

The University of Manitoba: Economic impact analysis

May 2019



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Executive summary

The University of Manitoba (“the University”) is a catalyst for economic growth. The operations and activities of the University lead to substantial and widespread benefits in Manitoba (“the Province”). The University engaged PricewaterhouseCoopers LLP (“PwC”) to assess and communicate the economic impact of the University on the Province through operating, research, and capital spending, along with other contributions. This study identifies and highlights the qualitative economic, social, and cultural benefits that the University provides.

We have estimated total economic impact of the University to be \$2.4 billion. This consists of:

- Operating and research expenditures by the University
- Capital spending by the University over five years from 2014/15 to 2018/19
- Spending by visitors and students
- Spending by spin-off companies

The total economic impact of the University includes indirect and induced impacts, which measure additional spending that was made in the Province due to the presence of the University. Indirect spending occurs along the University’s supply chain, and induced spending occurs as a result of spending by employees of the University. The following bullets and table summarize the total economic and tax impact of the University’s operations, including multiplier effects. Table 1 summarizes total impact attributable to the University of Manitoba.

Table 1: Summary of economic and tax impacts attributable to the University¹

Impact	Operating and research spending	Capital projects (5 years)	Students	Visitors	Spin-off companies	Total impacts ²
Initial spending (\$ million)	618.1	485.1	129.3	77.4	335.4	1,645.4
Total output (\$ million)	966.9	667.9	192.1	118.5	466.1	2,411.5
Total GDP (\$ million)	673.0	266.5	121.6	62.7	277.6	1,401.4
Employment ³	7,730	3,156	1,619	1,342	1,981	15,828
Total labour income (\$ million) ⁴	514.4	189.3	57.7	37.8	122.5	921.6
Total taxes (\$ million)	230.0	70.0	39.2	19.1	41.9	400.3

¹ 2017/18 except for capital projects. The impact of capital projects is estimated for five years from 2014/15 to 2018/19.

² Total impact figures may not equal the sum of other columns due to rounding.

³ Total employment refers to all employment generated and supported by the University of Manitoba. It is calculated on a full-time equivalent (FTE) basis.

⁴ Labour income is the pre-tax labour income associated with total employment.

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- The total output resulting from spending attributable to the University is \$2.4 billion
 - The total gross domestic product (GDP) impact of spending attributable to the University is \$1.4 billion⁵
 - 15,828 jobs are supported by spending attributable to the University, with total labour income of \$922 million
 - The total tax impact of the spending attributable to the University is \$400 million
 - Every dollar spent by the University generates \$1.50 of economic activity in Manitoba⁶

The University occupies a unique position as the largest and most comprehensive post-secondary institution in Manitoba. Through its faculties and schools offering over 100 programs, the University also provides broader economic, social, and cultural benefits to the province by:

- Attracting and retaining young people in the Province
- Meeting the needs of Manitoba's labour market
- Conducting innovative research that increases productivity

The University also serves as an economic catalyst through purchasing and procurement activities, expanding human capital through education and training, and generating knowledge and innovation through research. The University promotes economic growth by providing the skilled labour needed now and in the future. It does so by collaborating with the business community and tailoring its programming, health, and research services to meet the community's needs.

The University is a key player in Manitoba's research and innovation ecosystem. It promotes the development and commercialization of innovative technology through its technology transfer office. The University also supports the development of high-tech companies and develops partnerships with industry. The home of the University's innovation activity is its Smartpark Research Centre, which facilitates these activities.

The University attracts visitors to Winnipeg by hosting campus events such as conferences, sporting events, and graduations. All of these visitors contribute to the local economy by purchasing food, accommodation, and other products and services.

The University is also home to the National Centre for Truth and Reconciliation (NCTR), which houses the largest collection of curated material on the Residential School system in Canada. The NCTR plays an active role in the process of reconciliation, providing a safe, respectful and trustworthy space for survivors and their families to gain access to records and collect information about their history.

⁵ GDP is the "value added" to the economy, i.e. the unduplicated total value of goods and services. GDP includes only final goods to avoid double counting of intermediate inputs.

⁶ See Section 12: Summary of economic impact for more details.

1. *Introduction and methodology*

Introduction

The University performs a vital economic function by developing skills, conducting research, and serving as a hub for knowledge and innovation. It also provides a direct economic benefit by generating spending on employees, goods, and services. This spending supports businesses throughout their supply chain in Manitoba. Employees of the University and the University's suppliers also spend money in Manitoba on items such as housing, transportation, and food. Our study captures these benefits by quantifying the University's impact on gross domestic product (GDP), employment, labour income, and tax revenue.

Study objectives

PwC was engaged by the University of Manitoba to assess the University's economic impact in Manitoba. This work provides an update to a 2009 report, also by PwC, entitled "University of Manitoba: Economic Impact Analysis." The scope of the report includes the following:

1. Estimate the economic footprint in the Province of Manitoba, resulting from certain activities taking place and/or being facilitated by the University
2. Assess the benefits provided to society by the University's research and innovation activities
3. Assess other social and cultural aspects of the University that are beneficial to society
4. Benchmark the University's performance against other similar universities in Canada

We refer to the above collectively as our "Assessment."

Unless otherwise noted, all figures based on University spending data (including economic and tax footprints) are based on data from fiscal year 2017/18, which ends March 31. Other University data refers to the academic year, which begins in September. Unless otherwise specified, all dollar figures in this report are in 2018 Canadian dollars.

