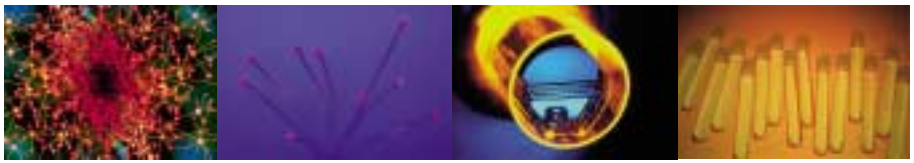
University of Waterloo



Regional Economic Benefits Study

August 31, 2001

PRICEWATERHOUSECOOPERS

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1.0 Executive Summary

1.1 Highlights

PricewaterhouseCoopers LLP (PwC) was retained by the University of Waterloo, (UW) to document and quantify the economic impact of the University, together with its federated university, St. Jerome's, and affiliated colleges, Renison, St. Paul's United and Conrad Grebel, on Waterloo Region's economy, including:

- University spending on capital projects, operations, maintenance and research;
- Spin-off business spending on operations and capital projects; and
- Student and visitor off campus spending.

It should be noted that the process of estimating the economic impact associated with knowledge and innovation emerging from universities (e.g., spin-off companies) is one of the most difficult aspects of trying to capture the real return on investing in higher education. The results of the work on behalf of the University suggest that further research into the linkages with the business community, such as technology receptors, would effectively establish the full nature and magnitude of the economic benefits attributable to UW regionally and nationally.

Since conventional methodologies would fail to capture the spectrum of knowledge transferred from the University to private enterprise, we also conducted a survey of "spin-off" companies to assess the broader impact of the University. The following summarizes some of our key findings as it relates to this study:

- As the region's economy evolves from one based on traditional manufacturing to one focused on information/communication technologies and advanced manufacturing, UW plays an increasingly important role. Business people and economic development representatives commonly credit UW as being the impetus for the development and growth of the region's technology cluster.

- UW's impact extends well beyond that of Waterloo Region to other areas of Ontario (including Toronto and Ottawa), Canada (including Montreal and Vancouver), North America (including Silicon Valley) and world-wide.

- In 1999, the University accounted for more than $1.1 billion of economic activity in the region, and $1.6 billion province-wide. As well, UW directly and indirectly was responsible for sustaining more than 23,000 full-time jobs.

- An analysis of the 1999 operating and capital expenditures of 30 UW spin-off companies suggests that more than $910 million in economic activity was generated in the Province including more than $660 million for Waterloo Region.

- There is a strong indication that UW's successful generation of spin-offs is attributable to UW's intellectual property ownership policy, which gives the researcher/creator ownership of innovations or intellectual property thus stimulating commercialization opportunities.

- Extrapolation of these results to PwC's broader database of spin-off companies, using an estimated impact per employee multiplier, suggests that provincial impacts could increase by as much as $630 million while regional impacts could increase by a further $460 million.

- UW has forged significant linkages with industry and other constituencies in the region. These relationships have facilitated a number of partnerships, spin-off companies, technology transfers and co-op student and graduate placements that result in a substantial transfer of technological and intellectual resources and resulting economic benefit.

- Based on the transfer of technological resources, over 100 spin-off companies, employing more than 2,100 people, were attributed to the University in 1994. By broadening the definition to include the transfer of intellectual resources, PricewaterhouseCoopers LLP has identified over 250 spin-off companies with some level of attribution to the University.

- A 1999 Statistics Canada report on Intellectual Property Commercialization identified 454 spin-offs from 84 universities (292 from the 12 largest). With over 100 spin-offs, UW is the leader in Canada outperforming other universities by generating over 22% of all technology transfer based spin-offs.

- Intellectual capital produced at UW has had a profound impact on development of the region's technology cluster and as such is an invaluable asset to Waterloo Region and a crucial component of Waterloo Region's continued prosperity.

- Significant knowledge generation is occurring at UW through basic interdisciplinary research, technology transfers, spin-off company generation, conventional research funding, and partnership-funded research. UW research funds from grants, public and private contracts totaled over $75.9 million in 1999-2000.

- A broader, more profound social impact attributed to this intellectual capital is also in evidence. For

example, Waterloo Region has recently benefited from an unparalleled donation of $120 million from three executives from the UW spin-off Research in Motion (RIM) to establish the Perimeter Institute of Theoretical Physics in Waterloo.

- UW's commitment to co-operative education has resulted in a widely renowned program that has a 2000 enrolment of nearly 10,000 students across all faculties, the largest of any university in the world.

- Province-wide economic activity stimulated by UW operating expenditures generated a total of $188 million of Federal tax revenue, $108 million for the Province and $26 million for governments in Waterloo Region.

- Expenditures by students from outside Waterloo Region results in an economic impact of nearly $89 million on the local economy. Province-wide value added economic impacts totaled almost $43 million.

- For the academic year 1999/2000, the estimated total number of UW-related visitors from outside the region was approximately 358,681 persons. The economic impacts resulting from various events and visits to students, faculty and staff contribute over $35 million to the provincial economy including $21 million accruing to the regional economy.

1.2 Background

PricewaterhouseCoopers' assessment of the economic and social contribution to Waterloo Region of the University of Waterloo, with its federated university St. Jerome's and three affiliated colleges – Conrad Grebel, Renison and St. Paul's – was completed in two phases. Phase I involved a preliminary assessment of the University's strengths and weaknesses and interviews with local economic development staff. Phase II, the results of which are the focus of this report, represent a more fulsome evaluation of the benefits attributed to university linkages with the business community, and a detailed analysis of the economic impact on Waterloo Region.

1.2.1 *The University as an Operating Organization*

A comprehensive profile of UW's operations including functions such as finance, purchasing, human resources, operation and teaching was developed using Council of Ontario Universities' financial reports as the basis for calculating economic impacts from operating expenditures. Expenditures, including spending under General Funds, Restricted Funds and Capital categories, totaled over $314 million for the 1998-1999 fiscal year. Total direct spending by, or on behalf of, the university would of course be still larger in a year when major construction projects were taking place on the campus, as they are in 2001-02.

1.2.2 *The University as a Knowledge Generator*

Evidence of UW transferring knowledge beyond the borders of its campus has also been incorporated. For discussion and analysis, these 'transfers' have been categorized as:

1. Technology Transfer Based Spin-offs – These include knowledge transfers documented through intellectual property protection processes and contractual transfers of rights. UW has a legacy of spin-off companies that dates from the early 1980s to present day. These include Waterloo Maple, Open Text Corp. and Dalsa Inc. to name a few.

2. Partnerships and Funded Research – These knowledge transfers occur through a range of contractual to less formal partnerships and research programs.

   It is widely recognized that 'basic' as opposed to 'applied' research is the wellspring for innovation. Many recent advancements in information and biological technologies can be attributed to research conducted at universities.

   Funding for research at UW originates from a number of private, philanthropic and public organizations. Spin-offs attributed to this form of relationship include Virtek Vision and Certicom Corp. The extent and attribution of benefits from these relationships is difficult to track due to the "collective attainment of knowledge" nature of interactions.

3. Knowledge Generation Through People – In their most familiar role universities educate students who graduate and enter the work force with a range of skills. Companies that hire graduates, students or co-op students are recipients of knowledge conveyed to the students while at the university. While the least tangible of these three methods of knowledge transfer, the value of this form of knowledge generation is reflected in a salary premium that is, on average, enjoyed by university graduates in all fields. As well, recent research indicates that UW co-op alumni achieve an additional salary premium averaging an annual $6,022 two years after graduation.

Based on information collected and published by the Provincial Ministry of Training, Colleges and Universities, UW consistently outperforms the rest of the Ontario university system across a variety of performance measures including placement at graduation, number of graduates and OSAP (student loan) default rates. The unique nature of the university with its large co-operative education program and use of technology in all areas produces graduates able to make immediate contributions at higher salary levels.

It is also worth noting that a significant number of technology companies recruit more heavily from UW than any other institution. Some of the largest local employers with ties to UW's cooperative education program include Research in Motion (RIM), Sybase, Conestoga-Rovers & Associates and Open Text Corporation. Overall, intellectual capital produced

at UW is an invaluable asset to Waterloo Region and the Ontario economy.

Survey of Spin-off Companies

Knowledge "spun off" from UW is multi-faceted and far-reaching. To quantify these benefits, we administered a questionnaire to a number of key local firms selected from an integrated database of 294 UW "spin-off" companies, 252 of which had some level of attribution to the University (See Appendix D).

Thirty companies were chosen for interviews, based on the perceived strength of indicated linkages to UW, the hypothesis being that companies with more linkages would more likely attribute their existence to UW.

Survey Results

Given the timing associated with the completion of the study, we succeeded in obtaining complete data from 18 of 30 selected companies. While efforts were made to identify companies that represented a broad range of disciplines, respondent companies were concentrated in three business classifications: electronics (8 firms), software (7 firms) and business services (3 firms). Overall, respondent companies accounted for over 2,800 local employees with 39% being UW faculty, alumni or students.

In financial terms (1999 $), these companies accounted for over $500 million in revenue, paid over $2.4 million in municipal taxes and invested over $54.4 million in buildings, machinery, equipment and software in their local operations.

The survey concluded with a question that explicitly asked to what degree "the university influenced the start-up and/or continued operations of the subject company." Ten of the respondents (56%) indicated, "This company would not exist **but-for** the University of Waterloo" attributing 80-100% of the company's existence to UW. Results are summarized in the following table:

UW Attribution	# of Respondents
a) "But-for"	56% (10)
b) "Primarily"	0% (0)
c) "Relied"	11% (2)
d) "At least in part"	33% (6)

To accurately reflect UW's contribution to the local economy while maintaining conservative estimates, we based all econometric analysis of UW spin-off companies on the results from the 18 completed surveys extrapolated to the selected sample of 30. Since the sample was selected rather than random, we have not extrapolated these results to the estimated population of UW spin-off or linked companies.

In response to qualitative questions, all respondents indicated UW's importance in the establishment or continued existence and future prosperity of their business and Waterloo Region's economy.

1.2.3 *The University as a Visitor Attraction*

Beyond the operational aspects of the university and the familiar role of knowledge generator, a university attracts visitors to a community, stimulating economic impacts in the process. Visitors include elementary/secondary school students and parents, business visitors, event goers and facility users, alumni and casual visitors. In the 1999-2000 academic year, we estimated there were approximately 358,681 UW-related visitors from outside Waterloo Region. Estimated off-campus expenditure of visitors from this group is over $32 million.

Students attending UW originate from a number of geographies. Information from the Ministry of Training, Colleges and Universities indicates that about 20% of the student body originates in Waterloo Region. For the purpose of our analysis, "visitors" to Waterloo Region include the 53% of students who originate from the rest of Ontario and 27% who are from outside Ontario (including the rest of Canada and international students). Estimated off-campus expenditure of students from the rest of Ontario is almost $67 million and by students who originate from outside of Ontario almost $34 million.

1.2.4 *The University as a Public Institution*

Quantification of all beneficial impacts generated by a university is not possible. Certain aspects of the university have qualitative benefits not easily assigned a precise monetary value but represent an extraordinary contribution to the overall quality of living in a community. They attract residents to the community, contribute to employee satisfaction and retention in workplaces throughout the Region, and raise the quality of local schools, cultural institutions and public health. These benefits include:

Economic Stimulus of Higher Education – University training and education is widely regarded as being beneficial to the economy. We have quantified a portion of this benefit in *Section 4.0 The University as a Knowledge Generator*. Other research indicates that university-educated students raise their lifetime productivity and have a higher probability of finding and retaining employment. Other researchers have noted that the accreditation role of the university potentially has the greatest impact.

A further consideration however, is the extra value attributed to having a UW co-op education. In 1999, UW collected wage data on 1,306 co-op students who graduated in 1997 from 10 different UW co-op programs. The extra income earned by UW co-op graduates when compared to all-Ontario average wages for graduates was estimated at $7.865 million, an average of $6,022 per graduate. While this information must

be viewed as a 'snapshot' in time it does suggest the added value and additional economic benefit that could accrue to a community as a result of the UW program.

Community and Cultural Contribution – Facilities and activities at the university serve to broaden the cultural base of the community. As well, UW and its colleges provide valuable research in cultural and social fields as well as in science, and offer a number of venues for public events including concerts, meetings, sports events and many summer day camps. For example, the annual East Asian Festival at Renison College celebrates Canadian and East Asian connections in culture, education, trade and technology.

Enhanced Reputation – Through participation in a wide range of scholarly activities UW has heightened the international profile of Waterloo Region. UW is a perennial leader in international competitions of the most demanding kind. Two events where Waterloo has had tremendous success are the William Lowell Putnam Mathematical Competition and the Association for Computing Machinery (ACM) international programming contest.

Open Space – UW has hundreds of acres of accessible open space that is often used by members of the community. These include the park-like main campus, the North Campus trails and an environmental reserve.

Charitable Contributions – Students, staff and faculty are all active in a range of charitable activities, which account for over $250,000 in donations to community causes. Research indicates increases in volunteering and charitable donations from university graduates.

1.3 Summary of Economic Impacts

The University of Waterloo contributes to the provincial and regional economies through a number of roles including as an operating organization, as a knowledge (spin-off) generator, as a visitor attraction and as a public institution. PricewaterhouseCoopers and Econometric Research Limited estimate the *Value Added* economic benefit to Waterloo Region in 1999 at approximately $1.1 billion.

Table 1-1: UW's Waterloo Region Impacts

Value Added Impacts (1999 $000)	Total	Multipliers
Operating Organization	$265,159	0.84
Knowledge Generation:		
Alumni	$58,577	0.84
Spin-offs Operating Expenditures	$618,412	1.02
Spin-offs Capital Expenditures	$48,209	0.53
Attracting Students:		
From Rest of Ontario	$58,895	0.89
From Outside Ontario	$30,004	0.89
Attracting Visitors	$21,316	0.66
Public Institution	Not quantified	
Total Value Added	**$1,100,572**	**0.96**

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Province-wide *Value Added* economic impacts grow to over $1.5 billion. Provincial impacts are greater than regional impacts because of economic activity, such as purchases of goods and services, occurring outside Waterloo Region.

Value Added is a measure of net output including only final goods to avoid double counting of products sold during an accounting period. See *Appendix A: Glossary* for details regarding this measure.

