map their programs and curricula to market demand so that the Manitoba skill base will be continually rejuvenated.

Many of these imperatives of the industry association are very much in line with the stated objectives of the CED model, which will be identified and explained in section 2.

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[1] For a complete list of Winnipeg businesses who have adopted the CED objectives see the *Community Shopping Guide: Supporting a Healthy Local Economy in Winnipeg* published by SEED Winnipeg in 2003.

[2] As reported in a June 10, 2002 News Release from the Manitoba Innovation Network.

To what extent has the industry association been successful in fulfilling these goals to build a cooperative and dynamically linked industry? The analysis conducted here will shed light on this question.

The first section will provide a brief overview of the ICT industry in Manitoba. A list of CED objectives will be identified and explained in section two, which will be used to analyze the alignment of the ICT industry with the goals of CED. To complete the framework for analysis, the objectives will be matched with the appropriate analytical tools and indicators, which will provide the measuring sticks by which we can evaluate the extent to which the ICT industry is contributing to CED in Winnipeg. With the analytical framework in hand, appropriate data on the Winnipeg industry are needed to actually conduct the study. A survey of the industry was conducted in the summer of 2004 to collect the required data for the study. Section three briefly reviews the content of the questionnaire, outlines the methodology used in conducting the mail-out survey, and describes the possible survey errors that may skew the results of the study. In section four, the results of the analysis are reported within the framework set out in the second chapter.

1 ICT IN MANITOBA

The ICT industry is intimately linked with the new economy (in fact, the new economy is often defined as the ICT sector) and its corresponding utopia of high wage, high skilled jobs, cutting edge technology, and rapid economic growth. For this reason, governments have been keen to foster the development of this particular sector (including initiatives like SSHRC's financing of academic studies on the new economy) and its growth is taken as evidence that a region is well placed to thrive. The goal of this study is to put the purported benefits of the ICT sector to the test, but it will be useful to start out with an overview of the ICT sector in Manitoba.

The new economy in Canada is fairly concentrated in a few very large metropolitan areas. Quebec and Ontario are certainly responsible for the bulk of the industry in Canada with British Columbia and Alberta accounting for most of the remaining production. In Manitoba, the ICT sector has historically made a smaller contribution to GDP than is the case nationally. In 1997, Manitoba's ICT sector accounted for 2.7 percent of total GDP compared to 4 percent in Canada as a whole. This gap widened during the boom years of the ICT sector and has narrowed slightly since 2000 as the ICT share of GDP has dwindled in Canada but continued to grow in Manitoba. However, despite these small gains in the first few years of this decade, as of 2002 ICT made up 5.9 percent of total GDP in Canada but only 3.9 percent in Manitoba. The ICT sector in this province is relatively small compared with the country as a whole and, the gap has been growing slightly between 1997 and 2002.

The growth of the ICT sector has been very strong in Manitoba, but it has lagged behind the industry's growth in the nation as a whole. Compared to Manitoba, the

Canadian ICT sector experienced much stronger growth during the boom years of the late 1990s, but it also suffered through a much more precipitous fall during the bust years after 1999. Manitoba seems to have had the misfortune of missing out on the boom but the good luck of avoiding the bust. All told, however, growth in five years between 1997 and 2002 has been stronger in Canada than in Manitoba. Growth for the five years in Manitoba was 64 percent compared to 80 percent for the nation (Calculated from Statistics Canada, Trends in Provincial and Territorial Economic Statistics: 1981-2002, Table 1, p 21)

The overall numbers hide an important distribution between ICT goods and services. ICT goods manufacturing is highly concentrated in Ontario and B.C., which produce 85 percent of the national output in this sector. (Statistics Canada, 2002, 19). In addition, this sector seems to be in decline in Manitoba. While the decline of this sector in Manitoba mirrors the drop off in the nation, the sectoral growth in the late 1990s was much stronger in the nation as a whole than it was in Manitoba. As a result, this component of the ICT industry actually declined in Manitoba by five percent between 1997 and 2002 while it grew in Canada by 35 percent.

Manitoba has had more success in the services component of the ICT sector. With the exception of one year, 1998, the growth of the ICT sector in Manitoba has kept pace with the rest of the country. Also in contrast to the goods sector, the services sector has enjoyed a fairly steady expansion. Although growth rates have fallen, they still remain at a very strong eight percent in both Manitoba and Canada for 2001. The result of these two trends is that the goods component of the ICT sector has declined from its fairly insubstantial 1997 level. In 1997 the goods sector comprised 12% of the ICT

sector but by 2001 this had fallen to 7%. While this decline in the relative importance of the goods component of ICT had also occurred throughout the country it still comprised a much larger 19 percent in 2002. (Calculated from Statistics Canada, Trends in Provincial and Territorial Economic Statistics: 1981-2002, Table 1, p 21)

Finally, it is worth noting that the industry in Manitoba is overwhelmingly located in Winnipeg. Fully 85% of the ICT sector employment in the province is located in Winnipeg, compared to 63% of all provincial employment (2001 Census). Any study of the ICT sector in Manitoba must recognize that it is located primarily in one urban center, is relatively small and growing relatively slowly.

2 SETTING UP THE FRAMEWORK FOR ANALYSIS

2.1 The Objectives of CED

Although specific interests and objectives will vary widely across different communities, the literature on CED has identified a number of generalized objectives that fit within the framework of the theory. The CED objectives that will be presented here are based on a list of principles developed in 1992 by Neechi Foods Co-op—a worker co-operative in Winnipeg.[3] The first five of eight intertwined objectives focus primarily on the economics of CED. These first objectives are essentially the mechanisms by which communities may strengthen and foster their own development from within to procure for themselves a higher level of income. The final three objectives for this analytical framework are centrally concerned with the non-economic needs of the community. The CED objectives are: (1) forward and backward linkages; (2) local ownership and decision-making; (3) long term employment of local residents; (4) local skill and knowledge development; (5) local re-investment of profits; (6) physical environment; (7) health and well-being; and (8) human dignity.

Linkages

The first CED objective focuses on strengthening the economic linkages within a region. Thomas (1974: 124-5) noted that:

> If the material manifestations of underdevelopment have been expressed as the dynamic divergence in the pattern of domestic resource use, domestic demand, and needs, in the absence of an indigenous technology to provide the basis for an organic link between them, then the principal

[3] Neechi Foods Co-op was a project of Winnipeg Family Economic Development Inc. (WNFED), Winnipeg, Manitoba.

> material goal must be to seek a dynamic convergence of these relationships.

Matching local resources and production with local needs serves to strengthen local economic linkages.[4] Linkages within the economy may be either backward or forward. Forward linkages are the sales from one industry to other local industries or final demand sectors; while backward linkages are the purchases by an industry or final demand sector from various local industries.

One of the central objectives of CED is for the use of locally produced goods and services as inputs into the production processes of other businesses in the region. Strong backward linkages within a region serve to circulate income—of various types—within the local community and minimize leakages (WNFED, 1993). As businesses purchase locally produced goods and services for use in their production process, income is circulated within the local economy. If the ratio of imported input purchases to domestic input purchases is high, then the remittance of income to businesses outside of the local economy will also be high. Any income that accrues to individuals in community (in the form of wages, profits, and rent) that is spent on goods and services outside of the region is also a form of leakages.

Strengthening the backward linkages does not only circulate more income within the economy; businesses' use of locally produced goods and services also reduces the dependence of the community on external markets. Divergence of needs and resources

[4] The importance of linkages as a mechanism for regional growth and development was widely accepted even before Thomas' work on convergence in 1974. Although, the theory of convergence is attributed to Thomas, many of its principles were central to earlier regional growth theories. In particular, Canada's own Staple theory heavily relies on the backward and forward linkages as the key to the success of a region's development, via a staple export (Watkins, 1963).

unnecessarily increases the dependence of the community in meeting its needs on import markets and subjects it to external shocks. Relying less on outside markets allows communities to have greater self-reliance and restores the balance of resources and needs within the local economy (WNFED, 1993)

There are needs in a community that may be met by utilizing local resources and locally produced goods and services. According to CED theory, the primary economic goal should be to meet the needs of the community, without dependence on external markets, favouring a more autonomous approach towards economic development. In order for businesses' production of goods and services to contribute to the objectives of CED, it should satisfy the needs of other local businesses and consumers.

Beyond the goal to meet needs, production of goods and services for use in the local community serves to circulate income within the local economy through forward linkages. "While exports of commodities from the economy are necessary for development, they must be matched with a strong internal component that captures and recirculates wealth and uses it to sustain wider economic activities" (Fairbairn et al., 1991: 49). By increasing the economic linkages between businesses and between businesses and consumers, the community benefits from greater value added, which circulates income within the local economy. By minimizing leakages, the community works to stop the drainage of profits out of the region. To widen and deepen the linkages, plans for development among individual sectors must be integrated so that they complement one another (Wien, 1986: 112).

Local ownership and decision making

In the CED model, decision-making is transferred to the community—so that the community itself is the primary initiator of its own development. CED is often mistaken as economic development within a community. Economic development within a community may be pursued without the initiation, participation, or even the approval of the community in question. This may occur where an external enterprise or non-local government takes the primary role in deciding, and/or implementing strategies for development in a community. Where the community is the primary driver of development, it is free to autonomously pursue its own development for its own benefit. "Local ownership and control are considered essential if patterns of investment are to change to promote community development and if surpluses are to be reinvested locally to guarantee long term development" (Loxley, 1986: 24). Local members of the community are more likely to have a vested interest in the economic development within the community than do non-members. The non-economic aspects of community living—that is, the safety and state of the physical environment, the health and well-being of fellow community members, and the investments into training and knowledge development—are shared by those living within a particular community. Thus, planning production so as to strengthen economic linkages within the community will be more likely when ownership is local, than when it is not local. CED is a model that shifts decision making power, which stems directly from ownership, to stakeholders within the region.

Domestic ownership also serves to minimize leakages. Rents, interest and profits accrue to owners of resources, capital goods, and entrepreneurial ability. When owners are not also members of community, resource rents and profits leak out of the region

(Loxley, 1981: 158). Non-community members who own resources, land, or businesses may be able to make large profits, but because ownership is not local, these profits tend to leak out of the community. Civic Economics, based in Chicago, recently published the results of *The Andersonville Study of Retail Economics*, which compared the economic impact of ten locally owned businesses and their chain competitors (Civic Economics, 2004: 1). The study found that "for every $100 in consumer spending with chain firms, $43 will remain in the local economy; if that same spending occurs with a locally-owned firm, that value jumps by 58 percent, to $68" (ibid., 5). The results of similar studies also show that locally-owned businesses may generate substantially greater economic impact than non-locally-owned businesses.[5] Local ownership serves to minimize leakages and strengthen the economic linkages within the community.

Let us turn our focus to the type of ownership. Many CED and regional growth theorists argue that collective ownership is necessary for community decision-making. "Communal ownership is thought to be the only type compatible with the strong democratic and participatory philosophy underlying some approaches to community development" (Loxley, 1986: 24). The primary types of communal ownership may include consumer or worker owned cooperatives, community development corporations and non-profit incorporated entities (ibid., 25). Communal ownership, Loxley argues, may also be exercised through partnerships, and for-profit enterprises (25).

The idea that ownership of the productive capacity of the community should not be held in a few private hands is not universally accepted by CED theorists. "The state

[5] The Institute for Local Self-Reliance, a non-profit research and educational organization in Minneapolis, Minnesota, lists recently published studies on sound economic development strategies on its website http://www.newrules.org.

must assume a dominant role, but rather than socialize the means of production, it must work to coordinate private and public enterprise in order to overcome the obstacles and contradictions between centre and periphery" (Chilcotte, 1984: 27). It is very possible for communal ownership to be exercised through partnerships between the private and public sphere. "Even companies incorporated as profit making entities can be operated in a manner that permits community input and control if the desire is there" (Loxley, 1986: 26). A for-profit business may have broader community goals in mind than a purely profit maximizing one (ibid., 26).

Long term employment of local residents

Secure, well-paying, personally satisfying employment enables community members to not only meet those needs that require a reasonable income, but also contribute to members' sense of self-worth. Therefore, job creation must be an important element of CED. Fred Wien (1986: 109) notes that:

> The increasing modern industrial activity (i.e. resource extraction or product manufacturing) is capital intensive, and in the absence of linkages, such industrial activity will provide few jobs. Most economies have labour surpluses, and thus development of capital intensive industries may not serve to fully utilize the resources available in the community.

In an economic system in which the capital is held in private hands, stable, long term employment is found in the wage labour market. While wage earners inevitably lack control over the labour process and product, compromising some of the non economic CED goals, long term, high wage employment is the most readily available means to meet economic needs for most of the population.

Local skill and knowledge development

Training members of the community for employment within the community is a highly valued characteristic of the CED model. Development of human capital increases the employability and income potential of community members and also serves to increase the production capacity of communities. (WNFED, 1993) More generally, education serves to increase individual well-being through cognitive and skill development.

Local re-investment of profits

Another objective of CED is for profits to be re-invested back into the community. If profits are produced within the region, then they ought to remain in the region so as to benefit community members and increase economic activity. Again, the likelihood that profits will be re-invested locally will be higher when ownership is local rather than non-local. Re-investing profits locally will minimize the leakages associated with income drainage, and also works to increase community self-reliance and cooperation (WNFED, 1993).

Ideally, the distribution of profits or the social surplus may be measured using income-expenditure analysis (see Appendix A). Using income-expenditure analysis, the surplus may be examined so as to trace its distribution to those within the community, and those agents outside of the community. However, to trace the distribution of profits of a particular business or industry requires availability of very detailed financial records from businesses within the industry. Such confidential information of business investments is neither readily available nor easily collected. Due to the difficulty of

collecting data at the local, industry level for this objective, it will not be further analyzed in this study.

Physical environment

CED is not only concerned with economic development. CED has a strong sustainable development component because it is believed that the key to vibrant communities is a healthy, safe, and attractive neighborhood (WNFED, 1993). Ecological sensitivity in business decisions, individual activity, and community projects is paramount in ensuring that economic development is pursued in such a way so that the impact on the environment is minimized. (CED Initiative, 2001: 3) A sustainable physical environment is a shared need of the community; and the physical environment is also a valuable resource for the community. It is the goal of the community to balance these two constraints in planning economic development.