Table 1-2: Annual Province-wide Value Added Economic Impacts

Value Added Impacts (1999 $000)	Total	Multipliers
Operating Organization	$458,823	1.46
Knowledge Generation:		
Alumni	$101,361	1.46
Spin-offs Operating Expenditures	$820,009	1.35
Spin-offs Capital Expenditures	$96,665	1.07
Attracting Students:		
From Rest of Ontario	$0	0.00
From Outside Ontario	$42,833	1.26
Attracting Visitors	$35,491	1.10
Public Institution	Not quantified	
Total Value Added	**$1,555,182**	**1.35**

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

It is important to note that this total is an underestimate of economic benefits. We have excluded certain impacts in this study, which include many spin-off companies not selected for interviews, spin-off companies operating outside Waterloo Region, technology receptor companies and social impacts. If included the impact would be much greater.

Although it is difficult to accurately estimate these additional benefits, we believe them to be very significant. It would be worthwhile for UW to fully explore these additional impacts through additional phases of research including:

- *Analysis of local "spin-off" companies with fewer identifiable linkages to UW – for example, those who employ alumni without participating in research at UW or the co-op program.*
- *Analysis of how the university's innovations and research results find their way into many companies that act as technology receptors.*
- *Quantification and analysis of social impacts including involvement in local organizations by people associated with the University, and direct use of University expertise for community benefit (such as faculty members' service to local government in their fields of expertise, free lectures to local community groups and acting as experts for media in areas of public interest).*
- *Analysis of "spin-off" companies outside Waterloo Region including Ontario, other provinces and internationally.*

2.0 Introduction

In June of 2000, University of Waterloo (UW) engaged PricewaterhouseCoopers LLP (PwC) to conduct a preliminary assessment of UW's, together with its federated university, St. Jerome's and affiliated colleges, Renison, St. Paul's United and Conrad Grebel, economic impact on Waterloo Region. As part of this initial effort, PwC conducted an independent assessment of local economic issues, with the knowledge that further study would be required, particularly as it related to UW's relationship with spin-off companies in the community. Our preliminary work included the following tasks:

- Assessment of UW's strengths, weaknesses, opportunities, and threats as an internationally recognized academic and research institution;
- Investigation of UW's contribution to the local economy;
- Review of secondary information sources; and
- Preparation of a preliminary statement of economic benefits and issues for further exploration.

Phase II was intended to increase understanding and awareness of the economic role of the University in the local economy. We examined not only the effects of faculty, staff, university and student spending, but also the impacts generated from "linked" or spin-off businesses. We evaluated specific quantitative, qualitative, economic and social benefits including:

- University spending (including on-campus enterprises) on capital projects, operations, maintenance and research;
- Spin-off business spending on operations and capital projects; and
- Student and visitor off-campus spending.

Wherever possible, we addressed and quantified other equally important social and cultural impacts of the university. These benefits include:

- Economic Stimulus of Higher Education;
- Community and Cultural Contribution;

- Enhanced Reputation;
- Open Space; and
- Charitable Contributions.

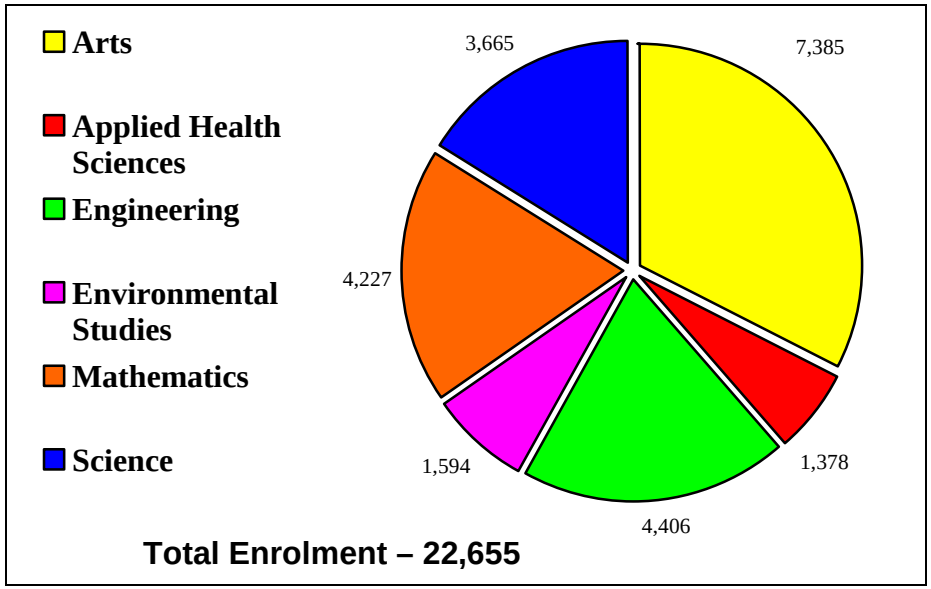
2.1 Background

Founded in 1957, the University of Waterloo is located in Canada's Technology Triangle (CTT), an economic region encompassing the municipalities of Waterloo, Kitchener, Cambridge, and the Regional Municipality of Waterloo (Waterloo Region). UW and its colleges contribute to the rapidly growing economy of this region providing advanced, high-quality education and highly sought after graduates in a variety of disciplines. UW began with a co-operative applied science (engineering) program and today offers a broad range of undergraduate and graduate degree programs in the six faculties shown in Figure 2-1.

2.1.1 *Innovation in Education*

Since its inception, UW has produced graduates with necessary skills and insight to make immediate contributions to society. UW's commitment to co-operative education has resulted in a widely renowned program that has current enrolment of nearly 10,000 students across all faculties, the largest of any university in the world.

Figure 2-1: 1999 / 2000 Student Enrolment



For example, the College of Optometry of Ontario, previously located in Toronto, moved to Waterloo to become the School of Optometry, the only English-language Canadian optometry program. As well, UW's School of Architecture is a prestigious program that only admits 60 students per year and as with other programs provides students access to a co-operative education program. UW's exceptional reputation is evident with its number one ranking nine years in a row according to *Maclean's* magazine's reputational survey.

UW's prestige among educational institutions has attracted organizations that wish to be associated with the University and benefit from the university's highly skilled students and graduates. UW fosters an outward-looking perspective in its faculty, students and programs, creating a learning culture that seeks to confront challenges facing society and the economy.

Since it was established, UW has forged linkages with industry and communities in the region. These relationships have facilitated a number of partnerships, spin-off companies, technology transfers and co-op student and graduate placements and resulted in a substantial transfer of technological and intellectual resources. High-tech and knowledge-based spin-off companies resulting from this transfer have in turn contributed to the local economy though job creation, other spin-off companies and a growing amount of external investment. Four prominent local companies (RIM, OpenText, MKS, and Com Dev) raised in excess of $2 billion in equity over the past five years. See *Section 4.0 The University as a Knowledge Generator* for further discussion of spin-off companies.

> *The University of Waterloo is a world-leading research and education institute. Its success is interwoven with the success of the community and business that thrives in the region.*
>
> Mike Lazaridis
>
> Founder, President and Co-CEO
>
> Research in Motion

Reductions in government funding faced by universities have forced schools to address alternative means of financing in an effort to maintain high educational standards and produce qualified graduates. This situation has created the opportunity to build new partnerships and increase public participation in post-secondary education. UW continues to develop strong linkages with the private and public sectors to enhance teaching, research and other programs.

2.1.2 *CTT Economic Base*

Traditional industries in CTT include insurance, auto parts manufacturing, meatpacking, and furniture making. For comparison purposes, the economy of CTT has more manufacturing activity on average than other communities in Ontario. High tech manufacturing producers are a significant and growing component of the CTT regional economy including firms that develop information / communication technologies (ICT) and advanced manufacturing companies. Commercialization of research and technology from UW has helped expand the established manufacturing base to create a more diversified local economy. In recent years, the area has been recognized for its cultivation of one of Canada's major technology clusters. Business people and economic

development representatives commonly credit UW as being the impetus for the development of the IT cluster.

The substantial growth of high tech companies, the emergence of new spin-offs and arrival of new business investment from outside the local economy contribute to graduate retention rather than migration to other areas with a high concentration of technology companies. The recent acquisition of Quack.com by America Online indicates that Waterloo is being recognized abroad as an expanding technology centre. By mixing academics with industry, UW succeeds in generating successful spin-off companies and facilitating transfers of knowledge and technology, contributing economic benefits to Waterloo Region's economy.

2.2 Report Outline

This report builds on previous studies that estimated economic impacts associated with universities. A recent study commissioned by the *Council of Ontario Universities* included a thorough review of the literature in this regard.[1]

We also incorporated two UW-specific studies in our study. One is the *Economic Impact of Wilfrid Laurier* University *and University of Waterloo on the Kitchener-Waterloo Region* by Douglas J. McCready (1985), then an Associate Professor with Wilfrid Laurier University. The other is the *Economic Impact of the University of Waterloo on Waterloo Region* by Thomas Meyer (1990) then a graduate student in UW's Department of Economics. Discussions with UW Economics Professor Larry Smith, an expert on economic impact analysis and UW's role in the local economy, enhanced this knowledge base.

Where appropriate we referenced these studies. However, changes in the regional economy and emergence of the technology cluster require a re-evaluation of the University and its regional economic relationship. We evaluated similar studies of other academic institutions to ensure that we addressed a full array of potential impacts. In contrast to other reports, we quantify economic contributions of "spin-off" companies attributed to the University of Waterloo.

We assess economic impacts of UW using the following approaches:

- **Section 3.0**: a university as an Operating Organization (e.g., employment, operating and capital expenditures).
- **Section 4.0**: a university as a knowledge generator (e.g., spin-off businesses, technology transfers,

[1] Council of Ontario Universities, *Literature Review: Economic and Social Impacts of Universities*, prepared by Enterprise Canada Research, September 30, 2000 and Council of Ontario Universities, *The Economic Impact of Ontario's Universities*, prepared by Enterprise Canada Research, January 22, 2001.

research expenditures, contract research, co-op and graduate placements).

- **Section 5.0**: a university as a visitor attraction (e.g., students and visitors attracted from outside Waterloo Region).
- **Section 6.0**: a university as a public institution (e.g. accrediting students, providing community facilities).

2.3 Limitations and Assumptions

The following points outline salient limitations and assumptions imposed on the approach and findings of this analysis.

- Estimates in the report are conservative to avoid overstating the results.
- Quantification of all beneficial impacts generated by a university is not possible. For example, social and cultural benefits from the presence of UW are not easily measured. In these cases, we have endeavoured to demonstrate the nature and extent of benefits realized locally through narrative means.
- Due to fiscal constraints, this research program did not administer surveys to UW visitors to determine spending patterns and their length of stay. We based assumptions on surveys conducted for previous university economic impact studies.
- We relied on information and/or assumptions from secondary sources assumed to be accurate, including:
    - Statistics Canada;
    - Council of Ontario Universities;
    - Ontario Student Assistance Program (OSAP);
    - PricewaterhouseCoopers LLP Tech Map 1999 and related data base;
    - University of Waterloo provided data;
    - *The Record*, Kitchener-Waterloo Region's newspaper;
    - *Maclean's*, *Canadian Business* and other popular media publications.
    - Prior post-secondary institution economic impact studies; and
    - Chamber of Commerce of Kitchener & Waterloo
- We used a 1999 base year throughout the report.

- Our primary study area is Waterloo Region with impacts also expressed at the provincial (Ontario) level.

2.4 Econometric Modeling

We employed two methods to present the economic benefits generated by UW. In all cases, we discuss the benefits in a qualitative/descriptive manner. Where possible, we expanded the discussion with quantitative elements. In sections supported by quantitative data, we have engaged the services of Econometric Research Limited (ERL) to conduct econometric analysis.[2]

The econometric model is a local / provincial input-output model based on a refined version of Statistics Canada Interprovincial Input Output Tables. The integrated framework of the model enables the assessment of economic interdependence between sectors and industries of the economy.

Measures typically used for the assessment of economic impacts include gross output (sales or turn-over), value added (Gross Provincial Income), employment, tax revenues (by type and level of government), and multipliers. Throughout our discussion, we use these and other related terms defined in *Appendix A: Glossary*.

[2] Dr. Kubursi is a Professor of Economics at McMaster University and President of Econometric Research Limited (ERL). Dr. Kubursi has extensive experience in economic impact analysis and is widely recognised as an expert in this field. Dr. Kubursi was responsible for running the economic input-output models used for this study.

3.0 The University as an Operating Organization

The University of Waterloo, together with its federated university and affiliated colleges, has operations similar to other organizations and businesses, as presented in the following examples.

- The Finance Office at UW is responsible for accounts payable, client services, corporate accounting and investments and insurance.
- UW's Athletics and Recreational Services are responsible for operating several University athletic and recreational facilities.
- The University contains retail services, such as the Book Store, Computer Store and UW Shop, offering educational and clothing merchandise typically at discounted student rates.
- UW's Food Services Department administers student dining options, including on and off campus Value Meal Plans and alliances with off-campus eateries.

Provincial and local impacts are determined using inputs that include university sales, income, employment and tax revenues. ERL feed inputs into the model to generate the income, employment and tax impacts.

Previous economic impact analyses of Ontario universities demonstrated that investments in Ontario universities often yield higher economic benefits for the Province than other sectors. Three reasons for this comparatively high return are:

1. A large proportion of a university's direct expenditures and resulting indirect and induced spending remain within the Province. Thus, unlike some industries that tend to import goods and services, universities spend more money locally.
2. A large proportion of spending is on wages and salaries. As a result, university expenditures create more jobs than some other sectors.
3. University employees typically earn higher wages relative to other industries, providing higher incomes and better job opportunities in their local economies. This results in considerable added spending power and higher tax revenues.

3.1 Economic Impacts of UW Operating Expenditures

3.1.1 *Value Added Impacts*

This section contains results of the econometric modeling[3] as Province-wide and Waterloo Region impacts.

Table 3-1: Province-wide Impacts of UW Expenditures

Impacts	Total (1999 $000)
Initial Expenditure	$314,380
Total Value Added	**$458,823**
Direct	$216,821
Indirect & Induced	$242,002
Multiplier	1.46
Total Employment	**10,701**
Direct	6,474
Indirect & Induced	4,227
Multiplier	1.65

Source: Econometric Research Limited and PricewaterhouseCoopers LLP based on Council of Ontario Universities, *Financial Report of Ontario Universities 1998 - 99: Volume I - Universities* , May 2000.

Table 3-1: Province-wide Impacts of UW Expenditures indicates that *Value Added* economic impacts (direct, indirect and induced), resulting from $314 million of initial UW operating expenditures (1999), are estimated at nearly $458 million for the Province.

Waterloo Region value added economic impacts are over $265 million (see Table 3-2). Provincial impacts are greater than regional impacts because of economic activity, such as purchases of goods and services, occurring outside Waterloo Region.

Value Added is a measure of net output including only final goods to avoid double counting of products sold during an accounting period. See *Appendix A: Glossary* for details regarding this measure.

Operating expenditures include purchases of goods and services, salaries, utilities, research expenditures and capital spending. Operating expenditures include capital spending since UW has an annual capital program with consistent spending. Research expenditures managed through UW's restricted funds are included in this analysis. Other research funds managed through private enterprise or independent organizations are not included in this amount except those included in the selected sample of spin-off companies.

[3] See *Appendix B: Detailed Economic Impact Tables* for detailed results.

Table 3-2: Economic Impacts in Waterloo Region of UW Expenditures

Impacts	Total (1999 $000)
Initial Expenditure	$314,380
Total Value Added	**$265,159**
Direct	$216,821
Indirect & Induced	$48,338
Multiplier	0.84
Total Employment	**8,668**
Direct	6,474
Indirect & Induced	2,194
Multiplier	1.34

Source: Econometric Research Limited and PricewaterhouseCoopers LLP based on Council of Ontario Universities, *Financial Report of Ontario Universities 1998 - 99: Volume I - Universities* , May 2000.

Direct impacts result from initial expenditures in the local economy. An example of a direct impact would be the purchase of stationery by the University from a local supplier. *Indirect impacts* are subsequent purchases by suppliers of goods and services to sustain the original (i.e., direct or initial) and derivative expenditures. For example, salaries paid or jobs created from producing the supplies purchased. *Induced impacts* occur when employees from businesses stimulated by direct and indirect expenditures spend their income on consumer goods and services. See *Appendix A: Glossary* for detailed definitions.

Since value added captures the full economic impact without double counting of benefits, no other measures are needed. For descriptive purposes, we present a breakdown of employment and tax impacts. See *Appendix B: Detailed Economic Impact Tables* for more details.

3.1.2 *Employment Impacts*

In Waterloo Region, 8,668 full time equivalent jobs are attributable to UW operating expenditures. This increases to 10,701 full time equivalent jobs when Province-wide impacts are considered.

3.1.3 *Tax Generation*

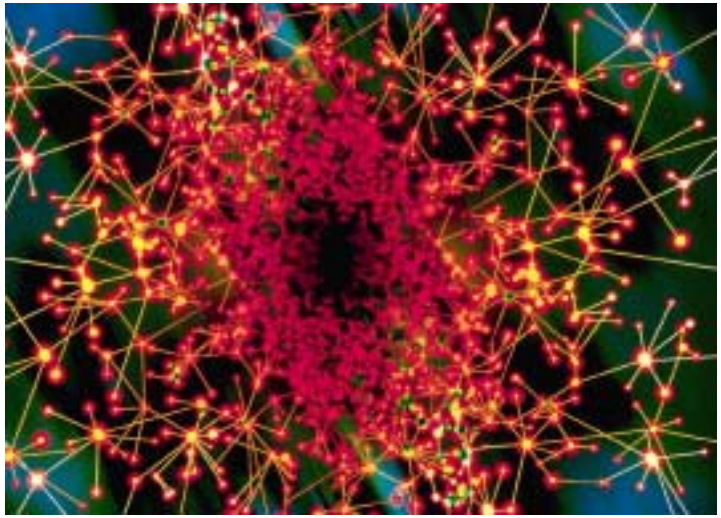
Province-wide economic activity stimulated by UW operating expenditures generates about $82 million of Federal tax revenue, $46 million for the Province and $18 million for local governments – including $9.1 million for governments in Waterloo Region.

4.0 The University as a Knowledge Generator

4.1 Technology Transfer Based Spin-offs

In addition to UW's operational business functions, the university is a knowledge generator. New technology development recognized as intellectual property through patents, copyrighting, trademarking, or other protective measures is the most tangible form of knowledge generation.[4] Less tangible examples include partnerships, funded research and knowledge gained by students.

Our review of primary and secondary sources found the proliferation of software companies in Waterloo Region is often attributed to information technology originating at UW. Computers, commonplace at UW since the 1960s and a focus on information technology have facilitated the creation of many information technology-related "spin off" companies by faculty, graduates and students. Entrepreneurs often cite UW as an incentive for establishing a business in Waterloo Region.



UW's success is evident with the growing list of spin-offs including Waterloo Maple, Certicom Corp. and Dalsa Inc. among many others. UW's Technology Transfer and Licensing Office (TTLO) services and entrepreneurial environment have been effective in building and maintaining linkages with the private sector and in attracting individuals establishing local start-up companies.

[4] For a thorough discussion of the relationship between universities and intellectual property see: Statistics Canada, *Survey of Intellectual Property Commercialization in the Higher Education Sector, 1999*, Science, Innovation and Electronic Information Division, May 2000, Cat. No. 88F0006XIB-00001 and Industry Canada, *University Research and the Commercialization of Intellectual Property in Canada*, March 1999.

Based on the transfer of technological resources, UW's Technology Transfer and Licensing Office (TTLO) publication *Spin-off Company Profiles 1994 Update* identified 106 spin-off companies employing over 2,130 people. By broadening the definition to include the transfer of intellectual resources, PricewaterhouseCoopers identified over 250 spin-off companies with some level of attribution to the University.

UW is clearly a leader in spin-off generation when we consider that Statistics Canada (op. cit. p. 25) identified 454 spin-offs from 84 universities (292 from the 12 largest). When compared with Statistics Canada's data, UW outperforms other universities by generating over 22% of all technology transfer based spin-offs.[5]

TTLO created profiles for each company, including details on its UW relationship, categorizing them as follows:

- **Category 1** companies were defined as those closely coupled where technology transferred from the university was a prime ingredient in their creation or expansion.
- **Category 2** companies were less coupled but with an identifiable transfer of intellectual resources significant in their success.
- **Category 3** companies had no identifiable transfer of specific university technology or resources, but were started by graduates, faculty and/or staff.

There is a strong indication that UW's successful generation of spin-offs is attributable to UW's intellectual property ownership policy. These vary among universities, but generally, there are two approaches:[6]

1) Innovations or intellectual property are owned by the inventor or originator, or
2) The university owns innovations or intellectual property invented or originating there.

UW policy gives the researcher/creator ownership of intellectual property regarding commercialization of technology by faculty, staff and students supported by the UW. The TTLO assists in identifying and protecting commercially viable technologies developed through academic research at the University. TTLO provides

[5] This is only an indication of UW's success, current research by Statistics Canada and others should provide a more definitive basis for comparisons in the future.

[6] Statistics Canada research indicates an even split; However, UW is widely recognized as having a very open policy.

expertise on patents, copyrights and trademarks and assists in creating companies commercializing new technology.

Another reason for UW's legacy of spin-off companies is the nature of the research conducted. Limited receptor capacity[7] in existing businesses for innovative or "cutting-edge" research leads to new business start-ups (spin-offs). This innovative research/receptor capacity cycle perpetuates itself as previous start-ups, such as Open Text and RIM, contract and collaborate on further research that is absorbed by the sponsoring organization or spun-off in another new business.

In addition, UW's success stems from its history of blending academics with industry. These partnerships date back to the founding of UW as a co-op university in the world so that UW is now the largest co-op university with over 10,000 students in co-op studies. This offers students the best of all worlds – excellent academics related to their area of study, job experience and immediate entry into the job force on graduation. Our researchers work closely with industry, spinning off inventions and innovations discovered in UW labs.

Building on UW founding president Gerald Hagey's vision, former UW president Douglas Wright's ardent promotion of blending academics with industry is thought to be largely responsible for the entrepreneurial culture that now exists at the university.[8] Current UW president David Johnston has continued this legacy and has successfully elevated UW's profile on national and international scales through a number of initiatives including his participation on several advisory boards dealing with new economy issues.

A significant number of companies in Waterloo Region are small-to-medium sized firms, an indication that Waterloo's tech cluster is at a youthful stage relative to other established technology clusters. As this cluster matures, companies will grow larger and spin-off other firms. Recent examples include the following UW-affiliated firms:

Table 4-1: UW Spin-off / Subsequent Spin-off

UW Spin-off	Subsequent Spin-off
PixStream (Cisco)	Kaparel
Spicer	PrinterOn
Open Text	B2bScene

[7] Receptor capacity is an organisation's ability to interpret, filter, circulate and apply new information or innovations.

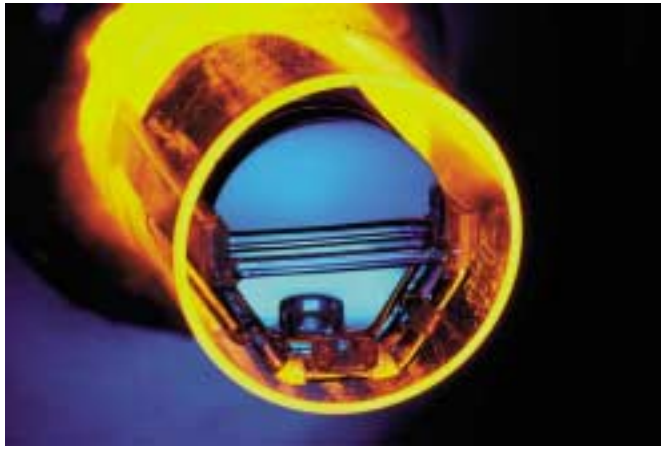
[8] The Record, Tech Spotlight, K2, October 26, 2000

There are several indications that UW inspired growth has generated a critical mass of companies that is now attracting capital investment and venture capital. Acquisitions of local companies by others outside Waterloo Region provides new capital allowing the purchased company to expand more rapidly and invest in other local start-ups.

As well, much-needed venture capital is moving into the region as several venture capital firms have assigned personnel to investigate emerging firms. Working Ventures, a Canadian labour-sponsored investment fund, established a $5 million seed capital fund in 1999 called Waterloo Ventures. The fund focuses on early stage internet technologies, wireless and photonics[9] companies. Waterloo Tech Capital is a $23 million fund focusing on companies in Canada's Technology Triangle, Guelph and southwest to London. Andrew Abouchar, a former Vice-President of Working Ventures Canadian Fund Inc. and Tim Jackson, former CFO with Pixstream manage both funds.[10]

4.2 Partnerships and Funded Research[11]

Partnerships and various forms of funded research (e.g., basic, applied, collaborative, contract) transfer knowledge in a less formal manner than with intellectual property protection measures. A number of community-based initiatives and partnerships have formed to support the development of Waterloo Region's technology cluster.



[9] Photonics is the branch of technology concerned with the properties and transmission of photons, e.g. in fibre optics.
[10] Silicon Valley North, *A Waterloo Windfall?,* May 2001.

[11] Research funds expended through UW are included in *Section 3.0 The University as an Operating Organization*.

One such organization is Communitech, a network of technology and technology service companies, educational institutions and government. Communitech's goals are to facilitate development and sharing of technology resources in CTT, to ensure companies remain in CTT, to encourage new company start-ups and assist in skills training initiatives.

Canada's Technology Triangle Accelerator Network (CTTAN) is a community-based effort intended to accelerate the growth and commercial success of newer companies by improving access to capital and providing mentoring.

It is widely recognized that basic research is the wellspring of innovation. Basic research conducted in the 1960s, 1970s, 1980s and 1990s formed the foundation for late-twentieth and twenty-first century advances in information and biological technologies, for example. UW research funds from grants, public and private contracts totaled over $60 million in 1998-99.

Senior governments support research through established programs such as the Social Sciences and Humanities Research Council of Canada (SSHRC), Natural Sciences and Engineering Research Council of Canada (NSERC), Ontario Graduate Scholarships (OGS) and the National Research Council (NRC). Recognizing that investing in intellectual capital is a competitive advantage, senior governments started funding the Canada Foundation for Innovation, Network of Centres of Excellence, Canadian Institutes for Health Research and Ontario Research and Development Challenge Fund. However, private funding of research is increasingly important.

Following are just a few examples of research initiatives at UW:

- The Lyle S. Hallman Institute for Health Promotion in the Faculty of Applied Health Sciences conducts research on preventative health and behaviour programs. At the time, the donation of $2.5 million by Hallman represented the largest private gift ever given to UW. In addition to the institute, the funding established a professorship to evaluate health promotion programs and initiate lifestyle management research at the institute.
- Rod Coutts', co-founder and former chairman of Teklogix, donation of $7 million worth of Teklogix stock, recently surpassed Hallman's donation. Coutts is a 1964 UW graduate in electrical engineering. The gift is intended to enhance the university's operations in the following three areas: Centre for Learning and Teaching Through Technology, student scholarships, and a major expansion of the Engineering Lecture Hall.
- Recently established through collaboration between Nortel, the Ontario Government and UW, the Nortel Networks Institute for Advanced Information Technology provides scholarships to students, funds

four research chairs, supports an on-site manager and created new undergraduate laboratories.

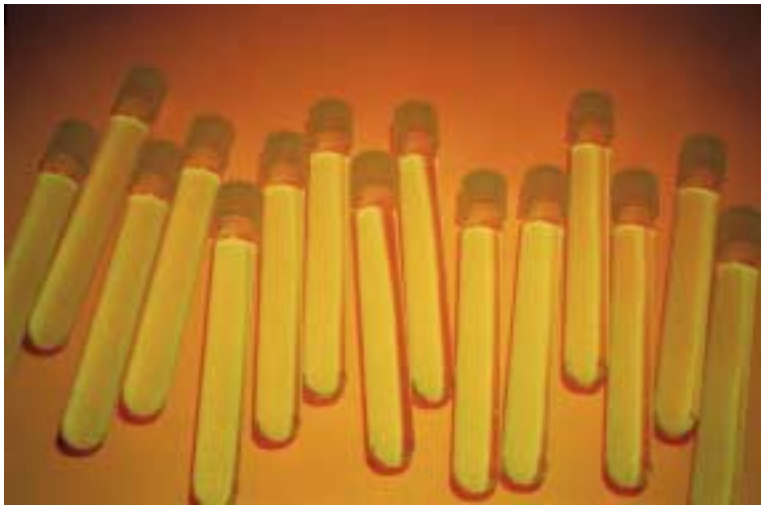
- With assistance from Ericsson Communications Canada, the Centre for Wireless Communications enhances the Department of Electrical and Computer Engineering at UW. Building on the existing graduate studies in the department, the aim of the centre is to develop a graduate research program in wireless communications to train highly qualified personnel in this field.
- Established by Bell Canada Enterprises, UW and the University of Toronto at UW and U of T in 1998, the Bell Canada labs develop technologies related to computing, networking and communications. Funding sources include the three aforementioned partners, the Ontario Research and Development Challenge Fund and the Canada Foundation for Innovation.