The physical environment also greatly benefits from the close proximity of production and consumption, which would be an inevitable result of meeting local needs with local resources. Nozick (1993: 29-30) explains that:

> The self-reliant community—which consumes what it produces and produces what it consumes, which replenishes itself with its own reprocessed wastes, and which extracts the maximum work out of its own existing resources—is contributing to the sustainability of the planet by reducing pollution and depletion of the earth's resources.

The physical movement of goods and services across air, land, and water from one global market to another is costly for the environment. The further goods and services must be transported before they are consumed, the greater is the potential damage to the natural environment. If goods and services are both produced and consumed within a small

geographical area, production and transportation externalities will be more likely to be internalized. Convergence of production and consumption also creates bioregional feedbacks which may expose many of the environmental consequences of consumption, and thus encourage a more harmonious integration of economic development and nature (Nozick, 1993: 29). Similarly, if ownership of the productive capacity is local, then the environmental costs of production are more likely to at least be known.

Health and well-being

The physical and mental health of individuals in the community is an important goal in CED. "A community is only as healthy as its individual members: at the same time, an individual's health depends upon the health of the community which shapes social attitudes and provides the individual with opportunities to live up to his or her potential" (Nozick, 1993: 29)

Human dignity

"A community plays an important role in helping its individual members to meet the full range of both their material and non-material needs" (Nozick, 1993: 37). In contrast to this CED ideal, particular groups of individuals are often excluded from fully participating in their communities. CED theory is particularly concerned with these marginalized groups. Some groups in society are underrepresented the more desirable sections of the labour market. Women, minorities and immigrants are frequently cited examples of groups that face barriers both in the labour market itself and within broader society that creates difficulty in the labour market. Women, for example, may face

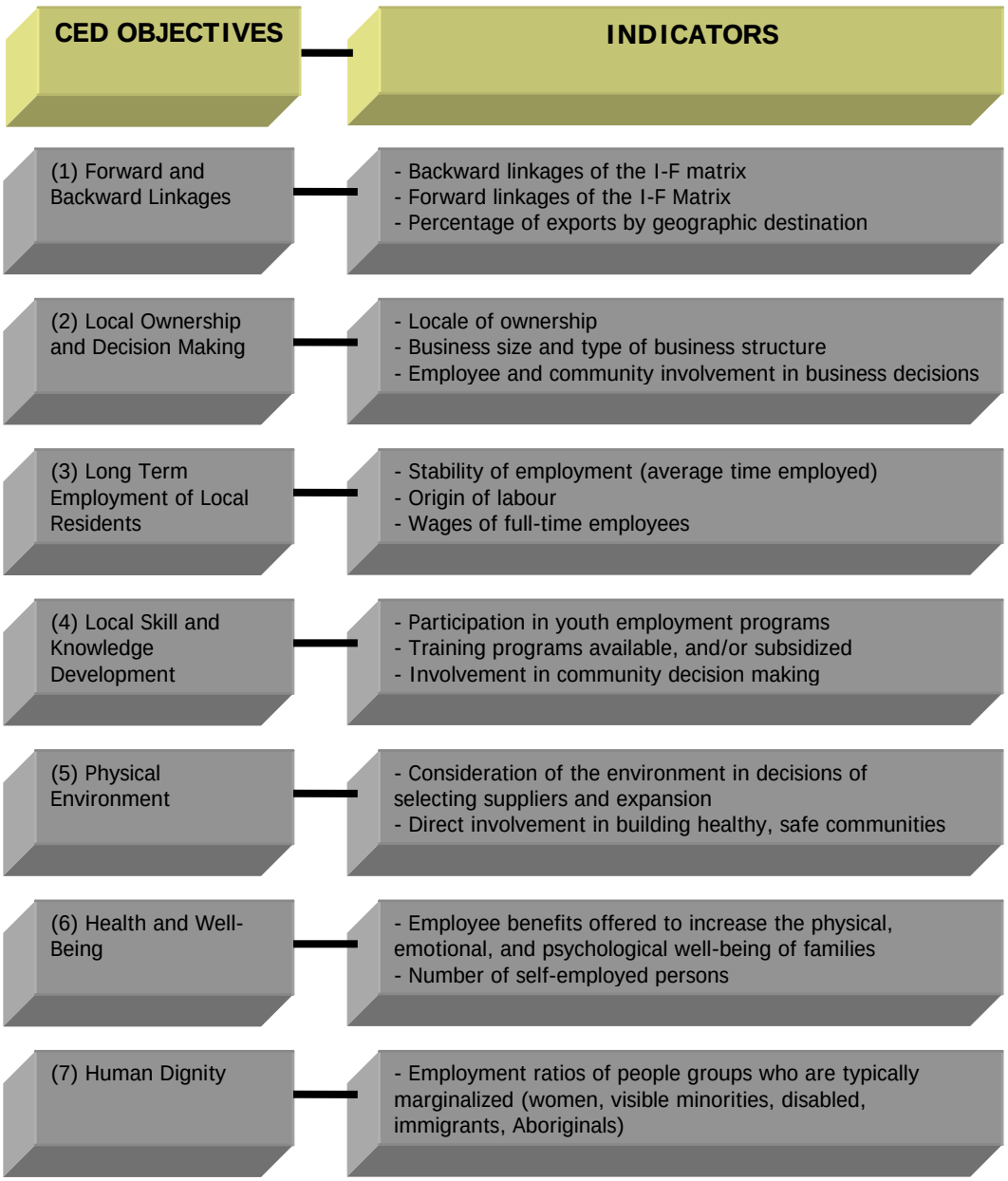
gender discrimination in the labour market and also tend to be responsible for household production, which often limits them in the labour market. So long as the primary source of income remains wage labour, ensuring access to desirable employment for disadvantaged groups is the most obvious method of meeting the needs of disadvantaged community members.

2.2 The Tools and Indicators to Complete the Framework for Analysis

We now face the painstaking task of finding appropriate indicators to measure these nine objectives. The framework for analysis, which matches the CED objectives with the relevant indicators, is presented in Figure 2.1.

There are three main tools used in regional economic analyses: economic base multipliers, income-expenditure multipliers, and input-output matrices. These three analytical tools are reviewed and discussed in terms of their advantages and disadvantages for regional analysis in Appendix A. The extent to which the industry uses local goods and services and produces goods and services for local use—that is, the first two CED objectives—will be best measured using a simplified form of the input-output (I-O) analysis. This simplified version of I-O analysis—known as, intersectoral flows (I-F) analysis—is also outlined in Appendix A. Both the I-O and I-F tables may be used as tools to identify a region's production and use of intermediate goods. An I-F table will be constructed to measure the backward and forward linkages within the ICT sector itself, and between the ICT sector and the rest of the Winnipeg economy. The I-F matrix will be used, rather than the I-O matrix since the data collected in this study are of sales flows only (see Appendix A for further discussion).

Figure 2.1 Framework for Analysis



Developing these indicators was made considerably more difficult due to data constraints. Data on local economies is notoriously difficult to come by and information on a particular industry within a local economy is even more elusive. Statistics Canada

data on the ICT industry is collected at the regional level grouping all of the prairie provinces together. Industry level data at the local level is available from the census, however, the range of information collected by the census falls well short of the requirements of this study. As a result, we conducted a survey of Winnipeg ICT businesses in the summer of 2004. The questionnaire used in this survey was specifically designed to obtain the data needed to analyze the ICT industry's contributions to the seven remaining (recall that data is not available for local reinvestment of profits) CED objectives. The content of the questionnaire is in Appendix B. In various parts of the analysis, this primary data source will be supplemented by Census 2001 data and other industry-level data collected by Statistics Canada.

The alignment of the industry with the first objective will be analyzed by examining the backward linkages of the constructed I-F matrix of the ICT industry. Because the I-F table is only of the ICT industry, and not of the Winnipeg economy as a whole, the backward linkages will only indicate the extent to which the sub-industry groups of the ICT industry are convergent. The industry's use of goods and services produced by non-ICT businesses in Winnipeg is, unfortunately, not captured in the industry I-F table. To have completed an I-F table for the entire Winnipeg economy would have required significantly more data than would have been feasibly collected for this study.

The extent to which the industry produces goods and services for local use will be measured using the forward linkages of the constructed ICT industry I-F matrix. The forward linkages provide a picture of the convergence between the sub-industry groups of the ICT industry, as well as the convergence between the ICT industry and Winnipeg

economy as a whole. Data collected on the geographic destination of ICT exports will further the analysis of this objective. The connection between the industry's production of goods and services for local use and the type of business will also be examined to shed further light on the hypothesis stated above.

Three indicators will be used to measure the extent of local ownership and decision-making. First, data on the geographical residency of owners will be used to measure the extent of local ownership. Second, data on the firms' ownership structure will measure the extent that the ICT industry in Winnipeg is held privately or in alternative ownership forms. Third, data on the extent of worker or community involvement in decision making will examine the extent to which the broader community participates in firm decisions.

Third, the objective of long term employment for local residents will be analyzed using three measures. The stability of employment will be analyzed using data on the average length of employment. Data on the origin of labour employed in the industry will be used to analyze the extent to which the industry employs local residents. The average wages of full-time employees will be used to analyze the extent to which the industry contributes to providing well-paying jobs to community members.

The fourth objective, local skill and knowledge development, will be analyzed using a variety of data on the industry's participation in these areas. We will use data from survey questions to determine the extent to which firms participate in youth employment, training, or education programs. ICT businesses also have significant knowledge and skills that they may share with the local community. Survey data on the

sector's participation on community boards and mentorship of other start-up businesses will be used for this part of the analysis.

The physical environment, the fifth objective, will be analyzed using data on the industry's consideration of the environment in selecting suppliers. The connections between ecological sensitivity, concern for local ownership and decision-making, as well as the type of business will provide extra insight into the analysis here. Data collected by the survey on businesses' direct involvement in building healthy and safe neighbourhoods will also be used to analyze the ICT industry's contributions to this environmental objective. To actually quantify the environmental impact of the industry far exceeds the scope of this research, thus no attempt to estimate the sector's actual contribution to a clean, green environment will be made.

The CED objective of the health and well-being of community members will be analyzed using the survey data on the employee benefits offered by the ICT sector. Businesses that offer dental and medical plans, day-care, flex-time, and job-sharing contribute to the physical and psychological well-being of employees and their families. The availability of these employee benefits will be used to analyze the extent to which businesses in the industry are concerned with the well-being of their employees and their families. The second measure that will be used to analyze the contributions of the industry to health and well-being is the number of self-employed persons in the industry. If owning your own business increases well-being, then an industry that is made up of many small businesses contributes to community health and well-being.

Identifying the indicators that will be used to analyze the extent to which the industry contributes to or detracts from the final objective of human dignity will complete

the analytical framework. Businesses may work towards this objective by implementing employment equity to deliberately hire individuals who have been typically excluded from the labour market. Data on the composition of labour in the ICT industry in Winnipeg will be used to construct employment ratios of particular groups of individuals who are typically marginalized in the labour market. These groups will include women, visible minorities, disabled persons, immigrants, and Aboriginals. These employment ratios in the ICT industry will be compared with the corresponding employment ratios of the entire labour force in Winnipeg.

This CED framework is now complete and ready for analysis of the ICT industry in Winnipeg. Section three describes the methodology and design of the survey that was used to collect the required data to use the framework for analysis.

3 METHODOLOGY

Regional data at the industry level is always difficult to come by and the ICT industry is no exception. The 2001 census collected industry-level employment data. Statistics Canada also collects quite good ICT data nationally, but has much more limited regional data. Indeed, Manitoba is lumped in with Saskatchewan as “the prairie region”. The lack of Winnipeg-specific data on the industry was the major factor in the decision to conduct a mail-out survey of Winnipeg ICT businesses.

3.1 The Questionnaire

The questionnaire was divided into six sections. The first section—section A—was designed to gather contact information of the businesses for classification purposes only. The remaining five sections formed the core of the five-page questionnaire. Section B included questions on ownership and decision making; section C was made up of questions on the purchasing and type of the business; section D included questions concerned with the distribution of sales; questions on employment formed section E; and section F was made up of questions on the nature of investments made by the business.

Two previous Manitoba studies significantly influenced the development of the questionnaire for this research. In the first of these, SEED Winnipeg surveyed Winnipeg businesses in 2003, in order to determine those that met the criteria for inclusion in the ‘Community Shopping Guide: Supporting a healthy local economy in Winnipeg’. In the second previous study, Richard L. Kenny (1981) surveyed all businesses in the municipal boundary of Leaf Rapids, Manitoba in order to apply the economic base multiplier and input-output analysis to the entire economy of Leaf Rapids. Consequently, his

questionnaire was mainly concerned with gathering data from each business on total employment and on the percentage breakdown between sales to customers located outside the area and sales to customers located inside the study area (Kenny, 1981: 64). The questions regarding the breakdown of sales between intermediate industries and final demand sectors in Kenny's survey were drawn upon extensively in formulating the questions in section D of the questionnaire developed here, on the distribution of sales.

3.2 Survey Methodology

Recognizing the importance of these two previous Manitoba surveys in the phrasing of questions and in the overall development of the questionnaire used in this research is fundamental. Don A. Dillman (2000) presents some important principles to be followed in surveying businesses in particular. The most important principle in business surveying is to "conduct on-site cognitive interviews to help tailor the questionnaire to people's ability to respond and to gather intelligence information for targeting its delivery and retrieval" (ibid., 347). These cognitive interviews are important for shaping questions that will enable respondents to understand the questions and to answer them correctly (ibid., 347-8). Although the development of the questionnaire for this research did not include conducting cognitive interviews with a small sampling of ICT businesses as Dillman strongly suggests, the questionnaire did largely develop out of the two cited surveys previously conducted in Manitoba. Thus, the questionnaire benefits from employing questions already defined and successfully used in previous studies. Furthermore, two individuals who have conducted numerous surveys in various fields of study were also consulted to review the questionnaire for its general design and wording of questions.