The Centre for Applied Cryptographic Research at UW is a prime example of constructive collaboration between government, the university and private corporations broadening UW's capabilities and producing greater expertise in the area. Cryptography is a field of mathematics associated with Internet security and the secure exchange of electronic data. The centre is world-renowned and works with partners including Certicom and MasterCard International. A prominent UW spin-off mentioned previously, Certicom started with technology developed by professors at UW and is now an Internet security company specializing in applications for wireless data and mobile computing.

Advanced facilities and expertise of knowledgeable faculty, staff and students has led to significant research contracts and partnerships being awarded to UW. A sample of more recent contracts and partnerships include:

- The Bell Canada Research Labs received $19.5 million from the Ontario Research and Development Challenge Fund. The fund invested an additional $573,000 to conduct research into high speed automated welding. Alcan International, Babcock & Wilcox Industries, Centreline, John Deere, Magna International and Ventra Group International all support this research and the Ontario Government invested an additional $1.1 million.

- The Ontario Teachers Retirement Village of Kitchener will contribute approximately $550,000 for research and education conducted at the Physical and Psychological Assessment Centre for the Elderly. The centre is based in UW's Faculty of Applied Health Sciences.
- The Centre for Behavioural Research and Program Evaluation moved from Toronto to UW in 1998. Objectives of the centre are to support National Cancer Institute of Canada program development and research across Canada in the Sociobehavioural Cancer Research Network, and to stimulate research for cancer prevention and control.



- In November 1999, UW announced a partnership with Scotiabank for a contribution of $2.5 million to create a software engineering program and to expand computer courses for people interested in high-tech careers.
- In March 2001, the UW-based Waterloo Biotelemetry Institute announced its collaboration with UW spin-off, Virtek Vision, expanding environmental monitoring performed at the institute to include genomic research in environmental areas.
- The Ontario Innovation Trust, intended to assist universities, colleges, hospitals and research institutions improve scientific research and development infrastructure announced close to $5.5 million supporting a number of research projects at UW. The largest portion of the investment is intended to upgrade the communications infrastructure of the university to enhance research and training capabilities.

UW's participation in community partnerships, funded and collaborative research and facility sharing provide value that is not easily measured. Protection of intellectual capital produced through these means is difficult and UW partners may protect it themselves. Whatever the protected status, it is undeniable that knowledge generated through these means has been made possible by UW's presence and knowledge transfer culture and philosophy.

4.3 Knowledge Generation Through People

The previous discussion demonstrated the significance of UW knowledge generation occurring through formal technology transfers, spin-off company generation, attracting research funding and partnerships and funded research. Another benefit gained from the presence of UW, is the transfer of knowledge through people (e.g., faculty, students, graduates, and co-op placements).

4.3.1 *Alumni Productivity*

There is general agreement and studies have shown that university-educated students raise their lifetime productivity and have a higher probability of finding and retaining employment. The increased employment stability experienced by university graduates reduces dependence on social assistance resulting in contributions to government revenues far exceeding government spending on their education.

Numerous studies have demonstrated that return on investment by governments on education is higher than any other public investment. Increased productivity by university graduates compared to those who complete only secondary school is perhaps most evident in the difference in annual incomes estimated at nearly $13,000 for bachelor degrees and $26,000 for masters degrees.[12] As well, in 1999, UW collected wage data on 1,306 co-op alumni who graduated in 1997 from 10 different UW co-op programs. UW co-op alumni earned $7.865 million more than average all-Ontario alumni or $6,022 per graduate. While this information must be viewed as a 'snapshot' in time it does suggest additional productivity attributable to UW co-op alumni.

Regarding these statistics as proxy measures reflects knowledge transferred from a university to other public and private organizations through people. The following table identifies the number of UW alumni living in Waterloo Region.

Table 4-2: UW Alumni in Waterloo Region

UW Degree	Alumni in Waterloo Region
Bachelor	10,574
Graduate	1,165
Both	1,019
Total	**12,758**

[12] Council of Ontario Universities, *Ontario Universities – 1999 Resource Document*, April 2000.

4.3.2 *Top Quality Students*

UW's reputation for the quality of students it attracts and recent statistics compiled by UW's Institutional Analysis and Planning Department demonstrate that it consistently outperforms the rest of the Ontario System in the following ways.

- UW students' 77% graduation rate is higher than the Ontario rate of 73.2%.
- UW exceeds the Ontario system for employment rates approximately two years after graduation.
- OSAP default rates are lowest in the Ontario system.
- UW had the largest percentage of new students from secondary school receiving Ontario Government scholarships for academic excellence.

> *The University of Waterloo produces some of the best engineers in the world.*
>
> Dave Caputo, Managing Director
> Video Networking Business Unit
> Cisco Systems

Computer Science students, particularly those who gain experience in UW's co-operative education program, are among the most sought-after graduates in North America. Business location and acquisition decision are motivated largely by the availability of engineering talent in the area. On two separate occasions, Microsoft founder, Bill Gates acknowledged that his company recruited more heavily from UW than any other institution. Some of the largest local employers with ties to UW include Research In Motion (RIM), Sybase, Conestoga-Rovers & Associates, and Open Text Corporation.[13]

4.3.3 *Local Co-op Program Benefits*

University of Waterloo's Co-operative Education Program benefits participating employers. Co-op student recruitment provides a readily available, flexible and high-value source of labour that may continue after graduation. Due to the short duration of co-op work terms, co-op students often meet company's hiring needs for special or short-term projects.

Local employers benefit from co-op availability because of the recruitment advantage they enjoy with students who prefer to stay in the area rather than move away every four months. Co-op employers give students a chance to enhance their academic skills in terms of research, analysis, and problem solving in a team environment. Co-op students return from work terms locally,

[13] The Record, Tech Spotlight, October 26, 2000

and from locations such as Silicon Valley, Scandinavia and Hong Kong with valuable experience and new ideas. Given the scope and scale of UW's co-op program, the value provided is unmatched in the world.

4.3.4 *Community Contributions*

In the fall of 2000, three executives of the UW spin-off company RIM, made an unparalleled donation of $120 million to establish the Perimeter Institute of Theoretical Physics in Waterloo. Mike Lazaridis founded RIM while he was a UW electrical engineering student. His $100 million donation is the largest single donation in Canadian history. Modeled after the Institute of Advanced Study, a centre for intellectual inquiry located in Princeton, New Jersey, the Institute expects to attract some of the top physicists from around the globe, enriching the scientific character of the area, and making Waterloo one of the world's leading centres of research in the physical sciences.

The talent Cisco gains from University of Waterloo co-op students and graduates helps us maintain our leadership position in Networking for the Internet.

Dave Caputo, Managing Director
Video Networking Business Unit
Cisco Systems

The recent release of the map of the human genome has resulted in a wealth of human genetic information. The field of study applied to genomic research is bioinformatics, a combination of Biology, Computer Science and Information Technology (IT). Recognizing the growing importance of this interdisciplinary area of study and the deficit of skilled professionals in the field, UW introduced the first bioinformatics undergraduate program in North America. Integration of cutting-edge technology into the curriculum further substantiates the fact that UW is intent on training students in new technologies.

This section has demonstrated the unsurpassed value of UW graduates for Waterloo region and beyond. UW attracts students that are among the brightest and produces graduates that are among the highest in demand. With leading-edge training and education, co-op students and graduates of UW benefit the companies and the communities in which they reside. Their high incomes and low unemployment rates provide unparalleled assets for the local economy, and in the example of RIM's Mike Lazaridis, their contributions can have profound long-term effects on their community. For these reasons, intellectual capital produced at UW is an invaluable asset to the Waterloo region.

4.4 Economic Impacts of UW Alumni

We calculate economic impacts generated by alumni by estimating the annual productivity gain of UW alumni living in

Waterloo Region. From this total, we deduct alumni working at UW (included in the Section 3.0 The University as an Operating Organization analysis) and UW alumni employed at spin-off companies (included in the analysis later in Section 4.0). We reduce incremental salary by an estimated tax rate of 45% to establish Initial Expenditures of UW alumni in Waterloo Region. The following tables summarize results of this analysis.

Table 4-3: Province-wide Impacts of UW Alumni Working in Waterloo Region

Impacts	Total (1999 $000)
Initial Expenditure	$69,451
Total Value Added	**$101,361**
Direct	$47,899
Indirect & Induced	$53,462
Multiplier	1.46
Total Employment	**2,364**
Direct	1,430
Indirect & Induced	934
Multiplier	1.65

Source: PricewaterhouseCoopers LLP based on UW alumni data

Province-wide value added impacts total $101,361. In Waterloo Region value added impacts are $58,577.

Table 4-4: Waterloo Region Impacts of UW Alumni Working in Waterloo Region

Impacts	Total (1999 $000)
Initial Expenditure	$69,451
Total Value Added	**$58,577**
Direct	$47,899
Indirect & Induced	$10,678
Multiplier	0.84
Total Employment	**1,915**
Direct	1,430
Indirect & Induced	485
Multiplier	1.34

Source: PricewaterhouseCoopers LLP based on UW alumni data

4.5 Spin-Off Questionnaire

It is clear from our discussion in sections 4.1 to 4.3 that the knowledge "spun off" from UW is multi-faceted and far-reaching. In early 2001, PwC developed a questionnaire and interviewed a sample of UW "spin-off" companies to quantify some of these benefits. The questionnaire explores

knowledge linkages between UW and the subject company, ending with an explicit question relating the existence of the company to UW. The degree to which the enterprise attributes its existence to the University, along with corporate financial information provided by the respondents, has allowed PwC to impute economic impacts attributable to UW because of "spin off" companies.

4.5.1 *Methodology*

To ensure representation of a strong and diverse sample of "spin-off" or UW-linked companies, we considered a number of factors in the selection process. Examination of the following indicators or linkages determined whether a business' existence is attributed or strongly linked to UW:

- Transfer of Technology.
    - UW sponsors venture.
    - Venture started with unlicensed technology (e.g., by a UW professor).
    - Venture started with licensed technology developed at UW.
- Transfer of Knowledge (research).
    - Contract research undertaken at UW.
    - Research partnerships (joint ventures and other agreements with UW).
    - Employment of UW students.
- Transfer of Knowledge (people).
    - UW faculty start a company.
    - UW staff start a company.
    - UW students/graduates start a company.

In addition to these criteria, all the businesses identified had to be credible enterprises with growth potential in the Waterloo Region. On-going relationships with the university through partnerships, agreements and/or co-op and graduate hiring were other criteria used in the determination of the sample companies. The questionnaire gathered capital and operating expenditure information. Survey design differentiated between operational activities whose existence or location is directly attributable to the university, versus activities that are, to a lesser degree, facilitated by the university.

4.5.2 *Database Integration*

PwC received information on companies linked to the University from several sources, consolidating it into one database. Database compilation occurred as follows:

- PricewaterhouseCoopers' 1999 Canada Technology Triangle Tech Map database is a "family tree" of Waterloo Region technology companies resulting from research on the technology community and subsequent

interviews with key industry contacts. From the Tech Map, we extracted companies linked to UW for purposes of this Economic Impact Analysis.

- We combined companies linked to UW in PwC's CTT Tech Map with spin-off company profiles compiled in 1994 by UW's TTLO and published in the *Spin-Off Company Profiles 1994 Update*.
- TTLO provided a list of current licensees and companies linked to the university, as of July 13, 2000, for integration with the database.
- UW's Office of Development and Alumni Affairs provided files containing current employer and work location of alumni (current to 1999) for integration with the database.
- The University's Co-operative Education & Career Services department provided information regarding recent co-op placements. These sources proved very useful in determining the degree to which companies were associated with the university.
- Lastly, we added employment levels from The City of Waterloo's current (2000-2001) business directory to the integrated database.

Data sources include spin-off companies, current licensees, alumni, co-op placements, and employment estimates.

4.5.3 *Survey Sample Selection*

Through discussions with UW, PwC selected a sample of 30 companies with demonstrated linkages to UW for interviews. The selection of 30 companies involved a screening process using the following criteria:

1) The first criterion for selection was typically a company started through or involving a transfer of licensed or unlicensed technology.
2) The second criterion was whether faculty, staff, students, or graduates started the company.
3) The third measure of a company's affiliation with UW examined the current level of co-op and alumni placement at the company.

In each instance, we determined whether intellectual resources from UW seemed to be a key element in the ongoing operations of the company. Companies that matched all three of the criteria were typically selected first, followed by companies that did not have as direct a linkage, but where data indicated UW contributions may be significant to the company.

4.5.4 *Questionnaire Development & Implementation*

Development of the questionnaire relied on questions used in previous economic impact studies refined to focus on issues specific to potential economic impacts attributable to UW. Variable selection included economic impact and company financial variables for analysis with the input-output model developed by Econometric Research Limited. A condensed version of the questionnaire is in *Appendix C: Questionnaire*.

Our Kitchener-Waterloo office conducted personal, telephone and e-mail interviews. These were completed and transcribed between December 2000 and March 2001.

4.5.5 *Survey Results*

We interviewed 18 companies out of the select sample of 30. Eleven of the companies in the sample were unable to schedule an interview in the allotted period and one firm declined to participate.

Although originating from a range of UW faculties, respondent companies were concentrated in three business classifications:

Table 4-5: Respondent Business Classification

Business Classification	# of Respondents
Electronics	8
Software	7
Business Services	3

Overall, the respondent companies represent over 2,800 employees in Waterloo locations[14] with 39% being UW faculty, alumni or students. The following table summarizes the combined financial responses.

Table 4-6: Respondent Financial Summary

Financial Category	Spending (1999 $)
Total Revenue	$500 Million
Municipal Taxes	$2.4 Million
Capital Investment in Waterloo:	
Buildings	$26.9 Million
Machinery, Equipment & Software	$27.5 Million
Contributions to UW	$447,000

[14] The City of Waterloo's current employment level is estimated at 43,000.

The questionnaire concluded with an explicit question attributing the existence of the company to UW.

> *Which of the following statements most accurately reflects the degree to which **Technology** or **Knowledge Transfers** from the University influenced the start-up and/or continued operations of the subject company? (Spin-off attribution weighting in brackets)*
>
> ***(Please circle ONE letter)***
>
> a) *This Company would not exist **but-for** the University of Waterloo (80-100%).*
>
> b) *This Company is **primarily** a result of the University of Waterloo (60-79%).*
>
> c) *This Company has to a significant degree **relied** on the University of Waterloo (40-59%).*
>
> d) *This Company has, **at least in part**, developed as a result of the University of Waterloo (20-39%).*

The results are summarized in the following table.

Table 4-7: UW Spin-off Attribution Results

UW Attribution	# of Respondents
a) "But-for"	56% (10)
b) "Primarily"	0% (0)
c) "Relied"	11% (2)
d) "At least in part"	33% (6)

To accurately reflect UW's contribution to the local economy while maintaining conservative estimates, we based all econometric analysis of UW spin-off companies on the results from the 18 completed surveys extrapolated to the selected sample of 30. Since the sample was selected rather than random, we have not extrapolated these results to the estimated population of UW spin-off or linked companies. However, to provide a sense of magnitude of potential economic impact of UW spin-offs, we categorized all companies in the spin-off database based on our estimate of UW attribution (interviewed companies are categorized by actual attribution responses). See the following table for our categorization.

Table 4-8: PwC Estimated Database Attribution

UW Attribution	# of Companies	# of Companies with Employment Data	Total Employees
a) "But-for"	9% (23)	96% (22)	1,426
b) "Primarily"	4% (11)	73% (8)	217
c) "Relied"	38% (95)	97% (92)	2,139
d) "At least in part"	49% (123)	27% (33)	1,076
Total	**100%** (252)	**155** (62%)	**4,858**

In describing the relationships with UW, one respondent expressed that from the date of inception, the company:

- Has continued to rely on UW graduates, students and co-ops as a pool of future employees
- Is continually looking at enhancing its relationship with UW, and
- Is working on initiatives with UW that would see stronger research and development relationships.

In this instance, the company categorized the attribution relationship with UW as "c." Respondents categorized as "a" typically have a technology linkage with UW. Many "a" companies were established when students or faculty transferred technologies originating at UW. Others started companies to continue research initiated at UW.

One respondent expressed the value of his education at UW and its role in the formation of his company as follows:

> *If it weren't for the [UW] resources I had and the education I got, the firm would have never been formed.*

Companies classified as "a" category typically maintain strong R & D relationships with UW. One company used students at UW labs for problem solving and critique. "A" companies commonly reported joint ventures with UW.

"A" companies and faculty members exchange ideas and frequently make an effort to identify suitable students for co-op or graduate placement. Students and companies exchange information through discussions on the application of theory and aspects of the technology surrounding their product and/or service.

One firm credited UW as being one of the few institutions that offered specialized training required in their field. Companies make extensive use of UW resources such as testing facilities and the library, viewing them as valuable resources. One respondent attributed both UW's facilities and its students to providing a competitive edge for the firm.

More than one respondent expressed the value of UW's international reputation for his or her own experiences abroad.

An individual noted this recognition is important to the future growth of Waterloo region.

A common theme conveyed by respondents was the contribution UW has made to local companies and how it supports the growth of the area. Companies contribute time and finances through donations, sponsorships and participation in conferences. Individuals from both UW and private companies often serve on each other's boards. One executive expressed support for UW in the following manner:

> *UW plays a significant role in the continued health of companies in the K-W area…In one form or another (financially) we have supported UW and will continue to do so…UW is contributing to the culture of the area which is good for the growth of the tech sector in the area.*

UW plays a significant role in the continued health of companies in the K-W area…

Quality of education received at UW and the abilities of its students is summed up in the following paraphrase:

> *Because of its ability to generate the calibre of students, it contributes to the growth of the local area, even drawing new companies to the area.*

An overwhelming majority of respondents indicated the importance of UW to either their establishment or to their continued existence and future prosperity. The interest expressed by firms that wish to continually strengthen their ties to UW augurs well for future partnership and research opportunities with local companies. Although these companies have "spun-off" from UW, the special relationship expressed in the survey clearly indicates that companies wish to retain their ties and continue to support UW.

4.6 Economic Impacts of UW Spin-offs

4.6.1 *Value Added Impacts*

This section contains results of the econometric modeling[15] as Province-wide and Waterloo Region impacts.

Table 4-9: Province-wide Economic Impacts of UW Spin-offs indicates $608 million (1999 $) in UW spin-off operating expenditures attributed to UW generate *Value Added* economic impacts (direct, indirect and induced) of about $820 million.

[15] See Appendix B: Detailed Economic Impact Tables for detailed results.

Table 4-9: Province-wide Economic Impacts of UW Spin-offs

Operating Expenditures

Impacts	Total (1999 $000)
Initial Expenditure	$608,402
Total Value Added	**$820,009**
Direct	$394,035
Indirect & Induced	$425,974
Multiplier	1.35
Total Employment	**13,440**
Direct	5,497
Indirect & Induced	7,943
Multiplier	2.45

Source: Econometric Research Limited and PricewaterhouseCoopers LLP based on PwC survey of University of Waterloo Spin-off Companies.

Table 4-10: Economic Impacts in Waterloo Region of UW Spin-offs

Operating Expenditures

Impacts	Total (1999 $000)
Initial Expenditure	$608,402
Total Value Added	**$618,412**
Direct	$394,035
Indirect & Induced	$224,377
Multiplier	1.02
Total Employment	**9,537**
Direct	5,497
Indirect & Induced	4,040
Multiplier	1.73

Source: Econometric Research Limited and PricewaterhouseCoopers LLP based on PwC survey of University of Waterloo Spin-off Companies.

Waterloo Region value added economic impacts are over $618 million (see Table 4-10). Provincial impacts are greater than regional impacts because of economic activity, such as purchases of goods and services, occurring outside Waterloo Region.

At minimum, these economic benefits are the tip of the iceberg since spin-off companies creating receptor capacity significantly increase employment and enhance productivity through innovation.

4.6.2 *Employment Impacts*

In Waterloo Region, 9,537 full time equivalent jobs are attributable to operating expenditures (attributable to UW) by UW spin-off companies. This increases to 13,440 full time equivalent jobs when Province-wide impacts are considered.

4.6.3 *Tax Generation*

Province-wide economic activity stimulated by operating expenditures (attributable to UW) by UW spin-off companies generates about $153 million of Federal tax revenue, $87 million for the Province and $33 million for local governments – including $18 million for governments in Waterloo Region.

4.6.4 *Capital Expenditure Impacts*

Table 4-11: Province-wide Impacts of UW Spin-off Capital Expenditures indicates that *Value Added* economic impacts (direct, indirect and induced), resulting from $91 million in UW spin-off capital expenditures (1999 $) attributed to UW, are estimated at $97 million.

Table 4-11: Province-wide Impacts of UW Spin-off Capital Expenditures

Impacts	Total (1999 $000)
Initial Expenditure	$90,737
Total Value Added	**$96,665**
Direct	$41,042
Indirect & Induced	$55,623
Multiplier	1.07
Total Employment	**1,378**
Direct	437
Indirect & Induced	941
Multiplier	3.16

Source: Econometric Research Limited and PricewaterhouseCoopers LLP based on PwC survey of University of Waterloo Spin-off Companies.

Waterloo Region value added economic impacts are over $48 million (see Table 4-12). Provincial impacts are greater than regional impacts because of economic activity, such as purchases of goods and services, occurring outside Waterloo Region.

Table 4-12: Waterloo Region Economic Impacts of UW Spin-off

Capital Expenditures

Impacts	Total (1999 $000)
Initial Expenditure	$90,737
Total Value Added	**$48,209**
Direct	$41,042
Indirect & Induced	$7,167
Multiplier	0.53
Total Employment	**638**
Direct	436
Indirect & Induced	202
Multiplier	1.46

Source: Econometric Research Limited and PricewaterhouseCoopers LLP based on PwC survey of University of Waterloo Spin-off Companies.

5.0 The University as a Visitor Attraction

In addition to economic impacts resulting from UW's operational functions and UW spin-off companies, a university attracts out-of-town students and other out-of-town visitors for attractions that include sporting events, theatrical, music or arts presentations, conferences and public lectures. Visitor expenditures attracted by university-held events are a significant source of "imported" revenue for Waterloo Region. Athletic, cultural and academic events at UW generate economic impacts attributable to the presence of UW.

5.1 Visitors

For the academic year 1999/2000, the estimated total number of UW-related visitors from outside the region[16] was approximately 358,681 persons. Among these visitors, the largest groups were students and guests for convocation, theatregoers, visitors to museums and/or galleries and attendees of public lectures. Visitor expenditures are a significant economic impact because they originate outside Waterloo Region and probably would not have occurred if not for the presence of the university.

Visitors were split into 6 categories outlined below.

- elementary/secondary students & parents;
- business visitors;
- event goers and facility users;
- conference attendees;
- alumni; and
- casual visitors.

5.1.1 *Visitor Expenditure*

We calculate initial or direct visitor expenditure using UW's Community Relations office and UW Community Resource Guide visitor data. We also rely on methods and assumptions used in previous economic impact studies. Where current data were not available, we relied on historic figures adjusted with an enrolment or graduate increase factor where applicable.

Off-campus expenditure information is from the UW Visitor Centre, Kitchener-Waterloo Chamber of Commerce and prior economic impact studies. In all cases, we adjusted figures for

[16] Reference to "visitors" in this section means visitors from outside Waterloo Region.

inflation to a 1999 base year and assumed all visitors stayed either one or two days (overnight).

- Elementary/secondary students and parents attended various Open Houses, academic contests and other campus events. This group numbered approximately 56,341 and is assumed to have stayed in the area for one day and spent an estimated $ 340,863 based on the 1990 Meyers' study assumption of $5 per person for lunch inflation adjusted to $6.05.
- Guest lecturers, sales people, and recruiters were categorized as business visitors. Of approximately 10,196 business visitors tabulated, we assumed 8,769 (86%) to have stayed one day, and 1,427 (14%) were believed to have stayed overnight. Business visitor expenditure was $1,007,222 based on assumed spending of $74.12 for one-day visitors and $125.18 per day for overnight visitors. [17]
- Attendees of public lectures, sporting events, theatre, academic contests and other events were grouped together as event goers and facility users. A total of 412,958 visitors were calculated for this category; however, of this amount only one quarter (103,240) of the visitors were assumed to have come from outside of Waterloo region. These one-day visitors were assumed to spend $74.12. [18]
- Visitors to the UW campus for conferences, seminars and workshops were classified as conference attendees. These overnight visitors totaled nearly 11,350 persons and they spent close to $2,841,586 based on the assumption of $125.18 per day. 1998/1999 Visitor attendance statistics for conferences at UW were not scaled upwards under our assumption that they would not be influenced by a slight increase in overall enrolment over the period.
- Alumni events including Convocation (becoming alumni), Homecoming and reunions attracted close to 23,242 overnight visitors that were estimated to spend close to $5,818,867 based on our assumption of $125.18 per day.

[17] Business visitors proportions and overnight visitor spending based Meyer (1990), based on a survey of business visitors conducted by McCready (1985). One-day visitor spending is from information provided by Kitchener-Waterloo Chamber of Commerce, Tourism Member Survey.

[18] This proportion assumption is based on the results found in a survey conducted of visitors by McCready (1985). Spending estimates are from the Chamber of Commerce (op. cit.).

- Casual visitors represent individuals who come into the area to visit faculty, staff and students. Casual visitors are the most difficult category to tabulate because unlike other events, casual visitors do not register on campus. Assuming staff had 6 visitors during the year, out-of-town full time students had 10 visitors, in-town full time students had 2 visitors and part time students had one visitor, the total number of casual visitors was 154,312. Total spending by casual visitors was estimated to be $14,881,849 based on our assumption of $48.22 per day.[19]

Total initial or direct spending for all six categories of visitors is estimated at $32,123,434. Economic benefits generated from this spending are analyzed as follows.

5.1.2 *Value Added Impacts*

This section contains results of the econometric modeling[20] as Province-wide and Waterloo Region impacts.

Table 5-1: Province-wide Economic Impact of Visitors to UW indicates that *Value Added* economic impacts (direct, indirect and induced), resulting from various events and visits to students, faculty and staff generate an economic impact of over $35 million in the provincial economy.

Table 5-1: Province-wide Economic Impact of Visitors to UW

Impacts	Total (1999 $000)
Initial Expenditure	$32,123
Total Value Added	**$35,491**
Direct	$13,507
Indirect & Induced	$21,984
Multiplier	1.10
Total Employment	**655**
Direct	281
Indirect & Induced	373
Multiplier	2.33

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Waterloo Region value added economic impacts are over $21 million (see Table 5-2). Provincial impacts are greater than regional impacts because of economic activity, such as purchases of goods and services, occurring outside Waterloo Region.

[19] PwC calculation based on assumptions from Meyer (1990), McCready (1985), Kitchener-Waterloo Tourism and others,
[20] See Appendix B: Detailed Economic Impact Tables for detailed results.

Table 5-2: Economic Impacts in Waterloo Region of Visitors to UW

Impacts	Total (1999 $000)
Initial Expenditure	$32,123
Total Value Added	**$21,316**
Direct	$13,507
Indirect & Induced	$7,809
Multiplier	0.66
Total Employment	**485**
Direct	281
Indirect & Induced	204
Multiplier	1.72

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

5.1.3 *Employment Impacts*

In Waterloo Region, 458 full time equivalent jobs are attributable to expenditures by visitors to UW. This increases to 655 full time equivalent jobs when Province-wide impacts are considered.

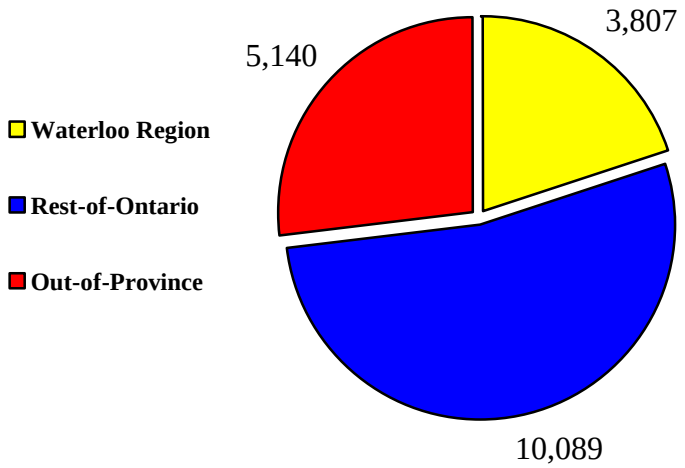
5.1.4 *Tax Generation*

Province-wide economic activity stimulated by UW visitor expenditures generates about $6.0 million of Federal tax revenue, $4.3 million for the Province and $2.6 million for local governments – including $1.2 million for governments in Waterloo Region.