The survey population for this research consists of the ICT industry in Winnipeg, Manitoba as of May 2004. The Winnipeg Information Technology Directory compiled by a sector of the Government of Manitoba in September 2003 served as the sample frame, or the list of businesses in the industry from which the sample to be surveyed was drawn. In this case, all businesses in the directory were included in the survey, such that the entire sample frame was included in the sample. In other words, the sample rate was 100 percent (i.e. a census).

The sample frame included mailing addresses, contact names, phone numbers, fax numbers, email addresses, and web pages for 434 ICT businesses in Winnipeg, Manitoba. Thus, the appropriate contact person for each business, along with their contact information, was readily available. Dillman (2000: 341) highlights that identifying the appropriate respondent is an important element of business surveying so that all communication may be directed towards the same person. Throughout the research, knowing the contact person up front simplified phone calls and aided in ensuring the mailed survey arrived on the appropriate desk, especially in middle-to large-size businesses.

Dillman (2000: 151) recommends five elements to achieve high survey response rates: a brief pre-notice letter; a questionnaire mailing; a thank you postcard; a replacement questionnaire; and a final contact. In this research, all businesses to be included in the survey were initially contacted by telephone to provide pre-notice of the survey that was to follow in the mail. In total, 308 out of 434 businesses were contacted before the first mailing of the survey (152 of these 308 pre-notices were left as voicemail messages). This initial contact by telephone, as opposed to the pre-notice letter suggested

by Dillman, was also used to verify and correct mailing addresses and contact names. The phone numbers of 39 businesses were found to be either not in service or wrong numbers. Eighty-seven businesses were not called before the mailed survey for various reasons: including that there was no phone number given, there was no answer after repeated attempts, or the line was repeatedly busy.

The questionnaires were mailed to all 434 businesses within the same week that these initial phone calls were made. A cover letter explaining the research and the importance of their response was included with the questionnaires, as suggested by Dillman (2000: 151). Postage-paid self-addressed envelopes were also included in the mail out package. Seventy-seven questionnaires came back as 'Return to Sender' due to wrong addresses (many of these were the same businesses with phone numbers that were not in service). Efforts to find correct addresses by checking for current mailing addresses on the business websites and the MTS Yellow Pages resulted in 14 surveys being re-mailed to new addresses (one of these came back 'Return to Sender'). At this stage 64 (77 – 14 + 1) businesses were removed from the sample frame. Forty-seven surveys were completed and returned before further contact.

Dillman (2000: 151) suggests that the third contact to all businesses be in the form of a thank you postcard to express gratitude for responding, or as a gentle reminder to those who have not yet responded. Within 2 to 4 weeks of the thank you postcard, a replacement questionnaire is to be sent to all non-respondents (ibid.). This fourth contact is to be followed by a final contact by telephone or priority post mail within a week (ibid.). In the survey design used here, the final three contacts in the sequence were not followed as closely as the first two were. This was due in large part to the costs of the

extra two mailings required in Dillman's survey design. Four weeks after the mail out, non-respondent businesses were contacted by telephone to encourage completion of the questionnaire. In this stage of the survey, 208 businesses were contacted by telephone (117 of these reminders were left as voice mail messages). Fourteen replacement questionnaires were sent to businesses, upon their request.

The final contacts by telephone revealed that at least 15 businesses were not completing the questionnaire because they were not in the ICT industry. Numerous businesses included in the original sample frame were new media, or graphic design businesses–-a sector which the provincial government included in their Winnipeg Information Technology Directory. The research conducted here did not intend to include new media within the ICT industry, and consequently three questionnaires completed by new media businesses were not usable for analysis. Thus, the 18 (15 + 3) new media businesses were also excluded from the sample frame. Subtracting the 64 nonexistent businesses and 18 new media businesses from the sample frame left the sample frame with 352 businesses. In all, 64 complete and useable questionnaires were returned to be used in the analysis. Dividing the number of returned surveys by the sample frame yields the response rate of the survey equal to 18.2 percent (64/352). This response rate is not particularly high, indicating that the results of the survey should be taken with a note of caution (Dillman 2000). The extent to which this low response rate might create problems with our findings is explored in Appendix C.

4 THE ANALYSIS OF WINNIPEG'S ICT INDUSTRY

The analysis of Winnipeg's ICT industry will be structured within the framework set out in section two. Each of the nine objectives of CED will be analyzed using the data collected by the survey of the ICT businesses. Where supplementary data are used, the data source will be explicitly noted. Thus, unless explicitly identified otherwise, all data used in the following analysis are the data obtained by the survey conducted specifically for this study.

Before moving on to the analysis of the CED objectives individually, the intersectoral-flows (I-F) table will be constructed using data collected by the survey, for use in the analysis of the first two objectives. The I-F matrix will provide an overview of the economic linkages both within the ICT industry and between the ICT industry and the Winnipeg economy as a whole.

This study will use Industry Canada's definition of the ICT industry. The manufacturing component consists of:

1. Commercial and Service Industry Machinery Manufacturing (NAICS 3333);
2. Computer and Peripheral Equipment Manufacturing (NAICS 3341);
3. Communications Equipment Manufacturing (NAICS 3342);
4. Audio and Video Equipment Manufacturing (NAICS 3343);
5. Semiconductor and Other Electronic Component Manufacturing (NAICS 3344);
6. Navigational, Measuring, Medical and Control Instruments Manufacturing (NAICS 3345); and
7. Communication and Energy Wire and Cable Manufacturing (NAICS 33592).

The intangible services include:

8. Software Publishers (NAICS 5112);
9. Telecommunications (NAICS 517);
10. Internet Service Providers, Web Search Portals, and Data Processing Services (NAICS 518); and
11. Computer Systems Design and Related Services (NAICS 5415).

The goods related services are:

12. Computer and Communications Equipment and Supplies Wholesaler-Distributors (NAICS 4173)
13. Office and Store Machinery and Equipment Wholesaler-Distributors (NAICS 41791)
14. Office Machinery and Equipment Rental and Leasing (NAICS 53242)

In order to appropriately include part-time employment in the construction of the I-F table, employment is conventionally measured in full-time job equivalents. The survey collected data on the number employed full-time (30 or more hours per week), part-time (10 to 30 hours per week), and casually (less than 10 hours per week). Statistics Canada reports that the average number of hours worked by part-time employees in 2004 was 15.8 hours a week. This average includes hours worked by casual labour, which is separated from part-time labour in the survey used in this study. To be consistent with the Statistics Canada data, part-time and casual employment may be summed together and weighted accordingly. Essentially, this sum of all part-time employees is weighted by one half and added to the number of full-time employees (those working over 30 hours a week), such that:

Full-time job equivalent = full-time employees + ½ part-time employees.

The breakdown of total employment by sub-industries for the survey of the ICT industry is shown in Table 4.1. As a comparison, Table 4.2 shows the number of persons employed in the sub-industry groups of the ICT industry in Winnipeg according to the 2001 Census. Comparing these two tables yields two very different pictures of the distribution of employment within the ICT industry. The most obvious incongruence is in the percentage of employment in telecommunications. Employment in

Table 4.1 Employment by Sub-Industry Group in the Survey of the ICT Industry Winnipeg, Manitoba 2003

	Number of Employees[a]	Number of Self-Employed Persons	Total Number Employed	Percentage of Total[b]
1. Commercial and Service Industry Machinery Manufacturing	0.0	0.0	0.0	0.0
2. Computer and Peripheral Equipment Manufacturing	16.5	3.1	19.6	1.8
3. Communications Equipment Manufacturing	0.0	0.0	0.0	0.0
4. Audio and Video Equipment Manufacturing	0.0	0.0	0.0	0.0
5. Semiconductor and Other Electronic Components Manufacturing	0.0	0.0	0.0	0.0
6. Navigational, Measuring, Medical and Control Instruments Manufacturing	13.0	2.0	15.0	1.3
7. Communication and Energy Wire and Cable Manufacturing	0.0	0.0	0.0	0.0
8. Total Manufacturing	29.5	5.1	34.6	3.1
9. Software Publishers	288.0	31.0	318.9	28.7
10. Telecommunications	3.6	0.8	4.4	0.4
11. Internet Service Providers, Web Search Portals and Data Processing Services	50.2	13.0	63.2	5.7
12. Computer Systems Design and Related Services	629.3	47.3	676.6	60.8
13. Computer and Communications Equipment and Supplies Wholesaler-Distributors	10.2	1.7	11.9	1.1
14. Office and Store Machinery and Equipment Wholesaler-Distributors	0.0	0.0	0.0	0.0
15. Office Machinery and Equipment Rental Leasing	3.3	0.0	3.3	0.3
16. Total Services	984.6	93.7	1078.3	96.9
17. Total Employment in Industry	1014.1	98.8	1112.9	100.0

[a] In full-time job equivalents
[b] May not add exactly to total because of rounding

Table 4.2 Employment by Sub-Industry Group in the ICT Industry Winnipeg, Manitoba 2000 (as reported by the 2001 Census)

	Total Number in Labour Force	Percentage of Total[a]
1. Commercial and Service Industry Machinery Manufacturing	60.0	0.5
2. Computer and Peripheral Equipment Manufacturing	115.0	0.9
3. Communications Equipment Manufacturing	220.0	1.8
4. Audio and Video Equipment Manufacturing	15.0	0.1
5. Semiconductor and Other Electronic Components Manufacturing	150.0	1.2
6. Navigational, Measuring, Medical and Control Instruments Manufacturing	755.0	6.1
7. Communication and Energy Wire and Cable Manufacturing	410.0	3.3
8. Total Manufacturing	1725.0	14.0
9. Software Publishers	230.0	1.9
10. Telecommunications	3905.0	31.8
11. Internet Service Providers, Web Search Portals and Data Processing Services	1055.0	8.6
12. Computer Systems Design and Related Services	3095.0	25.2
13. Computer and Communications Equipment and Supplies Wholesaler-Distributors	650.0	5.3
14. Office and Store Machinery and Equipment Wholesaler-Distributors	1165.0	9.5
15. Office Machinery and Equipment Rental Leasing	460.0	3.7
16. Total Services	10560.0	86.0
17. Total Employment in Industry	12285.0	100.0

[a] May not add exactly to total because of rounding

Source: 2001 Census Data, Statistics Canada

telecommunications represents less than one percent of the total employment captured in the survey. Yet in reality, telecommunications is the largest component of the ICT industry in Winnipeg—employing 30 percent of the labour force in the ICT industry. Most of those working in the telecommunications industry are employed by Manitoba Telecom Services—the third largest telecommunications company in Canada. Unfortunately, Manitoba Telecom Services (MTS) was not one of the businesses that completed and returned the questionnaire, and thus it is not included in the sample survey. Thus, telecommunications are highly underrepresented in the survey. In contrast, Computer Systems Design and Related Services is overrepresented. Employment in this sector makes up 60.8 percent of total employment in the survey sample, but only 25.2 percent in the 2001 census. Finally, the manufacturing industry as a whole is also underrepresented. Although ICT manufacturing makes up a small proportion of the overall industry in both the survey and 2001 Census, it only represents 3.1 percent of total industry employment in the survey, but a much more substantial 14 percent in the Census.

The I-F table for the ICT industry is shown in Table 4.3. Each row in this table shows how much industry employment was generated by sales to other firms in the ICT industry, other local businesses, local government, local consumption, and exports out of Winnipeg.

Forward and Backward Linkages

In an I-F table of an entire economy, the backward linkages are able to measure the extent to which local businesses, consumers, and governments use goods and services

produced in each local industry. However, in the ICT industry I-F table, the backward linkages are not as useful. The backward linkages only indicate the extent to which the ICT industry uses other goods and services produced by other firms in the ICT industry. Unfortunately, the industry's use of locally produced non-ICT goods and services is not captured in the I-F table. To complete the I-F table to include all employment in Winnipeg would have required significantly more data than would have been feasible for this study. The backward linkages that are captured in the I-F matrix of the ICT industry are minimal—the ICT industry uses very little other ICT manufactured goods and services in the production process.

Table 4.3 ICT Intersectoral Flows Table for Survey Firms, Winnipeg, 2003

	ICT Industry	Other Local Business	Local Consumption	Local Government	Exports from Winnipeg	Total Employment
Employment Percentage	3.3	21.8	8.0	26.0	40.6	100
Full Time Job Equivalents	41.6	242.2	88.8	288.8	451.6	1112.9

The model of CED used in this research is that of convergence, following in the tradition of Thomas. Convergence centres around the idea that exports of goods and services produced within a region are a symptom of a divergence of resources and needs. Other regional growth theories, such as staple theory and the economic base model, consider exports as the engine of growth for the region. Yet, even these two theories include components to encourage the strengthening of dynamic linkages between industry sectors either to supplement the export sector, or to eventually replace the staple export. The bias of this particular study is towards the model of convergence—such that

the production of goods and services is most beneficial for CED if they are purchased and used to meet needs within the region, rather than exported out of the region.

The forward linkages of the I-F matrix within the ICT industry are minimal. Approximately 3.3 percent of employment is generated by sales to other businesses in the ICT industry. However, the linkages between the ICT industry and the local Winnipeg economy are much stronger. A high percentage of goods and services are purchased by other local non-ICT businesses, local governments, and local consumers. The I-F table shows that overall, 21.8 percent of employment in the ICT industry is generated by sales to local businesses; 8.0 percent is generated by sales to local consumers; and 26.0 percent is generated by sales to either the City of Winnipeg, or the provincial government of Manitoba (along row 15). Thus, approximately 40 percent of employment in the industry is generated by exports out of the city, while just less than 60 percent is generated by sales to other Winnipeg businesses, local consumers, and local governments. Using the data from the survey on total adjusted gross revenue (gross sales less sales tax), as opposed to full-time job equivalents as the base measure to estimate ICT export activity, yields that 58.1 percent of goods and services are sold to Winnipeg markets.

The survey permits a further break down of exports to more detail than we have discussed up to this point. Table 4.4 shows revenue accrued from sales to various markets as a percentage of the total. The primary export market for firms in this survey is the United States: one quarter of the goods and services produced are sold to the United States. Very few ICT goods and services are sold to demand markets outside of Canada or the United States. The breakdown of exports by geographic destination for the ICT industry is shown in Table 4.4. Compared to the entire provincial economy, the ICT

sector sells a larger percentage of its goods to the local market. While 29% of Manitoba's GDP is exported to other countries, which is very close to that of the ICT firms in the sample, 31% of the GDP in Manitoba is shipped to other provinces, much more than the 6.1% in our sample (Statistics Canada, Cansim table 384-0002)

Table 4.4 Exports of ICT Manufactured Goods and Services by Survey Firms

	Within Winnipeg	Out of Winnipeg, but within Manitoba	Out of Winnipeg, but within Canada	In the United States	In other Countries (excluding the United States)
Percentage of ICT manufacturing and services sold to markets	58.1	9.5	6.1	25.1	1.2

Sorting the businesses according to size shows that the 32 smallest businesses in the survey sell 63 percent to Winnipeg markets on average, while the 32 largest businesses in the survey sell 59 percent to Winnipeg markets on average. Thus, smaller businesses are only slightly more likely to sell goods and services produced to local markets, than are larger businesses. Examining the locale of ownership indicates that on average, 59 percent of the goods and services produced by businesses that are 100 percent locally-owned stay within Winnipeg; while 66 percent of the goods and services produced by businesses that are not completely owned by Winnipeg residents stay within Winnipeg. Thus, locally-owned businesses are slightly less likely to produce goods and services to meet local needs than are businesses that are not completely locally-owned.

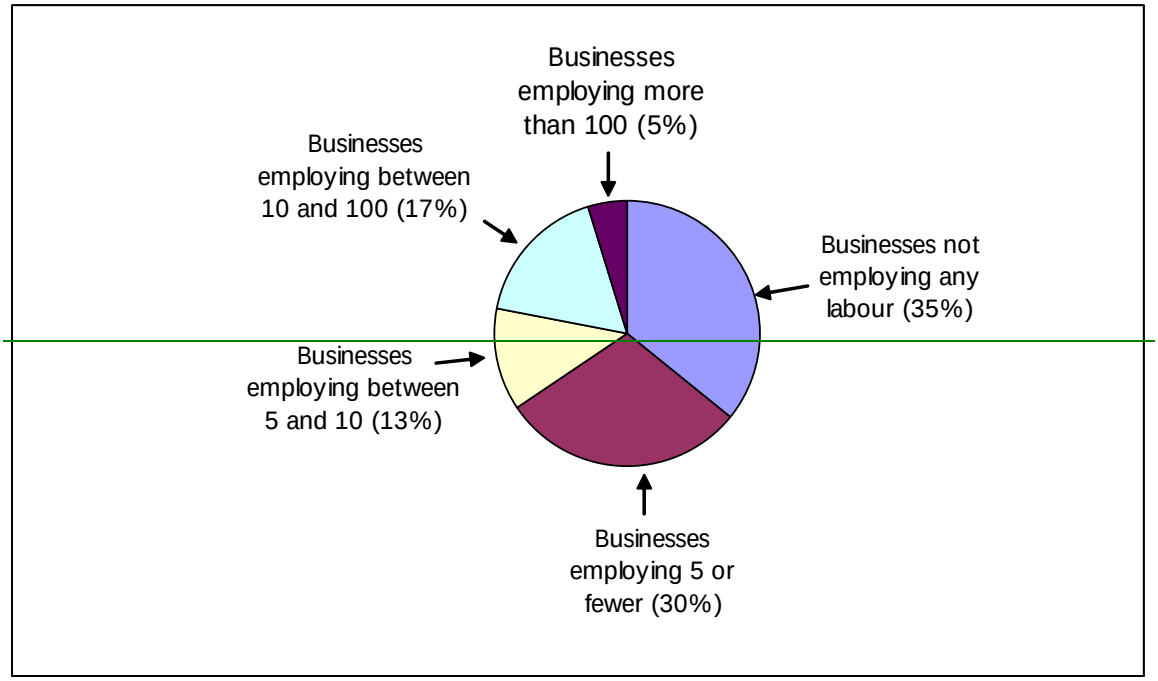
Local ownership and decision making

The industry firms in this survey sample are mainly small locally-owned businesses. Table 4.5 shows the distribution of ICT businesses in the survey by size. More than one third of the businesses in the survey do not employ any wage labour. Only three businesses in the survey hire more than 100 full-time employees. The ICT industry is primarily made up of small businesses employing little or no labour. Many small businesses share the market with only a few very large Winnipeg ICT businesses. Comparing these numbers with data reported by the Information and Computer Technology Association of Manitoba (ICTAM), a not-for-profit membership based industry organization representing the ICT industry in Manitoba, indicates that the sample survey is very representative of the disproportionate number of small and medium-sized businesses in the ICT industry. ICTAM reports that 26 percent of the ICT industry in Manitoba is made up of businesses with less than 10 employees; 67 percent is made up of businesses employing between 10 and 50 employees; three percent is made up of businesses employing between 50 and 100 employees; and businesses employing over 100 employees make up four percent of the industry.

As is generally the case with small firms, ownership is predominantly local. Over 90 percent of the owners of the ICT businesses surveyed live within Winnipeg.[6] Sorting the data set according to the size of business shows that the 42 smallest businesses are all 100 percent locally-owned. Many of the other 22 businesses in the sample are also completely owned by Winnipeg residents, but certainly the size of the business is a predictor of the locale of ownership

[6] Four businesses are removed from the sample here because they are publicly-owned and thus the location of ownership is not known. The sample size for this question is 59. These four publicly-owned businesses will be discussed separately for this analysis on the type of ownership.

Table 4.5 ICT Survey Businesses by Size, Winnipeg, Manitoba, 2003



Four of the businesses responding to the survey are owned by numerous shareholders who, presumably, may reside anywhere around the globe. These four businesses were removed from the sample in the above discussion, because the residency of shareholders is not known. Upon examination of the characteristics of these four businesses, it is found these publicly-owned businesses make some contributions to the goals of CED. Employees of two of the four publicly-owned businesses hold at least some of the publicly traded stock, and all four businesses reported that employees share in the decision-making. Each of these businesses also attempt to choose suppliers that are local to the immediate community. Over 75 percent of the goods and services produced by these publicly-owned businesses are for local use, which is 20 percentage points more than the proportion of production for local use of the entire survey. These four businesses also contribute more to the CED objectives than does the sample survey on average in

terms of benefits offered and participation in youth employment. Yet, they perform poorer in terms of concern for the environment, hiring of typically marginalized persons, and recruiting employees who are also residents of local community. The impact of these publicly-owned businesses on the community is mixed.

Of the businesses employing labour, 42 percent of businesses are at least partially owned by their employees. Having partial ownership of the business allows employees to share the profits of the company. It may also provide more opportunities for employees to participate in the decision-making process in some capacity than would otherwise be the case where employees do not share ownership. Even if they are not also owners of the business, employees may be able take part in the decision making process regarding how the business will be managed. Almost 70 percent of businesses in the ICT survey report that their employees are actively involved in making decisions pertaining to various aspects of the business. Indeed, the survey data indicates that employees who are also part owners of the business are 39 percent more likely to participate in the decision-making process.[7] Although business in the survey claim to include employees in firm decision making, the extent to which this is true, and importantly, the type of decision making permitted employees cannot be known from the general nature of the survey question. Studies on worker participation in other industries, which have explicitly attempted to grant employees more decision making power, have concluded that even in these cases, the range of employee decision making is quite limited, generally tapping the employee's knowledge of the production process in an effort to increase productivity or decrease costs. Crucial decisions surrounding the nature of investments, use of profits,

[7] Upon separating businesses that are partially owned by employees from those which are not, this statistic is the difference between the proportions of these businesses which involve employees in business decisions.

the choice of technology and corporate tactics remain very much in the hands of upper level management or ownership. (See, for example, Graham 1993)

In contrast to employee decision making, firms in the survey did not even claim to include the broader community in their decision making process. Only 6.5 percent of businesses identified that they had ever taken steps to include the local community in decision making.[8] Of these, only one of the businesses has taken formal steps to discuss their plans for expansion with local residents and city representatives. Formal consultation with the community on matters regarding decisions of the ICT industry is virtually non-existent.

Long term employment of local residents

Of the 41 businesses who employ labour, the average length of employment was reported as 59.3 months, approximately five years. This is remarkable longevity considering that so many of the ICT businesses in Winnipeg are very young. More than 60 percent of businesses are less than 10 years old. The most significant predictor of length of employment is the age of the business. Location of ownership has no correlation with average length of employment. Predictably, the size of business is a significant predictor of the average length of employment. Larger businesses are much more likely to retain employees longer than the average (i.e. more than five years) than are smaller businesses.

The analysis is also concerned with the geographic residency of employees in the industry. On average, 95 percent of employees hired by the ICT industry are Winnipeg

[8] Because two businesses did not answer this question the sample size for this question is 62.

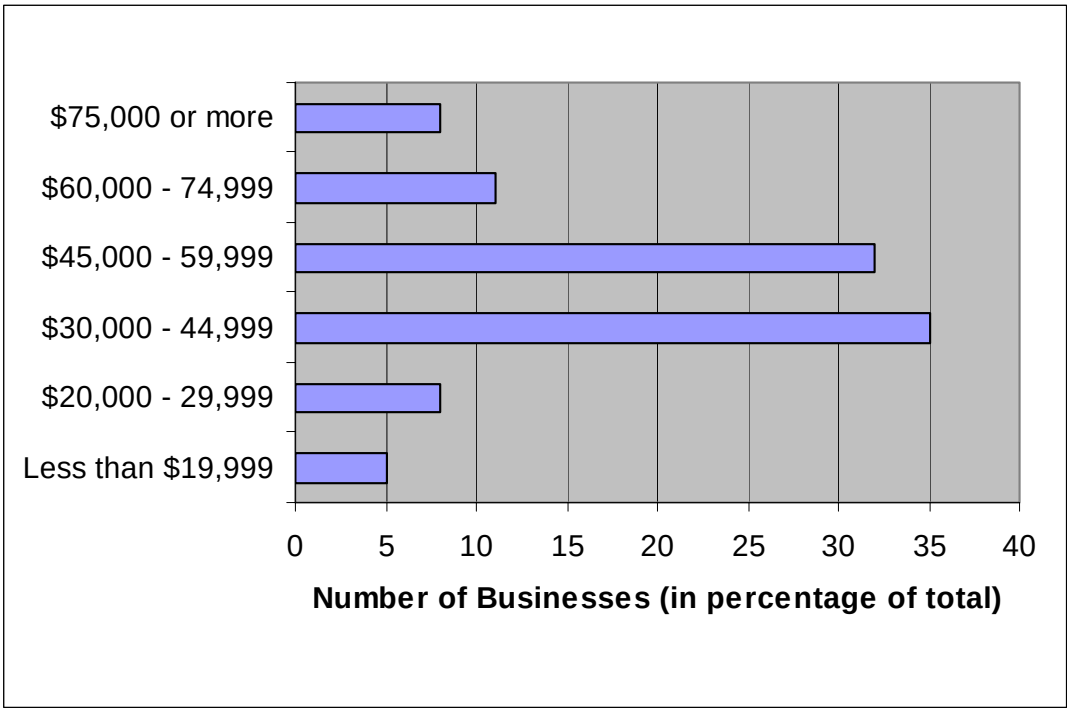
residents. Almost 75 percent of businesses report that 100 percent of their employees are recruited from Winnipeg. Less than 20 percent of the 41 businesses employing labour reported that they hire more than 10 percent of employees from regions outside of Winnipeg.

Locale of ownership is a good predictor of the likelihood of a business recruiting labour from the local community. Businesses that are 100 percent locally owned hire nine percent more employees from Winnipeg than do the 12 businesses that are not completely locally owned. The size of business is also a significant predictor of local resident recruitment for jobs within the ICT industry. Of the 75 percent of businesses that only recruit labour from Winnipeg, the average number of persons employed is 15; while of those businesses that hire at least some labour from outside of Winnipeg, the average number of persons employed is 57. Smaller and locally-owned businesses are more likely to contribute to the CED objective to hire local residents.

It is also important to determine the wages of ICT jobs. Of the 41 businesses that employ labour, two businesses did not answer this question because they do not employ any labour full-time and another two chose not to disclose this information. Table 4.6 shows the average annual salaries paid to full-time employees in the 37 firms responding to this question. Just over half of the businesses pay an annual average salary greater than $45,000 (summing the last three categories). If we weight these numbers by the number of employees in each firm, we can conclude that 74 percent of employees in the ICT industry are paid an average annual salary greater than $45,000. Data from the 2001 Census indicate that the average annual employment income for full-time employees in Winnipeg was $39,210 in 2000. Employees in the surveyed firms in the ICT industry are

paid more than the Winnipeg average. However, the average wage reported by firms in our survey is higher than that reported by Statistics Canada, which found that the average weekly wage in 2003 was $665 for a yearly salary of $34,600 (Destination Winnipeg, 2003, 12). This is a much more modest wage than reported by the firms in our sample, but seems to run counter to the national industry trend of higher than average wages.

Table 4.6 Average Annual Salary Paid to Full-Time Employees, ICT Survey Firms



It is also useful to compare the earnings of the ICT workers in the surveyed firms with other workers with similar educational qualifications. One half of employees in the sample have a University degree; and just over 75 percent of employees have either a University degree or a College diploma. The level of education in the surveyed firms also appears to be higher than that reported in other data sources. The 2001 Census reports that 24 percent of Winnipeg ICT employees have a college diploma and 25 percent have a university degree (Destination Winnipeg, 2003, 10). This is still higher

than the educational attainment of the rest of the Winnipeg population, 20 percent of whom hold a university degree. The average annual salary of full-time employees in Winnipeg who hold a University certificate, diploma, or degree for all industries (according to the 2001 Census) was $54,418 in 2000. For those with a College certificate or diploma, the average annual salary was reported as $38,081. Based on these comparisons, it would appear that ICT firms in our survey pay the regional average for university and college educated workers, but the industry as a whole does not appear to be paying particularly high wages for the skill level of their employees.

Local skill and knowledge development

Only nine out of the 41 businesses hiring labour indicated that they participate in youth employment programs. These programs include summer student term positions, work experience programs, and co-op practicum programs. Total number of workers is not a predictor of the business' participation in youth employment programs. Only one of the three largest firms (which each employ over 150 people) is engaged in employing and training youth and students. The other businesses that are participating in youth employment programs range in size from employing 1.3 to 37.3 full-time persons. Small businesses are participating in youth employment programs as much, if not more, than the larger businesses in the ICT industry.