5.2 Out-of-Town Student Analysis

Students attending UW originate from a number of geographies. Information from the Ministry of Training, Colleges and Universities indicates that about 20% of the student body originates in Waterloo Region (1998/1999). For the purpose of our analysis, "visitors" to Waterloo Region include the 53% of students who originate from the rest of Ontario and 27% who are from outside Ontario (including the rest of Canada and international students).

Figure 5-1: 1999 / 2000 Enrolment by Student Origin



OSAP provided estimated student expenditure information and we relied on the Ontario average to make our estimates. These figures were verified by referring to the Information for Prospective Students section on UW's website including average expenditures on books and supplies, housing costs, and transportation.

5.2.1 *Student Expenditure*

Students coming into the region are a source of outside spending (imports) resulting from the presence of UW. Estimated off-campus expenditure of students from the rest of Ontario is almost $67 million and almost $34 million by students who originate from outside of Ontario based on the following assumptions:

- All expenditures for tuition and books accrue to UW and have been accounted for in *Section 3.0 The University as an Operating Organization*.
- 50% of part-time student expenditures have been deducted as being not attributable to UW.
- 100% of housing and 50% of food expenditure is deducted for students living on campus.
- Average student expenditures per month per full-time student (i.e., prior to the above adjustments), are:

Table 5-3: OSAP Ontario Average Student Monthly Expenditures

Category	Amount ($ / month)
Food	$191
Transportation	$69
Housing	$426
Miscellaneous	$206

Table 5-4: Student Enrolment by Student Living Arrangement

Student Living Arrangement	On-campus housing	Off-campus housing
Undergraduate		
Full-time	5,418	11,048
Part-time	1,421	2,897
On co-op	1,198	2,444
Graduate		
Full-time	515	1,050
Part-time	1,421	2,897

5.2.2 *Value Added Impacts*

Expenditures by students from outside Waterloo Region result in value added impacts of nearly $89 million locally (see Table 5-5). Province-wide value added economic impacts are almost $43 million (see Table 5-6).

Table 5-5: Economic Impacts in Waterloo Region of Out-of-Town Student Expenditures

Impacts	From Rest of Ontario	From Outside Ontario	Total (1999 $000)
Initial Expenditure	$66,514	$33,886	$100,400
Total Value Added	**$58,895**	**$30,004**	**$88,899**
Direct	$36,522	$18,606	$55,128
Indirect & Induced	$22,373	$11,398	$33,771
Multiplier	0.89	0.89	0.89
Total Employment	**1,380**	**703**	**2,083**
Direct	889	453	1,342
Indirect & Induced	491	250	741
Multiplier	1.55	1.55	1.55

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

5.2.3 *Employment Impacts*

In Waterloo Region, 2,083 full time equivalent jobs are attributable to expenditures by out-of-region UW students. Province-wide, expenditures by out-of-province students generate 872 full time equivalent jobs.

Table 5-6: Province-wide Economic Impacts of Out-of-Province Student Expenditures

Impacts	From Rest of Ontario	From Outside Ontario	Total (1999 $000)
Initial Expenditure	$0	$33,886	$33,886
Total Value Added	**$0**	**$42,833**	**$42,833**
Direct	$0	$18,606	$18,606
Indirect & Induced	$0	$24,227	$24,227
Multiplier	0.00	1.26	1.26
Total Employment	**0**	**872**	**872**
Direct	0	453	453
Indirect & Induced	0	419	419
Multiplier	0.00	1.92	1.92

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

5.2.4 *Tax Generation*

Province-wide economic activity stimulated by out-of-province UW student expenditures generates about $7.4 million of Federal tax revenue, $4.8 million for the Province and $2.6 million for local governments. Out-of-region student expenditures generate $4.9 million for governments in Waterloo Region.

6.0 The University as a Public Institution

The study thus far has focused primarily on analyzing the impact the University has on the Region's economy based on what goods and services the University, its employees, spin-off businesses, students and visitors purchase locally.

Broadly speaking, the University is also a major source of social and cultural enrichment for the Region. This section addresses the important social and cultural benefits provided by UW and **not** represented in our economic analyses. A university offers a substantial amount of qualitative benefits that are not easily assigned a precise monetary value, but represent an extraordinary contribution to the overall quality of living in a community.[21]

> *The founders of most of the high-tech companies in the region know each other because they met at the University of Waterloo. They studied there, they taught there, or they partied there.*
>
> Peter Fraser, CEO
>
> Thinkage Limited

6.1 Economic Stimulus of Higher Education

At a high level, universities benefit the local economy by supplying a skilled labour force that typically earns higher incomes than a less educated work force. Earlier in our report, we suggested that the difference in annual incomes between individuals with a Bachelor Degree or Masters Degree and people without a post secondary education is estimated at $13,000 and $26,000 respectively. In addition, the presence of University graduates in a community stimulates economic activity by attracting businesses seeking to capitalize on the availability of its graduates. Broad-based training and research initiatives made available at universities generate intellectual capital that students and alumni apply to practical problems, resulting in benefits to society and high return on initial investment.

These impacts have been discussed in Section 4.3 *Knowledge Generation Through People* and quantified, to an extent, as economic impacts through our analysis of spin-off companies in Section 4.0 *The University as a Knowledge*

[21] For further information see Enterprise Canada's economic impact report (prior reference) that quantifies some of these impacts.

Generator. However, some benefits associated with higher education accruing to society are not easily quantified. A study conducted on the status of education in Waterloo Region recently determined that the supply of a skilled and motivated labour force is the principal determinant of economic prosperity in the region.[22] Individuals with a post-secondary degree are essential for the region's export-oriented knowledge-based economy.

In addition to these significant contingent values accruing to society through post-secondary education, others have noted that the accreditation role of the university potentially has the greatest impact. The 'signals' provided to potential employers regarding certain qualities (for example, ability to accomplish long term objectives, ability to deal with administrative issues, attainment of a certain level of social skills, etc.) are quite valuable. Without post-secondary designations, the cost to businesses of screening candidates for these skills would be immense.

6.2 University of Waterloo Co-Op Program

Earlier in our report, we discussed a Council of Ontario Universities report that documented the increased productivity being attributed to those individuals with bachelor and masters degree versus those without a post secondary education. A further consideration however, is the extra value attributed to having a UW co-op education.

In 1999, the University of Waterloo collected wage data on 1,306 co-op students that graduated from the University in 1997 representing 10 different co-op programs. The extra income earned by co-op graduates when compared to all-Ontario average wages for graduates was estimated at $7.865 million. This results in an additional premium of $6,022 for graduates. While this information must be viewed as a 'snapshot' in time, coupled with the income difference of $13,000 and $26,000 reported earlier, it does suggest the added value and additional economic benefit that could accrue to a community because of the UW program.

6.3 Community and Cultural Contribution

Many valuable facilities, services and forms of donation provided by UW enhance the quality of life in the community. UW students benefit the community with their involvement in various charities, fund raising events and volunteer work. The multicultural student body of UW broadens the ethnic diversity of the community and enhances the local cultural scene. A wide range of valuable research is also performed at UW that further contributes to the economy of the region and Canada.

[22] *Regional Municipality of Waterloo: Education in Waterloo*, Larry Smith/Essential Economics Corporation, 1997.

In terms of public venues, the University of Waterloo has four museums open to the public.

1. The Museum and Archive of Games is a public institution that exhibits and researches games and game related objects and is dedicated to their collection and preservation.
2. The Museum of Visual Science features examples of eye examination and vision instruments with a collection of eyeglasses dating back to 1700.
3. The Earth Sciences Museum contains a wide range of exhibits that include: dinosaurs, fossils, gems, minerals, and groundwater resources.
4. The Brubacher House is an historic site, built by a Pennsylvanian Mennonite settler in 1850.

In addition to the museums, the university has three distinctive ecological, botanical and geological gardens open to visitors. Works by students in the Fine Arts program are on display at the Artspace Gallery. Other local, regional and contemporary exhibits are on public display at the University of Waterloo Art Gallery. The Humanities Theatre offers events including theatrical performances, public lectures, children's entertainment, dance shows and competitions.

> *The fact that NDI works closely with the University gives our* [international] *customers and prospects a degree of assurance – recognition that NDI deals with an innovative and well-recognized institution.*
>
> Steve Currie, Senior Manager
> Sales and Marketing
> Northern Digital Inc.

The University's affiliated university and colleges are a central part of this academic and cultural mosaic. UW's university colleges make it five institutions in one: Renison College, Conrad Grebel University College, St. Jerome's University, and St. Paul's United College offer a wide range of social and cultural benefits to the local community.

Renison College specializes in East Asian studies, a program that examines the culture of the Pacific Rim countries and offers language instruction in Chinese, Japanese and Korean.

Conrad Grebel University College specializes in peace-and-conflict studies and is nationally recognized as a significant site of Mennonite literary activity, making it a valuable resource to members of the local community, and a draw for visitors to the region.

St. Jerome's University was the first university college to join UW. Its specialization program in religious studies prepares graduates to teach in the separate school system.

St. Paul's United is the centre for the UW Canadian Studies Program, an interdisciplinary program that involves many UW departments ranging from Anthropology to Urban and

Regional Planning. Eminent Canadians come to St. Paul's and UW regularly to give courses and public lectures

Other community-campus ties include those found in UW's Faculty of Applied Health Sciences, which encompasses the departments of Health Studies & Gerontology, Kinesiology, and Recreation & Leisure Studies. The faculty houses the Centre for Applied Health Research. Through partnerships with six long-term care facilities, one project researches innovative approaches and best practices in Alzheimer research and education. Co-op students assist with data collection and pilot program implementation and often work in the local community during their work terms. Ergonomics and Safety Consulting Services assist business and industry with the assessment of biomechanical aspects of risk of upper limb and lower back injury.

6.4 Enhanced Reputation

Academic contests, conferences and clinics held at the university attract scholars and professionals from around the world. UW, St. Jerome's and the colleges are well represented at international competitions where their accomplishments add to UW's esteemed academic reputation.

UW is a perennial leader in international competitions of the most challenging kind. Two events where Waterloo has had tremendous success are the William Lowell Putnam Mathematical Competition and the Association for Computing Machinery (ACM) international programming contest. UW student teams came first in Putnam in 1999, first in ACM in 1994 and 1999, second in 2000. Every year for the past ten, when not winning outright, UW has distinguished itself with many Top 10 placements in these prestigious international contests. Through its Centre for Education in Mathematics and Computing and the Canadian Mathematics Competition (which last year saw 189,000 students Grades 7 – OAC write the six contests), UW blazes a trail in encouraging and educating the best and brightest math students in the country while working with educators to upgrade skills and enhance the level of mathematics instruction in Canada.

6.5 Open Space

Unlike some industries, UW is generally non-polluting and residents of the area may enjoy open space provided on UW and affiliated college campuses. Columbia Lake Fields, nature trails, and greenhouses are all open to the public for recreational use.

6.6 Charitable Contributions

Some of the charitable contributions offered at UW, or provided by students, faculty, and staff are outlined below:

- The Turnkey Desk at UW's Student Life Centre is an information service that holds charity fund raising events. As well, the Student Life Centre provides necessary facilities for blood donor clinics.

- Students, faculty and staff at UW raise more than $140,000 annually for the United Way.
- The Village Charity Outreach Campaign, organized by Student Housing & Residence Dons raises approximately $20,000 annually for a selected charity
- Other UW groups and events raise thousands of dollars annually for community charities. These include the following: ACE Waterloo, Engineering Society, Mathematics Society, Fraternity Sorority Awareness Club, Hindi Movie Club, Orientation Week, Renison Residence Council, St. Jerome's Charity Run, Students for Society, Waterloo Christian Fellowship, and Waterloo Ismaili Students' Association.

The 1997 National Survey on Giving, Volunteering and Participating (NSGVP), compared philanthropic giving of university graduates versus high school graduates. Results found that university students were both more likely to give and tended to give more than the high school graduates. Average annual philanthropic giving was estimated at $531 for university graduates and $239 for their high school counterparts. Participation rates were 92 percent and 77 percent respectively. In 1998, the estimated difference between average annual charitable contributions between the university graduates and high school graduates in Ontario was $420.1 million.[23]

Using other data from the NSGVP, Enterprise Canada Research also quantified the magnitude of difference between volunteerism among university and high school graduates. The comparison indicated that university graduates had a higher participation rate and their volunteer hours exceeded those of the high school graduates. To assign a monetary value to the volunteer activity, Enterprise Research Canada calculated an economic contribution using the Ontario minimum wage of $6.85/hour (for 1998). The economic value calculated for university graduate volunteerism was $146.8 million for 1998.[24]

6.7 Commitment to Regional Economic Development

The University of Waterloo has a long tradition of working with the business and government sectors in an effort to develop the community and enhance quality of life in the Region. The University in partnership with the Regional Municipality of Waterloo, the City of Waterloo, Communitech and Canada's

[23] Council of Ontario Universities, *The Economic Impact of Ontario's Universities*, prepared by Enterprise Canada Research, January 22, 2000
[24] Op.cit.

Technology Triangle has recently announced the development of a 100-acre Research and Technology Park on the north campus of the University.

The $214 million initiative calls for the creation of 1.2 million square feet of space developed in three phases. The first phase would involve 400,000 square feet of building space.

Two thirds of the public funding for the project is being sought from the Superbuild Federal-Provincial Infrastructure program. The application for funding is jointly sponsored by the Region, the City and the University.

The park is intended to provide an opportunity for the University to form closer working and learning relationships with research-intensive companies in the information and high technology areas, foster more technology transfer and create new jobs for graduates and co-op students[25].

6.8 Summary

Like many organizations in the community, UW contributes to the greater good of the community through its community involvement, activities and donations from faculty, staff, students and alumni. The student population at UW and its status as one of Waterloo Region's largest employers magnifies this contribution. As a public institution, UW offers a wide range of facilities and cultural venues available for public use. As well, there are many broad reaching benefits to the community because of a wide range of research conducted at UW and donations and volunteering by UW students.

[25] Region of Waterloo News Release, May 16, 2001

7.0 Summary of Economic Impacts

7.1 Value Added Impacts

The University of Waterloo contributes to the provincial and regional economies through a number of roles including that of an operating organization, as a knowledge (spin-off) generator, as a visitor attraction and as a societal institution. PricewaterhouseCoopers LLP and Econometric Research Limited have estimated the *Value Added* economic benefits to be about $1.1 billion in Waterloo Region.