More firms offer and/or subsidize training programs than participate in youth employment programs. Nearly one in three of the 41 businesses hiring labour provides or finances formal training programs for their employees. Larger firms are more likely to provide these programs. More than 75 percent of those businesses offering formal

training programs are businesses that also employ more than the median number of employees—of 6.7. The high costs of training programs are more easily absorbed by larger firms than smaller ones, and thus it is logical that larger businesses are more likely to offer or subsidize training programs for their employees.

Mentorship of other businesses is another way in which businesses may contribute to the skill and knowledge development of the local community. Fifteen percent of businesses in the ICT industry are involved in mentoring other locally-owned businesses in Winnipeg. Further, 20 percent of all businesses surveyed indicated that they also participated in other forms of activities to support local community businesses. Given that this question was quite broad, permitting firms to answer in the affirmative for such activities as offering free services to non-profit organizations, actively serving as members of the Chamber of Commerce, serving as business advisors to other local businesses, and financially supporting local business districts, this would appear to be quite a low number. Many of those involved in CED might also question the extent to which participation in organizations, such as the Manitoba Chamber of Commerce, actually contributes to the objectives of CED. It could be said that participating as members of business organizations and industry associations may actually detract from the community, since much of the work carried out by these organizations involve swaying political decisions in favour of a small minority in the community.

Numerous businesses within the industry are also involved in community decision-making. Over thirty-five percent of ICT businesses have representatives that act as board members to at least one local community organization. As board members of community organizations, business owners utilize their own skills and knowledge to

better equip the decision-making of community groups. Just as many businesses are involved in contributing to knowledge development through their participation in various community events. A handful of businesses also sponsor Red River College students enrolled in technical programs.

Physical environment

While an actual assessment of the environmental impact of all of the firms in our sample would go well beyond the scope or resources of this study, the survey did contain a question about whether firms took environmental concerns into consideration when choosing their suppliers. Only 13 percent of the businesses reported that ecological sensitivity of potential suppliers factored into their decision-making process for selecting suppliers. There is a correlation between the size of business and its ecological sensitivity. Seventy-five percent of the businesses reporting that they take the environment into consideration when selecting suppliers hire less than four employees.[9] All businesses selecting a 'yes' answer to this question employ fewer than 10 employees. Certainly not all of the smallest businesses factor the impact of the production process on the environment, but the likelihood of selecting suppliers partially based on ecological issues certainly decreases with business size. None of the businesses employing 10 or more full-time employees (i.e. the top quartile of businesses with respect to size) report that they consider the environment when selecting suppliers.

The correlation between locale of ownership and ecological sensitivity is even more significant. Of the twelve businesses that are not completely locally-owned none

[9] In full-time job equivalents.

selects suppliers based on ecological sensitivity. Thus, all of the businesses that consider ecological sensitivity an important criterion to select suppliers are also 100 percent locally-owned.

Beyond considering the environment when making decisions of the production process, businesses may directly participate in activities to build healthy and safe neighbourhoods. However, only three percent of ICT businesses in Winnipeg are active participants in physically cleaning up neighbourhoods. Businesses engaged in neighbourhood safety programs only make up another three percent of the ICT businesses surveyed. The businesses directly involved in the community either in clean up or safety programs appear to be randomly distributed with respect to their size. At one end of spectrum is the largest business to respond to the survey (with 300 employees), and at the other are two businesses not employing any labour—each actively involved in building clean and safe environments in the Winnipeg community.

Overall, only 17 percent of ICT businesses are working in some capacity to build a safe, clean, and sustainable environment in the local community. The requirements for businesses to be included in this 17 percent are very lax. For example, businesses are included just for participating in activities as the blue box recycling program. Businesses in the ICT industry in Winnipeg are not contributing very much to the sustainability of Winnipeg's natural environment, or safe and healthy neighbourhoods.

Health and Well-Being

In order to get an indication of how businesses in the ICT industry are contributing to the health and well-being of its employees and their families, the survey

included a question on the nature of benefits offered to employees. These questions were only answered by those 41 businesses employing labour, so the analysis here draws upon a smaller sample size. Eighty-five percent of businesses in the industry provide leeway for employees to decide when they will work the required number of hours per week. Flex-time allows employees the ability to schedule daily appointments and numerous responsibilities away from work with minimal stress. Approximately 10 percent of businesses allow for job sharing to better accommodate the demands and needs of its employees. Again, just less than half of the businesses in the industry offer training and educational opportunities to its employees to develop specific job-related knowledge and skills, as well as self-confidence—a major contributor to health and well-being.

ICT businesses contribute very few parental benefits to employees, however. Less than 25 percent of businesses claim to offer parental leave. Further, no business responding to the survey offers any type of child care. However, since the majority of businesses responding to the survey hire less than 10 people, the fact that child care is not offered is understandable. Small businesses would have difficulty justifying day care services to employees—of which only a small proportion would have children requiring this service. Yet, with respect to any benefits for parents the industry fairs very poorly.

Twenty percent of businesses also indicated that they offer other benefits to employees. Some businesses offer stock option plans, profit sharing, and other financial bonuses to provide incentives for employees. A handful of businesses provide employees with dental and medical benefit packages, on-site massage therapy, entertainment (i.e. an air-hockey table), home internet, free beverages, and/or a casual dress code. One business also specified that it strives to offer employees a creative and respectful environment.

Many of these benefits serve to increase the well-being of those employed within the ICT industry.

Human dignity

Of the 41 businesses employing labour, 40 answered questions regarding the distribution of labour among various groups. The results are shown in Table 4.7. Thirty four percent of the employees in the survey are women, which is considerably lower than the 45 percent in the Winnipeg economy as a whole (as identified by the 2001 Census). Census data also reveal that women made up approximately 40 percent of the labour force in Winnipeg's ICT industry in 2000—which is a slightly higher percentage of women in the industry than was captured in the 2003 survey. However, not all jobs in the ICT industry are ICT technical jobs. According to the census, only 25 percent of the technical, highly skilled jobs in the ICT industry are held by women. Many of the women employed in the industry are not ICT technicians, engineers, or analysts. ICT jobs are dominated by men.

Table 4.7 Selected Groups as a Percentage of Total Employment in the ICT Industry Sample

	Women	Aboriginal	Immigrant	Disabled Persons	Visible Minority
As a Percentage of Total Employed	33.9	3.3	7.7	1.3	6.1

Disabled persons make up 12.5 percent of the entire Canadian population.[10] The proportion of disabled persons employed in the ICT industry survey sample is 1.3 percent—which is one tenth of the actual distribution of disabled persons in the Canadian population as a whole. Although Aboriginals make up 6.5 percent of the Winnipeg labour force, only 3.3 percent of employees in the ICT industry survey sample are Aboriginal. Six percent of employees in Winnipeg's ICT industry are persons of visible minorities. According to census data for 2001 it is known that visible minorities actually make up 12.5 percent of Winnipeg's labour force—which is more than double the proportion of visible minorities employed in the ICT industry sample. Data were also collected on immigrant workers in the ICT industry. Immigrants make up about 8 percent of the employees in our sample of Winnipeg's ICT industry, while immigrants make up 18.2 percent of the total labour force in Winnipeg. The industry firms in our survey are not contributing very well to the objective of hiring people belonging to typically marginalized groups.

Examining the characteristics of the businesses that do hire persons from the selected groups provides an interesting insight into the industry. Of the ten smallest businesses that employ labour, women employees make up 65 percent of the number employed. Very likely however, the jobs held by these women employed in these very small businesses—hiring two or less persons—are administrative. However, the size of business is negatively correlated with the proportion of women, immigrants, and visible minorities employed. Businesses employing less than ten employees are significantly more likely to employ persons that are typically marginalized in the labour market.

[10] Canadian population data is used here instead of labour force data on Winnipeg because this statistic could not be obtained.

Smaller businesses hire ten percent more women, three percent more immigrants, and seven percent more visible minorities as a percentage of total number of people employed than do larger businesses. However, there is no significant connection between the locale of ownership and the proportion of these certain groups employed.

To summarize the analysis, the ICT industry in Winnipeg is making some contributions to a few of the CED objectives, while making only weak contributions to others. Table 4.8 summarizes the results. A "yes" in the first column shows that the industry is contributing to a particular goal. Most of the goods and services produced by the industry are sold to meet the needs of local businesses, governments, and consumers. Further, the industry is primarily composed of small, locally-owned businesses, which CED theory argues are more likely to contribute to CED than large, foreign owned businesses (although we will also examine this hypothesis). Businesses in the industry also predominantly hire local Winnipeg residents for a relatively long period of time at reasonable wages. Contributions of the industry to local skill and knowledge development are less straightforward, or significant. Some businesses do participate in various capacities to aid in the training of employees and other members of the local community, but the extent to which memberships in organizations such as the Manitoba Chamber of Commerce actually contribute to the goals of CED are uncertain.

The industry is performing very poorly in regards to its concern for the physical environment both in terms of safe and pleasant physical space and incorporating environmental concerns into their decision-making. The industry's contribution to the health and well being of community members is also mixed. Flex-time is frequently

offered but other benefits like parental leave are less common. Finally, the industry makes virtually no contribution to hiring typically marginalized persons.

Table 4.8 Summary of Findings

Objective	Measure	ICT Sector	Local	Small
Linkages	I-F table	Yes	Decrease	No change
Decision Making	Local Ownership	Yes	N/A	Increase
	Worker	Inconclusive		Increase
	Community	No		Increase
Employment	Earnings	Inconclusive		
	Duration	Yes	No Change	Decrease
	Hire Local	Yes	Increase	Increase
Skill/Knowledge Development	Youth Employment	No		Increase
	Training	Yes		Decrease
	Community Participation	No		
Physical Environment	Environmental Consideration	No	Increase	Increase
	Healthy Communities	No	No Change	No Change
Health and Well Being	Flex Time	Yes		
	Parental Leave	No		
	Other Benefits	No		
Dignity	Minority Employment	No	No Change	Increase

Throughout this section we have also tested whether our survey firms actually support CED theory by examining whether the size of the firm and the location of ownership are related to the propensity of the industry to meet CED goals. In table 4.8, an "increase" indicates that locally owned or small firms are more likely to contribute to CED goals in the survey firms. The cell is left blank when there is not sufficient variation in the data to permit a reliable evaluation. In the sample firms, local ownership

does not influence businesses' contributions to long-term employment of local residents or human dignity, and is negatively correlated with businesses' contributions to the production of goods and services for local use. However, locally owned firms are more likely to hire local residents, and include environmental considerations in their decision-making process. By definition, local ownership increases the number of economic decisions that are made by residents and local firms do contribute more than other firms to several goals, but they fare worse in the crucial category of employment duration.

Smaller businesses in the sample encourage employees and community members to share in decision-making; they are more likely to employ local residents, make use of youth training, to be concerned for the physical environment' and hire minorities. However, business size does not influence the production of goods and services for local use, and has a significant reverse effect on long-term employment and employee training. The conclusions of these analyses are mixed. Overall however, the hypothesis is weakly supported—that is, it would appear that business size and locale of ownership are sometimes connected with contributions to CED in the expected direction.

4 CONCLUSION

This study investigates the extent to which the ICT industry in Winnipeg contributes to the goals of CED. The first step was to develop a list of objectives, gleaned from the CED literature. We then used a set of indicators to measure these objectives. In an effort to collect data for these measures the study surveyed ICT firms in Winnipeg and supplemented this source with data from the 2001 Census and Statistics Canada industry level data. The contribution of the firms in the industry survey to CED is quite mixed.

To a certain extent this study is subjecting the private, for profit firms of this industry to a test that they are not attempting to pass. ICT firms are not attempting to meet CED objectives. However, it is entirely possible that CED objectives can be fulfilled unintentionally. The ICT industry fared quite well in providing long-term employment, for example. While long-term employment is unlikely to be a goal of the firm, firms often offer long-term employment. In other words, long-term employment is not incompatible with high profits. In fact, when employees are difficult to replace or require substantial training, as is often the case with high skilled employees, retaining workers is necessary for profitability.

Objectives that may be less likely to be met by private for-profit businesses are those that would tend to increase production costs without increasing revenue, or productivity—or at least not in the short-run. Businesses may be discouraged from hiring typically marginalized groups because it may be unprofitable to do so. Individuals within these typically marginalized groups may be less employable (i.e. they may have less work experience, less education, and have other language, cultural, or physical barriers to

employment), and thus may be less profitable to the business than an individual who is more employable. Efforts to sustain a healthy and sustainable natural environment are also costly endeavors. These costs are generally not directly recovered by the business. Thus, although a commitment by private business to positively contribute to the physical environment will significantly benefit the community, the direct benefits to the business of doing so will be minimal. Our survey results demonstrate that these are precisely the CED objectives that firms in the ICT industry are not meeting.

For those objectives (contributions to sustaining the physical environment, hiring individuals from typically marginalized groups, involving community members in decision making) that are less likely to be met accidentally by private businesses, some type of intervention in the market is required. For example, if it is seemingly unprofitable to hire individuals from typically marginalized groups because they lack the skills and knowledge, it would be important for the local government, or a local community development corporation (CDC) to step in to provide and/or fund educational programs for these individuals. Or alternatively, local businesses may be encouraged to sponsor a particular individuals' training if that labour is subsidized.

Businesses may also be encouraged to make valuable contributions to the physical environment by way of tax incentives, or various other proposed methods of reducing wastes and emissions. A commitment to a greener and safer community may be incorporated into the marketing scheme of the business, so that the extra costs spent on the environment may become directly profitable. Local community organizations and community members can encourage these private businesses to take these efforts by

increasing public awareness of the state of the physical environment of the community and by lobbying government and private businesses for change.

Tax incentives are perhaps the most obvious method to create an incentive for private, for-profit business to contribute to CED. For example, the Government of Manitoba offers a CED tax credit—in the form of a 30 percent personal income tax credit on a maximum annual investment of $30,000—to Manitobans investing in approved local enterprises. In order for the private enterprise to be eligible for the tax credit, they must be small (i.e. employ no more than 200 employees), be owned by a Manitoba resident(s), and at least 25 percent of employees must reside in Manitoba. This tax credit program serves to encourage and support the growth of small, locally owned businesses which are committed to creating jobs for Manitobans. Certainly, such policies exist to encourage contributions to CED by private businesses that otherwise may not be encouraged within the market.

While it is certainly possible for the state to create incentives for private business to contribute to CED objectives, these types of policies are not generally welcomed by private business. In fact, the political role of organizations like the Chamber of Commerce is largely to avoid any state led initiative that would increase corporate costs, whether it is increased taxation to pay for the education of minorities or taxes to promote a greener community. Therefore, it could be argued that many private businesses are actively working against implementing many of the CED goals. For firms that compete with companies in other political jurisdictions, profit reducing interventions to meet CED goals decrease the firm's chances of survival. It is this inexorable logic of capitalism that leads many CED theorists to argue that CED is incompatible with private ownership.

This analysis has really only scratched the surface, and leaves many questions for further research. The nature of the study did not allow for anything to be said about causation. What is the causation between the industry's participation in contributing to the CED objectives and the economic success of the industry itself? Does one come at the expense of the other, or do the two go hand in hand? A second area of study that would be of interest to research is the application of the analytical framework on other Winnipeg industries, or on ICT industries in other Canadian cities. These similar analyses would be highly valuable to compare contributions to CED across industries.

Thirdly, it would be interesting to compare the contributions of the ICT industry in Winnipeg over time. Would the industry be made up of more large firms and fewer small firms after ten years of industry growth? Would the industry contribute more to building and maintaining a safe and healthy physical environment? As the industry grows, will the percentage of goods and services sold to markets outside of Winnipeg dramatically increase? Further testing of the CED hypothesis regarding the correlation, and even the causation between the type of business and its contributions to the objectives of CED would also be an interesting further study.

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Appendix A: A Review of Analytical Techniques

The nature and scope of regional economic changes resulting from both public and private sector investment initiatives have long been of interest to regional planners, various levels of government bodies, private business, communities, and individuals in communities. What is the impact on a region from an investment increase within a particular industry? Which industries in the region are more likely to benefit from changes in final demand? Answering these types of questions inspired the creation of the tools of regional economic analysis. The three main analytical tools—economic base multipliers, income-expenditure, and input-output analysis—will be reviewed here. The primary purpose of this appendix is to review these three analytical tools, discuss their advantages and limitations, and briefly introduce one important modification to input-output analysis. This literature review of analytical tools for regional analysis serves as the foundation from which the relevant tools may be extracted for analysis of the contributions of a particular industry to its local regional economy.

Economic Base Model

The underlying foundation of the economic base model is that exports are the only component of gross regional product that is significant for analysis of regional economic growth. Using this conceptual framework, the economy is divided into two sectors: the basic sector (which is essentially the export sector) and the services, or non-basic sector (the non-export sector). This can be represented mathematically as

$$Y_T = Y_B + Y_S$$

where Y_T is the total level of economic activity in the region, Y_B is the level of regional economic activity in the basic sector, and Y_S is the level of regional economic activity in the services sector.

All economic activities whose ultimate market lies outside of the region are included within the base sector, and all activities for local consumption fall within the services sector. The base sector includes direct export sales, as well as indirect export sales. If firm A sells its entire output locally to firm B who exports its entire production outside the region, then firm A is indirectly part of the base sector because its 'ultimate market' is outside the region. Thus, ultimate markets are used to distinguish between basic and non-basic sectors.

Since the basic sector is the primary engine of growth in a region, multipliers are constructed to capture the effects on the services sector given a change in the basic sector. The value of multiplier *k* is written as:

$$k = \frac{Y_T}{Y_B};$$

where *k* is the proportion of total economic activity in the region, Y_T, to economic activity in the basic sector of the region, Y_B. In order to derive the constant proportional multiplier, it must be assumed that the marginal propensity to consume is equal to the average propensity to consume (Nourse, 1968: 161). This assumption implies that the proportion of service activity to basic activity remains constant, and does not change with different levels of total regional income, over the period of analysis (Nourse, 1968: 161 and Davis, 1990: 10).

The economic base multiplier captures both the direct effect (employment in the basic sector) and the indirect effect (employment in the service sector) given an external

change in the demand for basic sector goods and services. By construction, an increase in basic employment must produce an increase in service sector employment in proportion to hold the basic: non-basic ratio constant. If this ratio is, say, 2:1 then, if two additional persons are hired in the basic sector, one additional person must be hired in the services sector (Hewings, 1977: 19). Employment is the choice unit of measurement for regional analyses. Employment is often the focus of public policy, and the concept of a job is easily understood. Data on employment are also more readily available than other possible units of measurements, such as income or value added (Davis, 1990:14). The effects of labour productivity and how employment is defined may affect analyses using employment as the unit of measurement (Davis, 1990:14).

The multiplier is able to capture the respending process that occurs as the result of export expansion within the region. For example, an increase in the demand for furniture by a wholesaler outside of the region will increase not only the wage bill of the local furniture manufacturer (the direct effect), but all the local firms which supply it (the lumber mill and the chemical plant) (Davis, 1990: 9-10). A portion of these wages will be spent on locally supplied goods and services, which will in turn increase the incomes of the suppliers of these local commodities, who will in turn spend a portion of their incomes on other locally supplied goods and services (ibid., 10-11). And so on. The presence of leakages (taxes, savings, non-local expenditures), however, will eventually drive the process of re-spending to an end. The more leakages in the economy, the smaller the economic base multiplier is, and the smaller is the impact of export expansion on the total activity in the region.

Advantages of the model. Economic base multipliers are simple indicators of the region's proportion of economic activity in the basic sector. The simplicity of the model in dividing the regional economy into two sectors (basic and non-basic) requires significantly less data than some of the other analytical tools that are used in more detailed analyses of regional economies (Kenny, 1981, 103-4). Economic base multipliers are also easy to calculate and thus the costs to calculating them are low (ibid., 104). The simplicity of economic base multipliers allows for researchers to easily calculate the proportion of economic activity in the export sector. Economic base multipliers are useful little tools to provide simple indicators of the region's export activity.

Limitations of the model. As a tool for regional development analysis and policy-making the economic base model is not without its limitations. It unrealistically assumes that the export sector is homogenous and so the model will have difficulty where diversities among export sectors exist (Davis, 1990: 11-12). H. O. Nourse (1968: 162) argues that the economic base multiplier is only useful for short-run analysis of the impact of the base sector, since in the long-run the variables held constant in the model may change—the parameter, *k*, in particular. It is assumed that the marginal propensity to spend is equal to the average propensity to spend, but the marginal propensity to spend locally tends to increase as the region's population and income increases. The economic base model is not usable as a tool for multi-regional analyses because the model implicitly assumes that the marginal propensities to import are identical across all other regions (Richardson, 1969, 251). The single region model also neglects the full account of interregional feedback effects due to trade linkages across regions (Richardson, 1969,

252 and Davis, 1990, 12). Perhaps the most obvious debilitating assumption is that of assuming the export sector is the only engine of economic growth in a region.

There are also numerous practical difficulties with the use of economic base model. The most obvious measures of economic activity are income, physical production, sales, or value added. However, regional data for income and production sales of particular sectors are not always available; and employment data are often used as substitute measures (Davis, 1990: 14). Employment is thought to be a good proxy for economic activity in a region, but it also has its disadvantages: ambiguity in the definition of what constitutes a job; and difficulty in dealing with changes in productivity, property income, or differences in wages across and within sectors (Davis, 1990: 14; Nourse, 1968: 162). Further, because the economy is presumed to be initially at rest (Davis, 1990: 13), the economic base model is a comparative static model limited to simply predicting the end result, but not how or when this end will be worked out. Finally, the data used to construct the multipliers are often survey data that suffers from respondents' possible confusion between intermediate purchasers and ultimate markets, which may skew responses, or the interpretation of responses.

Income-Expenditure Analysis

Of primary interest in the Keynesian multiplier model or income-expenditure (I-E) model is the tracking of the social surplus. How much social surplus is produced? And how is it distributed? In particular, we are interested in the size and distribution of the social surplus to analyze the impact specific firms, or industries have on the regions in which they are located. The size of the social surplus may be calculated either by using

conventional economic data to compute value added less the wage bill or by summing the specific components of surplus value recorded on a conventional accounting sheet (Gunn and Gunn, 1991: 23). Investigating the distribution of the surplus is a little more complicated. Does the surplus stay within the region, or does it leave? A firm may accumulate much social surplus, but if it leaves the region it will have little impact on the other firms and individuals in the region. The class distribution of the surplus within the community is also of concern. Who benefits from the increased social surplus in the region? What proportion of the surplus is spent, saved, or invested locally? The I-E model attempts to answer these questions (Gunn and Gunn, 1991, 23).

Gunn and Gunn (1991) trace the social surplus of a hypothetical McDonald's restaurant using estimates based on national data and other knowledge of the particular franchise in order to evaluate the impact of its investment on a region. They estimate the social surplus produced by McDonald's by adding the components of the social surplus: total cost of sales, advertising, utilities, rent, property and other taxes, property insurance, interest payments, and profits (ibid., 28-34). The distribution of the social surplus is divided between the proportion that stays within the region and the proportion that leaks out of the region. The distribution of the social surplus among four classes (capitalist, petty bourgeoisie, professional managerial, and the working class) is also included in the table to estimate the distributional impact of a McDonald's franchise (ibid., 35-36). Gunn and Gunn's simple estimates of the leakages of a specific firm may be easily modified to estimate the leakages of an aggregation of firms, or particular industries in a region.

The I-E approach is more commonly described in terms of a small regional system, rather than an analysis of a specific firm. However, the I-E model may be easily

modified to analyze the impacts of a particular firm or group of firms. The model may be formally set up using Keynesian notation for an open regional economy with a government such that local income *Y* is defined as:

$Y = C + I + G + X - M$.

Income after taxes, known as disposable income Y_d is defined as:

$Y_d = Y - tY$.

Consumption *C* and imports *M* are linear functions of disposable income such that:

$C = c_0 + c_1 Y_d$;

$M = m_0 + m_1 Y_d$.

Substituting the above identities into the first equation for *Y* and rearranging yields the regional income multiplier *k*

$$k = \frac{1}{1-(1-t)(c_1 - m_1)}$$

The multiplier is inversely dependent on the leakages in the economy, namely the tax rate t, the marginal propensity to import m_1, and the marginal propensity to save $(1\text{-}c_1)$ (Davis, 1990: 32).

Advantages of the model. Unlike the economic base model, the I-E model is not constricted to one primary engine of growth, and thus the impact of the expansion in any final demand sector may be analyzed (Davis, 1990: 40). Fiscal operations of local governments may be explicitly treated within the I-E model to undertake impact studies of changes in government spending or taxation (ibid., 41). The model is also able to accommodate differing consumption patterns across individuals in the region which improves the accuracy of the estimates (ibid., 40-41). Another advantage of I-E is that its

elaborate detail of the economic structure itself provides a more valuable description of the economy than does the economic base model (ibid., 41).

Limitations of the model. The model assumes that the tax rate, and the marginal propensities to import and consume are constant over the period of analysis, but evidence would suggest that these coefficients are dependent on the level of income. The coefficients are also assumed to be constant across rounds of expenditures, which implies that the marginal propensity to consume is universal among residents. It is also assumed that there are no capacity constraints on the producing sectors, but this highly simplifies the more general reality of unemployment in most regions. The model also assumes that inter-regional feedback is negligible. I-E also requires significant amounts of sensitive financial records from firms, and thus the data requirements for making this tool operational is very high.

Input-Output Analysis

The development of the Input-Output (I-O) model is usually attributed to Wassily Leontief (Davis, 1990:, 53 and Gunn and Gunn, 1991: 45). This static model may be used to describe and analyze the interdependence of economic systems as "large as an entire nation or even the entire world economic system, or as small as the economy of a metropolitan area or even a single enterprise" (Leontief, 1986: 19). Because the model essentially captures the still life macro picture in terms of the economy's micro linkages, it may be considered as a general equilibrium approach to economics (Davis, 1990: 53; Gunn and Gunn, 1991: 45). Because of its versatility in level of detail or aggregation, it has become a popular tool for both national and regional economic analysis. The number

of sectors into which the economy is divided depends on the particular economic system, the purpose of the analysis, and the type of data available (or the amount of funding available to gather data).

Table A.1 shows an I-O table of an open three sector economy: an agricultural sector, a manufacturing sector, and a services sector. Household consumption *C*, investments *I*, government purchases *G*, and exports *X* are components of final demand. The sales and purchasing flows within the interindustry matrix (which excludes the final demand sectors) are known as the intermediate sales (or intermediate demand) since the sold products undergo further processing within the region (Davis, 1990: 55; Hewings, 1977: 41).

Table A.1 Open Economy Industry Transactions Table ($ million)

				Final Demand				
into / *from*	Agriculture	Manufacturing	Services	C	I	G	X	Total
Agriculture	10	5	5	10	5	10	25	70
Manufacturing	20	30	25	5	5	5	10	100
Services	5	10	10	35	5	10	5	80
Imports	5	15	5					
Value Added	30	40	35					
Total	70	100	80					

Source: Davis (1993: 54).

Reading across say, the third row, $5 million services are sold as intermediate inputs to agriculture, $10 million services are used by manufacturing, and another $10 million are

used within the services sector for further production of services. Further along the row the allocation of the sale of services to the four final demand sectors is shown. Down the columns of the endogenous industry sectors, we can read the allocation of purchases of each sector from the three local sectors. Down the column of, say, manufacturing, we read that the manufacturing sector requires an additional $15 million worth of imports and $40 million of value added to produce $100 million worth of manufactured goods in the given period. Each sector in the interindustry matrix is both a buyer and a seller. Summing across each of the three sector rows yields total sales, and summing down each industry sector column yields total costs plus profits. Profits are included as a component of value added, along with wages and salaries to labour and returns to investments (Davis, 1990: 55). The double-entry bookkeeping system reveals the fabric of the economy that is woven together by the flow of trade among all sectors (Leontief, 1986: 22).