Table 7-1: Economic Impact in Waterloo Region of UW

Value Added Impacts (1999 $000)	Total	Multipliers
Operating Organization	$265,159	0.84
Knowledge Generation:		
Alumni	$58,577	0.84
Spin-offs Operating Expenditures	$618,412	1.02
Spin-offs Capital Expenditures	$48,209	0.53
Attracting Students:		
From Rest of Ontario	$58,895	0.89
From Outside Ontario	$30,004	0.89
Attracting Visitors	$21,316	0.66
Public Institution	Not quantified	
Total Value Added	**$1,100,572**	**0.96**

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Province-wide *Value Added* economic impacts grow to over $1.5 billion. Provincial impacts are greater than regional impacts because of economic activity, such as purchases of goods and services, occurring outside Waterloo Region.

Table 7-2: Province-wide Economic Impact of UW

Value Added Impacts (1999 $000)	Total	Multipliers
Operating Organization	$458,823	1.46
Knowledge Generation:		
Alumni	$101,361	1.46
Spin-offs Operating Expenditures	$820,009	1.35
Spin-offs Capital Expenditures	$96,665	1.07
Attracting Students:		
From Rest of Ontario	$0	0.00
From Outside Ontario	$42,833	1.26
Attracting Visitors	$35,491	1.10
Public Institution	Not quantified	
Total Value Added	**$1,555,182**	**1.35**

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Value Added is a measure of net output including only final goods to avoid double counting of products sold during an

accounting period. See *Appendix A: Glossary* for details regarding this measure.

It is important to note that we have underestimated the economic benefits since we have not included certain impacts to avoid overstating the results. Excluded categories of impacts include many spin-off companies not selected for interviews, spin-off companies operating outside Waterloo Region and social impacts. If included, the impact would be much greater.

Although it is difficult to accurately estimate these benefits, we believe them to be very significant. For example, if we extend the analysis by extrapolating value-added impacts to the full database of "spin-off" companies (see *Table 4-8: PwC Estimated Database Attribution*) using an estimated impact per employee multiplier, regional impacts increase to over $1.5 billion and provincial impacts increase to over $2.1 billion. It would be worthwhile for UW to fully explore these additional impacts through additional phases of research including:

- *Analysis of local "spin-off" companies with fewer identifiable linkages to UW. For example, those who employ alumni without participating in research at UW or the co-op program.*
- *Analysis of how the university's innovations and research results find their way into many companies that act as technology receptors.*
- *Quantification and analysis of social impacts including involvement in local organizations by people associated with the University, and direct use of University expertise for community benefit (such as faculty members' service to local government in their fields of expertise, free lectures to local community groups and acting as experts for media in areas of public interest).*
- *Analysis of "spin-off" companies outside Waterloo Region including Ontario, other provinces and internationally.*

Direct impacts result from initial expenditures in the local economy. An example of a direct impact would be the purchase of stationery from a local supplier. *Indirect impacts* are subsequent purchases by suppliers of goods and services to sustain the original (i.e., direct or initial) and derivative expenditures. For example, salaries paid or jobs created from producing the supplies purchased. *Induced impacts* occur when employees from businesses stimulated by direct and indirect expenditures spend their income on consumer goods and services. See *Appendix A: Glossary* for detailed definitions.

Since value added captures the full economic impact without double counting of benefits, no other measures are needed. For descriptive purposes, we present a breakdown of

employment and tax impacts. See *Appendix B: Detailed Economic Impact Tables* for more details.

7.2 Employment Impacts

In Waterloo Region, 23,326 full time equivalent jobs are attributable to UW economic impacts. Province-wide, UW economic impacts generate 29,410 full time equivalent jobs.

Table 7-3: Summary of University of Waterloo Employment Impacts

Employment Impacts	Total	Multipliers
Operating Organization	8,668	1.34
Knowledge Generation:		
Alumni	1,915	1.34
Spin-offs Operating Expenditures	9,537	1.73
Spin-offs Capital Expenditures	638	1.46
Attracting Students:		
From Rest of Ontario	1,380	1.55
From Outside Ontario	703	1.55
Attracting Visitors	485	1.72
Social Institution	Not quantified	
Total Employment	**23,326**	**1.60**

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Table 7-4: Summary of University of Waterloo's Province-wide Employment Impact

Employment Impacts	Total	Multipliers
Operating Organization	10,701	1.65
Knowledge Generation:		
Alumni	2,364	1.65
Spin-offs Operating Expenditures	13,440	2.45
Spin-offs Capital Expenditures	1,378	3.16
Attracting Students:		
From Rest of Ontario	0	0.00
From Outside Ontario	872	1.92
Attracting Visitors	655	2.33
Social Institution	Not quantified	
Total Employment	**29,410**	**2.02**

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

7.3 Tax Generation

Province-wide UW economic impacts generate about $188 million of Federal tax revenue, $108 million for the Province and $44 million for local governments– including $26 million for governments in Waterloo Region.

Appendix A: Glossary

Direct impacts are those that result from initial expenditures in the local economy. An example of a direct impact would be the purchase of stationery by the University from a local supplier. *Direct impacts* result from operating or on-going spending and capital or one-time expenditures. *Operating expenditures* include salaries and goods and services purchased on an on-going basis. *Capital expenditures* include hard costs such as equipment and materials and soft costs such as salaries and professional fees.

Indirect impacts represent the subsequent purchases by suppliers of goods and services to sustain the original and derivative expenditures. For example, salaries paid or jobs created from producing the supplies to be used in the construction or operation of a business are *indirect effects*.

Induced impacts occur when workers from the sectors that were stimulated by direct and indirect expenditures spend their income on consumer goods and services. These include job creation because of this additional spending. Circulation and re-circulation of impacts stops if imported goods are purchased because the sourcing of materials is outside of the local economy. Dr. Kubursi's model accounts for these factors.

Gross Output or *Gross Sales* are the value of goods and services sold by a business in a year to sustain the project's normal year operations. Gross output indicates the total sales and transactions triggered by university operations. Sales and resales of transactions at all rounds of expenditure are combined, thus items are double counted several times. Gross output serves to determine the level of taxes collected at each round of economic activity. To eliminate the double counting in the *gross output* measure, *value added* is calculated.

Value Added, also known as *Gross Provincial Income (GPI)* or *Gross Domestic Product (GDP)* is a measure of net output. *Value Added* includes only final goods to avoid double counting of products sold during an accounting period. There are two equivalent methods to calculate *Value Added*. One way is to add wages, interest, rent and profits. It may also be calculated by removing the cost of purchased inputs from revenues.

Direct sales are the value of goods and services purchased for on-site operations. *Direct sales* are the portion of revenues from the activity that excludes taxes, depreciation, wages and salaries, and net profits. The turnover of goods and services required to sustain the activity are *total sales*.

Labour Income includes the total earned salaries and wages generated in the economy.

Employment is expressed as the number of equivalent full time jobs indicated in person years.

Taxes in the model are linked with the level of government that is receiving them. For example, taxes on corporate profits are shared between the federal and provincial governments and local (municipal) governments collect business and property taxes. These amounts are included in *Gross Output* and *Value Added*. *Taxes* do not include indirect business taxes such as sales tax that is included in *Gross Output* and *Value Added*.

Imports are the value of imports from other countries.

Multipliers: In the measurement of economic impacts, a dollar spent directly on the operation of the university, for example, circulates and re-circulates within the economy, magnifying the effects of the original expenditure. This process is referred to as an economic multiplier effect.

Appendix B: Detailed Economic Impact Tables

Table B-1

Province Wide Economic Impacts of the University of Waterloo Operating Expenditures

(In Thousands of 1999 Dollars)

Impacts	General Funds	Restricted Funds	Capital	Total
Initial Expenditures	$245,205	$65,042	$4,133	$314,380
Gross Output				
Direct	$245,205	$65,042	$4,133	$314,380
Indirect & Induced	$361,882	$96,017	$5,359	$463,258
Total	$607,087	$161,059	$9,492	$777,638
Multiplier	2.48	2.48	2.30	2.47
Value Added				
Direct	$180,821	$33,880	$2,120	$216,821
Indirect & Induced	$190,068	$49,185	$2,749	$242,002
Total	$370,889	$83,065	$4,869	$458,823
Multiplier	1.51	1.28	1.18	1.46
Employment (person yrs)				
Direct	5,161	1,291	22	6,474
Indirect & Induced	3,320	861	46	4,227
Total	8,481	2,152	68	10,701
Multiplier	1.64	1.67	3.09	1.65
Labour Income				
Direct	$172,742	$31,770	$1,344	$205,856
Indirect & Induced	$109,530	$28,700	$1,605	$139,835
Total	$282,272	$60,470	$2,949	$345,691
Taxes				
Federal	$66,491	$15,150	$811	$82,452
Provincial	$37,128	$8,884	$572	$46,584
Local	$13,969	$3,654	$385	$18,008
Total	$117,588	$27,688	$1,768	$147,044
Imports				
From Other Provinces	$18,475	$5,194	$306	$23,975
From Other Countries	$51,011	$15,169	$744	$66,924
Total	$69,486	$20,363	$1,050	$90,899

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Table B-2

Economic Impacts in Waterloo of the University of Waterloo Operating Expenditures

(In Thousands of 1999 Dollars)

Impacts	General Funds	Restricted Funds	Capital	Total
Initial Expenditures	$245,205	$65,042	$4,133	$314,380
Gross Output				
Direct	$245,205	$65,042	$4,133	$314,380
Indirect & Induced	$97,264	$18,273	$2,230	$117,767
Total	$342,469	$83,315	$6,363	$432,147
Multiplier	1.40	1.28	1.54	1.37
Value Added				
Direct	$180,821	$33,880	$2,120	$216,821
Indirect & Induced	$41,233	$5,859	$1,246	$48,338
Total	$222,054	$39,739	$3,366	$265,159
Multiplier	0.91	0.61	0.81	0.84
Employment (person yrs)				
Direct	5,161	1,291	22	6,474
Indirect & Induced	1,783	393	18	2,194
Total	6,944	1,684	40	8,668
Multiplier	1.35	1.30	1.82	1.34
Labour Income				
Direct	$172,742	$31,770	$1,344	$205,856
Indirect & Induced	$35,886	$6,923	$659	$43,468
Total	$208,628	$38,693	$2,003	$249,324
Taxes				
Federal	$43,889	$8,531	$549	$52,969
Provincial	$18,510	$3,635	$460	$22,605
Local	$7,900	$920	$322	$9,142
Total	$70,299	$13,086	$1,331	$84,716
Imports				
From Other Provinces	$11,530	$3,120	$199	$14,849
From Other Countries	$33,251	$9,788	$487	$43,526
Total	$44,781	$12,908	$686	$58,375

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Table B-3

Province Wide Economic Impacts of University of Waterloo Spin-off Business Operating Expenditures

(In Thousands of 1999 Dollars)

Impacts	Category A	Category C	Category D	Total
Initial Expenditures	$275,882	$45,623	$43,536	$365,041
Gross Output				
Direct	$275,882	$45,623	$43,536	$365,041
Indirect & Induced	$384,390	$64,459	$57,806	$506,655
Total	$660,272	$110,082	$101,342	$871,696
Multiplier	2.39	2.41	2.33	2.39
Value Added				
Direct	$179,312	$30,035	$27,074	$236,421
Indirect & Induced	$194,316	$32,831	$28,437	$255,584
Total	$373,628	$62,866	$55,511	$492,005
Multiplier	1.35	1.38	1.28	1.35
Employment (person yrs)				
Direct	2,507	424	367	3,298
Indirect & Induced	3,622	611	533	4,766
Total	6,129	1,035	900	8,064
Multiplier	2.44	2.44	2.45	2.45
Labour Income				
Direct	$141,533	$24,007	$20,413	$185,953
Indirect & Induced	$111,788	$18,885	$16,366	$147,039
Total	$253,321	$42,892	$36,779	$332,992
Taxes				
Federal	$69,824	$11,773	$10,296	$91,893
Provincial	$39,492	$6,659	$5,755	$51,906
Local	$15,564	$2,637	$2,253	$20,454
Total	$124,880	$21,069	$18,304	$164,253
Imports				
From Other Provinces	$18,581	$3,105	$2,830	$24,516
From Other Countries	$51,306	$8,389	$8,402	$68,097
Total	$69,887	$11,494	$11,232	$92,613

Source: Econometric Research Limited and PricewaterhouseCoopers

Table B-4

Economic Impacts in Waterloo of University of Waterloo Spin-off Business Operating Expenditures

(In Thousands of 1999 Dollars)

Impacts	Category A	Category C	Category D	Total
Initial Expenditures	$275,882	$45,623	$43,536	$365,041
Gross Output				
Direct	$275,882	$45,623	$43,536	$365,041
Indirect & Induced	$189,728	$32,763	$25,150	$247,641
Total	$465,610	$78,386	$68,686	$612,682
Multiplier	1.69	1.72	1.58	1.68
Value Added				
Direct	$179,312	$30,035	$27,074	$236,421
Indirect & Induced	$103,364	$17,996	$13,266	$134,626
Total	$282,676	$48,031	$40,340	$371,047
Multiplier	1.02	1.05	0.93	1.02
Employment (person yrs)				
Direct	2,507	424	367	3,298
Indirect & Induced	1,854	318	252	2,424
Total	4,361	742	619	5,722
Multiplier	1.74	1.75	1.69	1.73
Labour Income				
Direct	$141,533	$24,007	$20,413	$185,953
Indirect & Induced	$63,095	$11,021	$8,019	$82,135
Total	$204,628	$35,028	$28,432	$268,088
Taxes				
Federal	$54,765	$9,333	$7,733	$71,831
Provincial	$28,996	$4,932	$4,113	$38,041
Local	$8,354	$1,403	$1,226	$10,983
Total	$92,115	$15,668	$13,072	$120,855
Imports				
From Other Provinces	$12,486	$2,106	$1,828	$16,420
From Other Countries	$34,629	$5,721	$5,457	$45,807
Total	$47,115	$7,827	$7,285	$62,227

Source: Econometric Research Limited and PricewaterhouseCoopers

Table B-5

Province Wide Economic Impacts of University of Waterloo Spin-off Business Capital Expenditures

(In Thousands of 1999 Dollars)

Impacts	Category A	Category C	Category D	Total
Initial Expenditures	$7,290	$43,362	$3,790	$54,442
Gross Output				
Direct	$7,290	$43,362	$3,790	$54,442
Indirect & Induced	$9,134	$54,826	$5,036	$68,996
Total	$16,424	$98,188	$8,826	$123,438
Multiplier	2.25	2.26	2.33	2.27
Value Added				
Direct	$3,286	$19,600	$1,739	$24,625
Indirect & Induced	$4,382	$26,475	$2,517	$33,374
Total	$7,668	$46,075	$4,256	$57,999
Multiplier	1.05	1.06	1.12	1.07
Employment (person yrs)				
Direct	35	209	18	262
Indirect & Induced	75	448	42	565
Total	110	657	60	827
Multiplier	3.14	3.14	3.33	3.16
Labour Income				
Direct	$2,226	$13,429	$1,268	$16,923
Indirect & Induced	$2,569	$15,533	$1,481	$19,583
Total	$4,795	$28,962	$2,749	$36,506
Taxes				
Federal	$1,359	$8,156	$750	$10,265
Provincial	$835	$5,064	$490	$6,389
Local	$425	$2,630	$279	$3,334
Total	$2,619	$15,850	$1,519	$19,988
Imports				
From Other Provinces	$509	$3,075	$293	$3,877
From Other Countries	$1,554	$9,195	$779	$11,528
Total	$2,063	$12,270	$1,072	$15,405

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Table B-6

Economic Impacts in Waterloo of University of Waterloo Spin-off Business Capital Expenditures

(In Thousands of 1999 Dollars)

Impacts	Category A	Category C	Category D	Total
Initial Expenditures	$7,290	$43,362	$3,790	$54,442
Gross Output				
Direct	$7,290	$43,362	$3,790	$54,442
Indirect & Induced	$604	$4,843	$1,033	$6,480
Total	$7,894	$48,205	$4,823	$60,922
Multiplier	1.08	1.11	1.27	1.12
Value Added				
Direct	$3,286	$19,600	$1,739	$24,625
Indirect & Induced	$448	$3,271	$581	$4,300
Total	$3,734	$22,871	$2,320	$28,925
Multiplier	0.51	0.53	0.61	0.53
Employment (person yrs)				
Direct	35	209	18	262
Indirect & Induced	15	94	12	121
Total	50	303	30	383
Multiplier	1.43	1.45	1.67	1.46
Labour Income				
Direct	$2,226	$13,429	$1,268	$16,923
Indirect & Induced	$266	$1,955	$349	$2,570
Total	$2,492	$15,384	$1,617	$19,493
Taxes				
Federal	$670	$4,107	$417	$5,194
Provincial	$450	$2,788	$299	$3,537
Local	$238	$1,502	$173	$1,913
Total	$1,358	$8,397	$889	$10,644
Imports				
From Other Provinces	$260	$1,609	$172	$2,041
From Other Countries	$747	$4,520	$433	$5,700
Total	$1,007	$6,129	$605	$7,741

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Table B-7

Incremental Economic Impacts of Student Expenditures

(In Thousands of 1999 Dollars)

Impacts	Waterloo
Initial Expenditures	$100,400
Gross Output	
Direct	$100,400
Indirect & Induced	$57,008
Total	$157,408
Multiplier	1.57
Value Added	
Direct	$55,128
Indirect & Induced	$33,771
Total	$88,899
Multiplier	0.89
Employment (person yrs)	
Direct	1,342
Indirect & Induced	741
Total	2,083
Multiplier	1.55
Labour Income	
Direct	$39,685
Indirect & Induced	$21,798
Total	$61,483
Taxes	
Federal	$16,234
Provincial	$10,337
Local	$4,872
Total	$31,443
Imports	
From Other Provinces	$4,949
From Other Countries	$11,310
Total	$16,259

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Table B-8

Incremental Economic Impacts of Student Expenditures

(In Thousands of 1999 Dollars)

Impacts	Ontario
Initial Expenditures	$33,886
Gross Output	
Direct	$33,886
Indirect & Induced	$47,831
Total	$81,717
Multiplier	2.41
Value Added	
Direct	$18,606
Indirect & Induced	$24,227
Total	$42,833
Multiplier	1.26
Employment (person yrs)	
Direct	453
Indirect & Induced	419
Total	872
Multiplier	1.92
Labour Income	
Direct	$13,394
Indirect & Induced	$13,703
Total	$27,097
Taxes	
Federal	$7,398
Provincial	$4,757
Local	$2,569
Total	$14,724
Imports	
From Other Provinces	$2,649
From Other Countries	$6,073
Total	$8,722

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Table B-9

Province Wide Economic Impacts of Visitor Expenditures

(In Thousands of 1999 Dollars)

Impacts	Single Day	Overnight	Total
Initial Expenditures	$8,643	$23,480	$32,123
Gross Output			
Direct	$8,643	$23,480	$32,123
Indirect & Induced	$11,684	$32,190	$43,874
Total	$20,327	$55,670	$75,997
Multiplier	2.35	2.37	2.37
Value Added			
Direct	$3,402	$10,105	$13,507
Indirect & Induced	$5,802	$16,182	$21,984
Total	$9,204	$26,287	$35,491
Multiplier	1.06	1.12	1.10
Employment (person yrs)			
Direct	58	223	281
Indirect & Induced	99	274	373
Total	158	497	655
Multiplier	2.70	2.23	2.33
Labour Income			
Direct	$2,104	$6,678	$8,782
Indirect & Induced	$3,284	$9,187	$12,471
Total	$5,388	$15,865	$21,253
Taxes			
Federal	$1,545	$4,494	$6,039
Provincial	$1,114	$3,165	$4,279
Local	$684	$1,902	$2,586
Total	$3,343	$9,561	$12,904
Imports			
From Other Provinces	$787	$2,071	$2,858
From Other Countries	$1,550	$4,207	$5,757
Total	$2,337	$6,278	$8,615

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Table B-10

Economic Impacts in Waterloo of Visitor Expenditures

(In Thousands of 1999 Dollars)

Impacts	Single Day	Overnight	Total
Initial Expenditures	$8,643	$23,480	$32,123
Gross Output			
Direct	$8,643	$23,480	$32,123
Indirect & Induced	$2,012	$8,045	$10,057
Total	$10,655	$31,525	$42,180
Multiplier	1.23	1.34	1.31
Value Added			
Direct	$3,402	$10,105	$13,507
Indirect & Induced	$1,832	$5,977	$7,809
Total	$5,234	$16,082	$21,316
Multiplier	0.61	0.68	0.66
Employment (person yrs)			
Direct	58	223	281
Indirect & Induced	52	152	204
Total	110	375	485
Multiplier	1.88	1.68	1.72
Labour Income			
Direct	$2,104	$6,678	$8,782
Indirect & Induced	$1,333	$4,172	$5,505
Total	$3,437	$10,850	$14,287
Taxes			
Federal	$941	$2,948	$3,889
Provincial	$606	$1,918	$2,524
Local	$291	$929	$1,220
Total	$1,838	$5,795	$7,633
Imports			
From Other Provinces	$373	$1,080	$1,453
From Other Countries	$802	$2,348	$3,150
Total	$1,175	$3,428	$4,603

Source: Econometric Research Limited and PricewaterhouseCoopers LLP

Appendix C: Questionnaire

University of Waterloo
Direct Impact on Regional Economy
November 2000

Preamble: Good morning/afternoon, my name is _____ from PricewaterhouseCoopers. Our firm has been brought on to assist the University of Waterloo to determine the overall impact the University has on the regional economy. As part of our information gathering process, we have been contacting representatives of "Spin-Off" companies, or those companies that have significant interaction with the University of Waterloo.

Interview Date:_____Telephone: ☐ **In - Person:** ☐

(Interviewer Note: Interviews are to be conducted with executives, be mindful of their time and gather information as efficiently as possible. Please remember to focus on Waterloo where specified. All financial information gathered will be for the 1999 fiscal year. Determine whether a 1999 Annual Report or financial statements can be obtained. Reassure the respondent that all data collected will remain confidential and will only be released in aggregate).

Company Name:_____

Address:_____

Executive Responding:_____

Position:_____

Phone Number:_____

1. **What are your company's major products or services offered?** (details, for example, volume, market share or market reach are appreciated)_____

2. **What was your Total Revenue in 1999?** $_____

   Or provide a range if preferred:

   1. $1 to $5 million
   2. $6 to $10 million
   3. $11 to $15 million
   4. $16 to $25 million
   5. Above $25 million (please provide approximate amount above)

3. **Type of Businesses**: Please indicate which category your business fits into.

A. Agriculture, Forestry & Fishing _____

C. Manufacturing

- Food & beverage _____
- Tobacco _____
- Plastics & rubber products _____
- Leather, textiles & apparel _____
- Wood and paper products _____
- Furniture & related products _____
- Paper & related products _____
- Printing & related _____

B. Mining, Quarrying & Oil Well _____

D. Construction _____

E. Transportation & Storage _____

F. Information/Communication

- Broadcasting & telecommunications _____
- Computer & Internet _____
- Information & data processing services _____
- Motion picture & sound recording _____
- Publishing _____

G. Wholesale trade _____

- Primary metal _____
- Fabricated metal _____
- Machinery _____
- Transportation equipment _____
- Electrical equipment, appliance, & components _____
- Computer & electronic products _____
- Chemical products _____
- Miscellaneous products _____

H. Retail trade _____

I. Finance, insurance & real estate _____

J. Business services _____

K. Government services _____

L. Educational services _____

M. Health & social services _____

N. Accommodation, food & beverage services _____

O. Other services _____

4. Please describe your corporate locations within the Waterloo Region:

Plant/Office Location # of Employees

---

5. How much was paid in Municipal Taxes in 1999? $_____

6. What Capital Expenditures were made in Waterloo Region in 1999 (details are appreciated)**:**

Buildings and structures: $_____

Machinery and equipment: $_____

7. Funds allocated to the University of Waterloo in 1999 (for example, research funds, grants, bursaries, scholarships): **$**_____

8. What non-financial contributions are being /will be made to UW? For example, speaking engagements, pro bono work, curriculum input, speaking engagements, etc.

SPIN-OFF QUESTIONS PREAMBLE

We are endeavouring to quantify the extent to which companies are spun-off from the University of Waterloo to establish impacts and document evidence of the university's contribution to the local economy. The purpose of this questionnaire is to identify companies that would qualify as a "spin-off" which we define as follows.

Spin-off businesses range from those that are indisputably linked to the university to those with linkages that are more tenuous. What distinguishes these businesses is the extent to which a business' existence may be directly and unequivocally attributed to the university. A high attribution relationship between a business and the university indicates a stronger linkage. Indicators of an attribution relationship include the following factors which can clearly be sourced back the university:

- *Transfer of Technology*
  - *UW sponsors venture*
  - *Venture started with unlicensed technology (e.g., by a professor)*
  - *Venture started with licensed technology*
- *Transfer of Knowledge through people*
  - *Faculty start a company*
  - *Staff start a company*
  - *Students / graduates start a company*
- *Transfer of Knowledge through research*
  - *Contract research*
  - *Research partnerships (joint ventures and other agreements)*
  - *Employment of students (current, co-op and graduates)*

Other companies, such as subsidiaries of high attribution companies or mergers or acquisitions they are involved in, must be considered separately based on the listed indicators. For any business to be considered as a spin-off, it should be a credible, innovative enterprise with growth potential. An example of a company with high attribution relationship would be one that has close ties to UW through an initial transfer of technology and / or knowledge and ongoing partnerships or hiring practices.

1. **Technology Transfer Based Spin-offs**

   What is the nature of the relationship with the University of Waterloo in the case of a **Technology Transfer**? (For example, is this a UW sponsored venture? Does it involve licensed or unlicensed technology originating from the university?) Describe the technology and the way it is employed by the venture.

2. **Knowledge Transfer through People Based Spin-offs**

   In the case of a spin-off identified as being a **Knowledge Transfer through people**, how many people from UW work(ed) for the company?

	Year	Faculty	Staff	Graduates	Students	Co-op
At start-up						
Previous Peak						
Current						
Anticipated (foreseeable future, 1-2 years)						

3. **Knowledge Transfer through Research Based Spin-offs**

What is the nature of the **Knowledge Transfer through research**? (For example, is contract research part of the relationship? Are there other research relationships with UW such as partnerships, joint ventures, etc.? Alternatively, does knowledge transfer mainly occur through employment of graduates and / or co-op students?)

4. Which of the following statements most accurately reflects the degree to which **Technology** or **Knowledge Transfers** from the University influenced the start-up and / or continued operations of the subject company? (*Spin-off attribution weighting in brackets*)

(Please circle ONE letter)

a) This Company would not exist **but-for** the University of Waterloo (*80-100%*).

b) This Company is **primarily** a result of the University of Waterloo (*60-79%*).

c) This Company has to a significant degree **relied** on the University of Waterloo (*40-59%*).

d) This Company has, **at least in part**, developed as a result of the University of Waterloo (*20-39%*).

Other Comments:

If you have any questions or concerns about the content and use of this information gathered through this interview, please contact:

<PwC Contact>

Appendix D: Database of UW Linked Companies

The following table is a list of companies included in the database compiled by PricewaterhouseCoopers LLP. Only companies that included in the sample (30) have been confirmed and updated. If you are aware of any businesses that should be or should not be included in this list, please contact UW's Technology Transfer and Licensing Office (TTLO) with the appropriate information. Please note that this database includes companies linked to UW (e.g., alumni and co-op placements) – in some cases, these may not result in a material attribution of value to UW. With regard to spin off companies, it would be useful to provide the TTLO with information similar to that gathered by our questionnaire in Appendix C: Questionnaire.

724 SOLUTIONS INC.

A SONG FOR YOU

A.J. ROBINSON & ASSOCIATES INC.

ACRONYM SOFTWARE INC.

ADVANCED COMPUTER SOLUTIONS INC.

AEA TECHNOLOGY ENGINEERING SOFTWARE LTD.

ALLIANCE TECHNOLOGIES CORPORATION

ANALOGY INC.

ANKH TECHNOLOGIES INCORPORATED

APOLLO PHOTONICS INC.

APPLIED FINANCIAL SYSTEMS INC.

ARCHELON INC.

ARCHITECH MICROSYSTEMS INC.

ARISE TECHNOLOGIES CORP.

ATEC MARKETING LIMITED

AVANTEL CONSULTING INC.

B & M ASSOCIATES

BABENSEE CONTROLS ENGINEERING

BARBARA BUTLER & ASSOCIATES INC.MANAGEMENT CONSULTANTS

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