The model is also able to predict the effects of changes in final demand for the output of any sector. To show the process of the feedback effects throughout the economy given a change in final demand, a second table model must be constructed. This table of direct input coefficients, or what Leontief (1986) named the structural matrix, is constructed using the data from the transactions table. The technical coefficients are derived by dividing the intermediate sector entries of each column in the transactions matrix by the corresponding total input figure of that column (Miernyk and Sears, 1974: 12; Davis, 1990: 56; Hewings, 1977: 38). “The quantity of the output of sector *i* absorbed by sector *j per unit of its total output j* is described by the symbol a_{ij} and is called the *input coefficient* of product of sector *i* into sector *j* ” (Leontief, 1986, 22), such that:

$a_{ij} = \frac{x_{ij}}{x_j}$.

Using the data from Table A.1, the coefficients down the services column, for example, are calculated as 5/80 = 0.0625, 25/80 = 0.3125, and 10/80 = 0.125. The coefficients represent the proportion of direct purchases by each of the row sectors for producing one dollar of output of the column sector (MacMillan, 1975: 62). All the resulting coefficients derived from Table A.1 are entered into the table of direct input coefficients, as shown in Table A.2 below.

Table A.2 Direct Input Coefficients (per dollar of total output)

	Agriculture	Manufacturing	Services
Agriculture	.14	.05	.06
Manufacture	.29	.30	.31
Services	.07	.10	.12

Source: Davis (1990: 57).

The summation of the coefficients down any given column in Table A.2 may be thought of as a ‘recipe’ to yield one dollar of output for that particular column sector (Davis, 1990: 57 and Leontief, 1986: 30). Reading down the second column, we read that in order to yield one dollar of manufacturing output, $0.05 agricultural products, $0.30 manufactured goods, and $0.10 services are purchased by the manufacturing sector as intermediate purchases. An increase in the demand for, say, manufactured goods will require proportional increases in the purchases of inputs from the three input sectors to increase the manufacturing output. Assume that the demand for manufactured products doubled from $1 million to $2 million worth of goods. Before the increase in demand, the manufacturing sector was purchasing $1 million * 0.05 = $50,000 from the agriculture

sector. After the increase in demand, the manufacturing sector will increase its purchases from agriculture to 0.05 * $2 million = $100,000. This is known as the direct effect of changes in final demand.

But the effect of the manufacturing sector demanding more inputs from the three sectors is essentially an increase in demand for each of these sectors simultaneously. Thus, continuing with the example above, the agriculture sector will in turn demand more inputs from the manufacturing sector to meet the increased demand of the manufacturing sector. This will in turn increase purchases from the input sectors to meet these secondary purchases. The I-O model is able to trace out these rounds of indirect effects through the iterative process. As the rounds of spending are traced further back, the effects become weaker because of the leakages in the economy. The process to compute the total effects (direct plus indirect effects) of changes in final demand is easily completed by a computer-generated matrix inversion technique (Davis, 1990: 58).[11]

The induced effects of an increase in final demand may also be calculated within the I-O model. Induced effects are those effects due to the increased demand for labour, as well as other capital goods, given expansion in an industry to meet the increased final demand for its output. Increasing the wage bill in the region increases personal income in the region which induces consumer demand in the region to increase. The secondary round of spending would further induce an increase in consumer demand, as it too is characterized by a mix of increased capital and labour. Thus the region expands to an even greater extent due to induced effects of increases in consumer demand triggered by the industry's expansion. The induced requirement coefficient is calculated by closing the

[11] For the algebraic derivation of the total effects coefficients see Leontief (1985: 23-27).

input-output transactions table with respect to households (i.e. making the household sector endogenous as both a row and a column) (Kenny, 1981: 45-46; Davis, 1990: 59-61). Induced effects of government expenditures may also be included using the same methodology (Gunn and Gunn, 1991: 49).

Advantages of the model. Because the model is capable of capturing the complex linkages of an entire nation, it can be used as a descriptive device of national income accounting for a wide range of economic structures and sizes. The relationship between the level of industry output and the amount of inputs into the production of that output is captured in I-O analysis. Sales to a particular industry depend on the level of output of the industry in question, such that all the entries in the matrix are dependent upon each other (Leontief, 1986: 11). The primary improvement of the I-O model over the economic base model is its ability to deal with sources of growth and decline other than solely exports (Davis, 1991: 63). The I-O model also benefits from a greater level of detail than either the economic base or the I-E model.

Limitations of the model. I-O analysis suffers from many of the same limiting static assumptions as the other regional models reviewed previously. Although I-O distinguishes between producing sectors and exogenous final demand sectors, I-O analysis also assumes sector homogeneity (Davis, 1990: 66). It also assumes linearity in the production function and thus cannot incorporate diseconomies of scale (Kenny, 1981: 51 and Davis, 1990: 66). Because the model is assumed to be in stationary equilibrium, the requirement coefficients may be limited in their predictive capability if the region under analysis is not initially stationary (Kenny, 1981: 52-53). The absence of resource constraints in the model further limits its applicability to resource-constrained economies

(Davis, 1990: 63). It also assumes constant input-output ratios, such that multipliers are not impacted by technological improvements, changes in the level of imports, changes in the classification of data or the structure of the coefficient matrix, changes in relative prices, changes in the population level (Davis, 1990: 63, 65; Kenny, 1981: 54-55). Practically, if the model is constructed using a top-down approach—that is, modifying national I-O coefficients to construct regional ones—the analysis may suffer from problems of "'regionalization' of the coefficients" (Davis, 1990: 64). If the model is constructed using a bottom-up approach—that is, using survey data—the analysis may suffer from measurement error (Davis, 1990: 64).

A modification of I-O: Intersectoral Flows Analysis

Although the I-O model is a substantial theoretical improvement over the economic base and the I-E models for most purposes, "the real difficulty lies in translating either approach into an operational one so that meaningful estimates of these interrelationships can be generated at a reasonable cost" (Hansen and Tiebout, 1963: 409). Both sales and purchase data are required for a true I-O analysis. However, most regional studies are data-limited and seek to reduce the amount of data required to complete impact studies. The intersectoral flows (I-F) model is a useful modification to the I-O model which reduces the data requirement by using sales data only.

In 1961, Hansen, Robson and Tiebout developed the I-F, or 'rows' only model as an alternative approach to regional analysis. The primary objective in designing the model was that the necessary data to make it operational could be obtained at a reasonable cost (Miernyk, 1965: 73). Mail-out surveys to a sample of firms of the manufacturing industry were used to gather data on the allocation of sales to its own

industry, other industries, specified domestic final demand sectors (households, investment, and local government), and exports (classified by regions of destination) (Nourse, 1968: 163). Firms were not required to provide data on inputs or employment. The rationale behind using allocation of sales data, rather than purchasing data, is that firms are more familiar with the destinations of their products, than they are with the origins of their production inputs, since bundles of inputs are often highly varied and complex (Richardson, 1972: 132; Hansen and Tiebout, 1963: 411). The sales data are then arranged in the form of an I-O table, implicitly assuming that the columns are representative of inputs. This is known as the rows-only technique since the matrix is completed by filling in sales or 'rows' data only (Miernyk, 1965: 74; Clapp, 1977: 81). The I-F model may also be constructed using employment as the base unit of measurement.

Advantage of the modification. Because this model requires significantly less data to construct the interindustry table, it is inexpensive and simply operated. This is its most obvious advantage. This short-cut approach to I-O analysis is certainly more preferred to estimating regional coefficients based on national input coefficients (Miernyk, 1965: 75).

Limitations of the modification. I-F analysis is a simplified version of I-O analysis, and thus cannot provide as much information as the more complex I-O model (Richardson, 1972: 133). The double-accounting characteristic of the I-O analysis is lost in the rows-only simplification, and consequently I-F analysis may suffer from less accuracy. Sales data are limited in their capability to distinguish between inventory and capital accumulation, which may skew estimates of interindustry flows that are calculated using sales data (Clapp, 1977: 86). These limitations of I-F analysis may, however, be

partially corrected for by augmenting rows-only data with secondary data to provide benchmarks, consistency checks, and estimates of leakages (Clapp, 1977: 85-87).

Summary

The analytical tools available for regional economic analysis are widely criticized. All three models suffer from some of the same limiting assumptions—namely linearity in the production function, stationarity of the region, sector homogeneity, absence of resource constraints, and constant coefficients. In particular, the complex structure of regional economies is not captured in the economic base model due primarily to its reliance on exports as the primary engine of growth. Essentially the lack of detail in the economic base model severely hinders its ability to accommodate for import leakages, and consequently lowers its accuracy even as a simple tool for short-run analysis. Economic base multipliers are however, useful to use as starting points to analyze the extent of the export sector in a region. The I-E model is capable of tracing the social surplus through the various parts of the economy. Consequently it is able to evaluate the impacts of changes in any final demand sector, not just exports.

The descriptive elaboration of the economic structure of the region in the I-O model uniquely allows the underlying transactions of the economy to be traced. It is certainly a theoretical improvement over the first two analytical techniques. However, the main limitation, and it is a debilitating one, is the extensive data required to complete the I-O table. The most popular remedy for the large data requirements of I-O analysis is the

utilization of rows-only data for I-F analysis. The trade-off of higher levels of sophistication and accuracy data is at the expense of higher data costs.

Appendix B: A Copy of the Questionnaire

A Survey of Information Technology Industries in Winnipeg within a Community Economic Development Perspective

Your completion of this survey indicates your consent to participate in this study.

The contact information in section A will be used by the researcher for classification purposes only, and will not in any way be disseminated along with your responses to the following questions.

A. Contact Information

- Name of Business: _____
- Name of respondent completing survey: _____
- Title (position) of respondent: _____
- Address and Postal Code of Business: _____ _____
- Website: _____
- E-mail _____
- Phone: _____
- Fax: _____

B. Ownership and Decision Making

1. In what year was the business established? _____
2. In what year did the current ownership take over (if applicable)? _____
3. What is the business structure? [Select one only]
   - ☐ Sole proprietorship
   - ☐ Partnership
   - ☐ Corporation (owned by investors)
   - ☐ Worker cooperative
   - ☐ Consumer cooperative
   - ☐ Other (please specify) _____
4. Is the business part of a franchise?
   - ☐ yes
   - ☐ no

   If yes, in what city is the franchise based? _____
5. How many entities (or individuals) own the business? _____

If the business has more than one owner, skip to question 8

6. Does the owner reside within Winnipeg?
   - ☐ yes
   - ☐ no
7. Does the owner live in the local community (within a 5 kilometre radius of the business)?
   - ☐ yes
   - ☐ no

If the business has only one owner, and you answered questions 6 and 7, please skip to question 10.

8. How many of the owners reside within Winnipeg? _____
9. How many of these owners live in the local community (within a 5 kilometre radius of the business)? _____
10. Has the business ever taken steps to include the local community in decision making?
    - ☐ yes
    - ☐ no

    If yes, please explain: _____ _____ _____ _____ _____

If your business does not employ any persons, please skip to section C.

11. Do the employees share in the ownership of the business?
    - ☐ yes

☐ no
If yes, please explain: _____

12. Are employees formally involved in the decision making process regarding the management of the business?
☐ yes
☐ no
If yes, please explain: _____

*If your business is **not** a co-operative, please skip to section C.*

13. As a co-operative, how does your business involve members in the decision making process about the business?

C. Purchasing and Type of Business

If the business has multiple outlets, only consider transactions by outlets located in Manitoba.

14. Aside from price and quality, what other criteria does your business use to select its suppliers? [Select all that apply]
☐ Manitoban-owned
☐ Canadian-owned
☐ Ecologically sensitive
☐ Co-operative business
☐ Employment policies
☐ Other (please specify): _____

15. What percentage of total adjusted gross revenue in 2003 was accrued from the sales of?
a. IT Products _____%
b. IT Services _____%
c. Other Products and Services _____%
If you checked other, please specify:

Response choices in questions 16 and 17 are classified according to the North American Industry Classification System (NAICS).

Please ensure that for each question your responses sum to 100%.

16. Please indicate the type(s) of manufactured IT **goods** your business produces, and allocate the percent distribution of each type as a component of **total adjusted gross sales of IT goods** (gross sales less sales tax). [Select all that apply]
☐ None [business is an IT service provider only]
☐ Commercial and Service Industry Machinery _____%
☐ Computer and Peripheral Equipment _____%
☐ Communications Equipment _____%
☐ Audio and Video Equipment _____%
☐ Semiconductor and Other Electronic Components _____%
☐ Navigational, Measuring, Medical and Control Instruments _____%
☐ Communication and Energy Wire and Cable _____%
☐ Other (please specify): _____
_____%

17. Please indicate the type(s) of IT **services** your business provides, and allocate the percent distribution of each type as a component of **total adjusted gross sales of IT services** (gross sales less sales tax). [Select all that apply]
☐ None [business is an IT manufacturer only]
☐ Software Publishers _____%
☐ Cable and Other Program Distribution _____%
☐ Telecommunications _____%
☐ Other Information Services _____%
☐ Data Processing Services _____%
☐ Computer Systems Design and Related Services _____%
☐ Computer and Communications Equipment and Supplies Wholesaler-Distributors _____%
☐ Office and Store Machinery and Equipment Wholesaler-Distributors _____%
☐ Office Machinery and Equipment Rental and Leasing _____%
☐ Other (please specify): _____
_____%

D. Distribution of Sales

For the following questions , please ensure that for each question your responses sum to 100%.

If the business has multiple outlets, only consider transactions by outlets located in Manitoba.

18. What was the total adjusted gross revenue (gross sales less sales tax) of the business in the 2003 calendar year? $_____

19. In the last year, what percentage of total business revenue accrued from customers in the following regions?
- ☐ Winnipeg _____%
- ☐ Manitoba (excluding Winnipeg) _____%
- ☐ Other Canadian provinces _____%
- ☐ United States _____%
- ☐ Other Countries _____%

If the entry for 'Other Countries' is non-zero please specify the names of the countries to which your business exports: _____

_____

20. Allocate the percent distribution of total adjusted gross sales (for 2003) between the following two groups of customers:
- *(a)* those located within Winnipeg and surrounding area (including sales to the municipal and provincial governments) _____%
- *(b)* those located outside of the Winnipeg area (including sales to the federal government) _____%

21. Take a typical dollar of sales estimated in 20(a) (within the Winnipeg area plus provincial and municipal governments), how would you distribute this dollar of sales among the following groups?
- *(a)* sales directly to local consumers (i.e. individuals living in Winnipeg) for their own personal use _____%
- *(b)* sales to the municipal and provincial governments _____%
- *(c)* sales to business establishments in the Winnipeg area (including self-employed persons' purchases for business purposes) _____%

22. Take a typical dollar of sales estimated in 21(c) (to local business establishments), how would you distribute this typical dollar of sales among the following industries?
- *(a)* information technology manufacturing _____%
- *(b)* information technology services _____%
- *(c)* all other local businesses _____%

Response choices in questions 23 and 24 are classified according to the North American Industry Classification System (NAICS).

23. Take a typical dollar of sales estimated in 22(a) (to information technology manufacturing), how would you distribute this typical dollar of sales among the following sub-industries?
- *(a)* Commercial and Service Industry Machinery _____%
- *(b)* Computer and Peripheral Equipment _____%
- *(c)* Communications Equipment _____%
- *(d)* Audio and Video Equipment _____%
- *(e)* Semiconductor and Other Electronic Components _____%
- *(f)* Navigational, Measuring, Medical and Control Instruments _____%
- *(g)* Communication and Energy Wire and Cable _____%

24. Take a typical dollar of sales estimated in 22(b) (to information technology services), how would you distribute this typical dollar of sales among the following sub-industries?
- *(a)* Software Publishers _____%
- *(b)* Cable and Other Program Distribution _____%
- *(c)* Telecommunications _____%
- *(d)* Other Information Services _____%
- *(e)* Data Processing Services _____%
- *(f)* Computer Systems Design and Related Services _____%
- *(g)* Computer and Communications Equipment and Supplies Wholesaler-Distributors _____%
- *(h)* Office and Store Machinery and Equipment Wholesaler-Distributors _____%
- *(i)* Office Machinery and Equipment Rental and Leasing _____%

E. Employment

For this section, please consider only employed persons. Exclude independent contractors.

If the business has multiple outlets, only consider employment by business outlets in Manitoba.

25. Does your business have any employees?
    - ☐ yes
    - ☐ no

If your business does not employ any persons, skip to section F.

26. How many employees are employed full-time (30 or more hours per week)? _____

27. How many employees are employed part-time (10 to 30 hours per week)? _____

28. How many employees are employed casually (less than 10 hours per week)? _____

29. How many employees are in management positions? _____

30. What percentage of employees are:
    - ☐ Women and/or _____%
    - ☐ Aboriginal and/or _____%
    - ☐ Immigrant and/or _____%
    - ☐ Disabled persons and/or _____%
    - ☐ Visible minorities _____%

31. What percentage of management positions are held by:
    - ☐ Women and/or _____%
    - ☐ Aboriginal and/or _____%
    - ☐ Immigrant and/or _____%
    - ☐ Disabled persons and/or _____%
    - ☐ Visible minorities _____%

32. What is the average length of time current employees have been employed by your business? (An estimate is acceptable)
    _____ months

33. Did your business participate in any youth employment programs in the past year?
    - ☐ yes
    - ☐ no

    If yes, please explain: _____

34. What benefits does your business offer its' employees, apart from those required by labour laws? [Select all that apply]
    - ☐ Higher than average wages
    - ☐ Flex time
    - ☐ Parental Leave (maternity leave)
    - ☐ Child Care
    - ☐ Training/Educational opportunities
    - ☐ Job Sharing
    - ☐ Other (please specify) _____

35. What is the percent distribution of your employees' education level? [Please ensure responses sum to 100%]
    - ☐ Less than Grade 12 _____%
    - ☐ High School Diploma _____%
    - ☐ Some Community College or University _____%
    - ☐ Community College Certificate/Diploma _____%
    - ☐ University Undergraduate Degree _____%
    - ☐ University Graduate Degree _____%

36. What percentage of employee hiring/recruiting originates in the following locations? [Please ensure responses sum to 100%]
    - ☐ Winnipeg _____%
    - ☐ Manitoba (excluding Winnipeg) _____%
    - ☐ Other Canadian provinces _____%
    - ☐ Other Countries _____%

    If the entry for 'Other Countries' is non-zero please specify the countries from which your business recruits employees: _____

37. What percentage of employees received their education from either a community college or university in Manitoba? (An estimate is acceptable)
    - ☐ _____%
    - ☐ Don't know

38. What is the average annual salary of your full-time employees? [Select one only]
    - ☐ Up to $19, 999
    - ☐ $20,000 - $29,999
    - ☐ $30,000 - $44,999
    - ☐ $45,000 - $59.999
    - ☐ $60,000 - $74,999
    - ☐ $75,000 - $99,999
    - ☐ $100,000 or more

39. What percentage of your employees currently reside within the local community (within a 5 km radius from the business)?
    - ☐ _____%
    - ☐ Don't know

40. Does your business have a formal training program for new employees?
    - ☐ yes
    - ☐ no

F. Investments

41. Within the past five years, in which of the following categories has your business made an internal capital investment of $1000 or more? [Select all that apply]
    - ☐ Purchase of equipment
    - ☐ Building renovations
    - ☐ Furniture/Fixtures
    - ☐ Company vehicles
    - ☐ Other (please specify): _____

42. Does the business have a policy on reinvesting profits in the local community?
    - ☐ yes
    - ☐ no

    If yes, please describe the policy, or if you have a written policy, please attach a copy: _____

43. Aside from purchasing, has your business been involved in any of the following activities to support local community businesses? [Select all that apply]
    - ☐ Member of the Community Development Business Association
    - ☐ Mentoring other businesses
    - ☐ Other (please specify): _____

44. Has your business been involved in any of the following activities to promote community development? [Select all that apply]
    - ☐ Participation in community events
    - ☐ Work placement programs
    - ☐ Grants or donations to community groups
    - ☐ Neighbourhood clean-up
    - ☐ Neighbourhood safety programs
    - ☐ Sitting on community boards
    - ☐ Other (please specify): _____

45. Has your business formally adopted any policy regarding ethical business conduct?
    - ☐ yes
    - ☐ no

    If yes, please describe the policy (or attach a copy), indicate when the policy was adopted, and explain why the business decided to adopt the policy:

Thank you for participating in this survey.

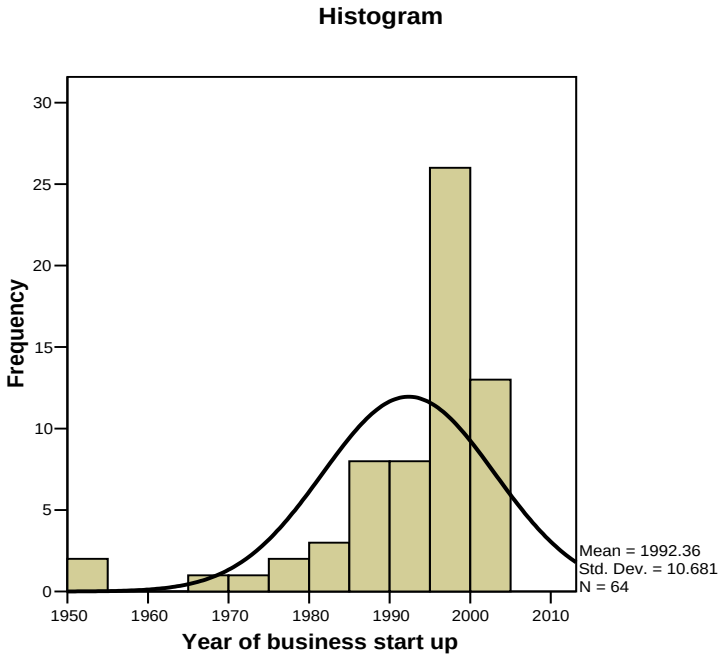
If you wish to receive a copy of the results, please check here: _____.

Please return completed survey in the enclosed postage paid pre-addressed envelope.

Appendix C Potential Survey Errors

There are four types of potential survey error: coverage, sampling, nonresponse, and measurement. Minimizing all four types of potential survey errors is the “most difficult challenge of surveying” (Dillman, 2000: 197). The better is the sample frame the smaller is the potential coverage error in the survey. If the list is up-to-date and includes all businesses of the survey population, and does not include those not in the survey population, then coverage error is minimized (ibid., 198-200). The list used in this survey was compiled in September 2003, only 8 months before the survey was conducted. Yet 77 questionnaires were returned undeliverable, which seems high given the recently compiled sample frame. However, looking at the distribution of business start-up dates shows that more than 55 percent of businesses were established after 1995 (see Figure 3.1). Newly established businesses characteristically have the highest rate of failure. Given the very high number of new businesses in the sample frame, the high number of businesses no longer in existence (identified by the 77 questionnaires returned as undeliverable) is reasonable despite the recently compiled directory. Further, recall that the sampling rate for this survey was 100 percent. That the survey was essentially a census works to further reduce the coverage error of this survey.

Figure 3.1 Histogram of 'Year of Business Start Up'



Measurement error, which arises from survey questions that are misunderstood or incorrectly answered, can be minimized by taking efforts to produce and administer a 'respondent-friendly questionnaire'. Sections C and D of the questionnaire, particularly the questions requiring the use of disaggregating sales by the North American Industry Classification System, appeared to be somewhat misunderstood by respondents. In an attempt to minimize the measurement error due to this problem, 29 respondents were contacted by telephone to clarify their responses of particular questions. Using these clarifications, margin notes made on surveys by some respondents, and some information collected from business webpages, the data collected from sections C and D are believed to be 'cleaned'. The data cleaning process served to minimize the potential measurement error in the survey data.

If the 18.2 percent of the sample who did respond differs from the 81.8 percent who did not respond, then the survey may suffer from nonresponse error (ibid., 197). There are no obvious reasons why this survey would suffer significantly from self-selection error. However, business size may have somewhat determined response or nonresponse, and the possibility of this self-selection error is acknowledged. Almost 75 percent of respondents reported that their total revenue in 2003 was less than one million dollars (based on 44 responses to this question); 36 percent of all businesses do not have any employees; and of the businesses that do employ labour, 50 percent of them employ 5 or fewer persons. Clearly, a significantly greater number of small to medium sized businesses than large businesses completed and returned the survey.

Comparing these results with national data for the proportions of small businesses to larger businesses in the ICT industry, it would appear that the data from this survey may indeed be more representative of small to medium-sized firms, than larger ones. This result may be explained by the high probability that contact persons of the larger businesses may not have known the answers to the wide-range of questions on various aspects of the business, whereas the contacts of small single-owner businesses would better know all areas of their business. On the other hand, a few of the businesses that were contacted in various stages of the survey design indicated their hesitance in responding because they believed their “home” businesses to be too small to matter to the survey. Thus, an actual prediction of this potential error, and even its direction of bias is difficult to estimate.

Sample surveys are attractive in that their results may be generalized to the survey population, so long as a large enough sample completes the survey to estimate closely the

distribution of a characteristic of the population. Sampling error, unlike the three other types of potential errors, may be "precisely calculated for each variable based on the number of completed questionnaires and the distribution of respondents' answers across response categories" (ibid., 197). The formula used to determine how large a sample is required to produce precise estimates of the characteristics of the population is derived such that:

$$N_s = \frac{(N_p)(p)(1-p)}{(N_p - 1)(B/C)^2 + (p)(1-p)}$$

where N_s is the completed sample size needed for desired level of precision; N_p is the size of the population; p is the proportion of population expected to choose one of the two response categories; B is the acceptable amount of sampling error; and C is the Z-statistic associated with the confidence level (ibid., 206-7).

Using Dillman's formula, the sample size needed to generalize the survey results of each question to the entire population within a certain level of precision may be calculated. The value of p depends on the proportion of the population expected to choose one of two response categories for the binary questions (i.e. with yes/no answer). Thus, the sampling error and the level of precision will vary for each question. However, to get a sense of the size of sample required for this analysis in general, let's set $(p)(1-p)$ at the most conservative value possible, (0.5)(1 - 0.5), such that maximum heterogeneity is assumed (ibid., 207-8). B, which measures the amount of precision, will be set so that we will be able to estimate percentages of the population within plus or minus ten percentage points (ibid., 207). Using the common 95 percent confidence level, C is set at 1.96, such that 19 out of 20 times that a random sample is drawn from the population, the estimates drawn from the completed sample will be within the desired range of precision

(ibid., 207-8). Assuming that the size of the population is equal to the sample frame, N_p is set at 352. Plugging these values into the formula, we get:

$$N_s = \frac{(352)(0.5)(1-0.5)}{(352-1)(.10/1.96)^2 + (0.5)(1-0.5)}$$

$$N_s = 75.45$$

Using these values of heterogeneity, level of precision, and level of confidence, 75 completed questionnaires are required. This minimum requirement exceeds the number of questionnaires that were completed and returned in this survey.

This result is not completely disastrous, however. In fact, just by increasing the 10 percent band of precision by 1 percent to 11 percent, the number of surveys required decreases to 64 (holding all other values constant). Coincidentally, this is exactly the number of questionnaires that were returned in this study. Alternatively, if we alter the level of confidence from 95 percent to 90 percent while holding all other values constant, only 57 completed surveys are required. Thus, in order to ensure that the estimates drawn from the completed sample will be within the desired range of precision, we need only to slightly alter the level of confidence or the band of precision.

Further, examining the frequencies of the yes/no questions on the questionnaire shows that the *p* value is actually 0.80 or higher for almost half of the binary response questions. This indicates that the level of homogeneity is high for many of the questions with yes/no answers. Plugging in 0.80 for *p*, rather than the more conservative 0.50 value, with a 10 percent margin of precision and 95 percent confidence interval into the formula yields 52.46 required surveys. Thus, at least half of the binary response questions may be confidently analyzed without sampling error using a 10 percent band of precision. And

just less than 25 percent of binary questions (all those with *p* values of 0.95 or higher) may be estimated within a 5 percent band of precision at the 95 percent confidence interval. The level of precision allowable for individual questions, or variables, will be further discussed in the following chapter as they are used in the analysis.