Report outline

The rest of the report is structured as follows:

- Section 1 outlines our approach and methodology
- Section 2 provides a profile of the University
- Section 3 describes the University's contributions to economic growth
- Section 4 discusses the University's initiatives and partnerships in support of Indigenous students, faculty and staff, and community members
- Section 5 describes the University's sustainability strategy
- Section 6 discusses the University's research and commercialization activity
- Section 7 presents our estimates of the economic impact of operating and research expenditure
- Section 8 presents our estimates of the economic impact of capital project spending
- Section 9 presents our estimates of the economic impact of students' spending
- Section 10 presents our estimates of the economic impact of visitor spending
- Section 11 presents our estimates of the economic impact of spin-off businesses
- Section 12 summarizes the economic impacts assessed in sections 7 to 11
- Section 13 benchmarks the University against peer institutions
- Section 14 concludes

Scope of review

To prepare our Assessment, we have reviewed and, where appropriate, relied upon various documents and sources of information. By general classification, these sources include the following:

- Expenditure data provided by the University
- Interviews with University staff and faculty
- Interviews with representatives of spin-off companies
- The Canadian Association of University Business Officers (CAUBO)
- AUTM (formerly Association University Technology Managers)
- Academic studies
- Economic impact studies of other universities

A full list of sources is available in Appendix A: References.

Defining economic impact

Economic impact measures the quantitative effects of spending generated by the University on the outcomes of output, GDP, employment, labour income, and tax revenues. These metrics are defined below:

- **Output** is the total gross value of all business revenue. This is the broadest measure of economic activity and indicates the total sales and transactions triggered by operations.
- **GDP** is the “value added” to the economy, i.e. the unduplicated total value of goods and services. GDP includes only final goods to avoid double counting of intermediate inputs.
- **Employment** is the number of jobs created. It is expressed as the number of equivalent full-time jobs, measured in person years.
- **Labour income** is the total gross value of wages and salaries associated with employment impacts.
- **Tax impact** is total revenue going to all levels of governments. It includes taxes on products i.e. trading profits, gas tax, sales taxes, and excise taxes; taxes on production at the federal, provincial and municipal levels; personal income taxes at the federal and provincial level; and corporate income tax.

We have reported each of the above metrics at the direct, indirect, and induced level. These levels are defined below:

- **Direct impacts** result from the University’s spending on employees and its suppliers (e.g. salary of a professor, purchase of a computer by the University)
- **Indirect impacts** from the activities of the firms providing inputs to company’s suppliers (in other words, the suppliers of the University’s suppliers).
- **Induced impacts** are the result of consumer spending by employees of businesses included in the direct and indirect impacts.
- The **total economic impact** of the University’s spending is the sum of the direct, indirect, and induced impacts.

A full description of our methodology and tax calculations is available in Appendix D: .

Methodology

To calculate the economic impact of the University’s operations, we used Statistics Canada’s input-output model. This model is based on data on the sales and purchases of all industries in Manitoba. The input-output model estimates the relationship between the University’s spending and the resulting impacts throughout the economy (including demand for other goods and services and tax revenues).

In addition to our input output analysis, we also conducted qualitative research on the University’s impact. This included a review of documents from the University, secondary research, and interviews with faculty and staff.

2. University profile

This section provides key information about the University, including program offerings, enrolment, and demographics.

The University of Manitoba was established in 1877 and is the largest and most comprehensive post-secondary institution in the Province. It consists of two campuses: the Fort Garry Campus, home to more than sixty academic and support buildings, and the Bannatyne Campus, a complex of ten buildings housing the University's medical, dental, pharmacy and rehabilitation sciences units. The University has four affiliated Colleges that provide community for students. These are St. Andrew's College, St. John's College, St. Paul's College and University College.

The University's affiliated hospitals, St. Boniface Research Centre, Health Sciences Centre, and Cancer Care Manitoba and the Children's Hospital Research Institute of Manitoba train residents and medical students. The University is also home to 39 research centres, institutes, facilities, and groups. These groups conduct research, expose students to cutting-edge ideas, and create a platform for multidisciplinary collaboration. A full list of research centres is available in Appendix C: Research institutes at the University of Manitoba.

Faculty and staff

The University of Manitoba has a comprehensive selection of postsecondary programs, which are offered through the academic units listed below. The University of Manitoba houses the only medical, law, dental, pharmacy, engineering and architecture programs in the province.

-
- | | | |
|---|--|---|
| • Faculty of Agricultural and Food Sciences | • Faculty of Engineering | • Faculty of Kinesiology and Recreation Management |
| • Faculty of Architecture | • Extended Education Division | • Faculty of Law |
| • School of Art | • Clayton H. Riddell Faculty of Environment, Earth, and Resources | • Marcel A. Desautels Faculty of Music |
| • Faculty of Arts | • Faculty of Graduate Studies | • Faculty of Science |
| • I.A. Asper School of Business, Faculty of Management | • Rady Faculty of Health Sciences | • Faculty of Social Work |
| • Faculty of Education | | • University 1 |
-

As of March 2018, the University directly employed a total of 9,412 staff, of which 4,859 were full-time faculty and staff and 4,553 were part-time employees, as shown in Table 2.

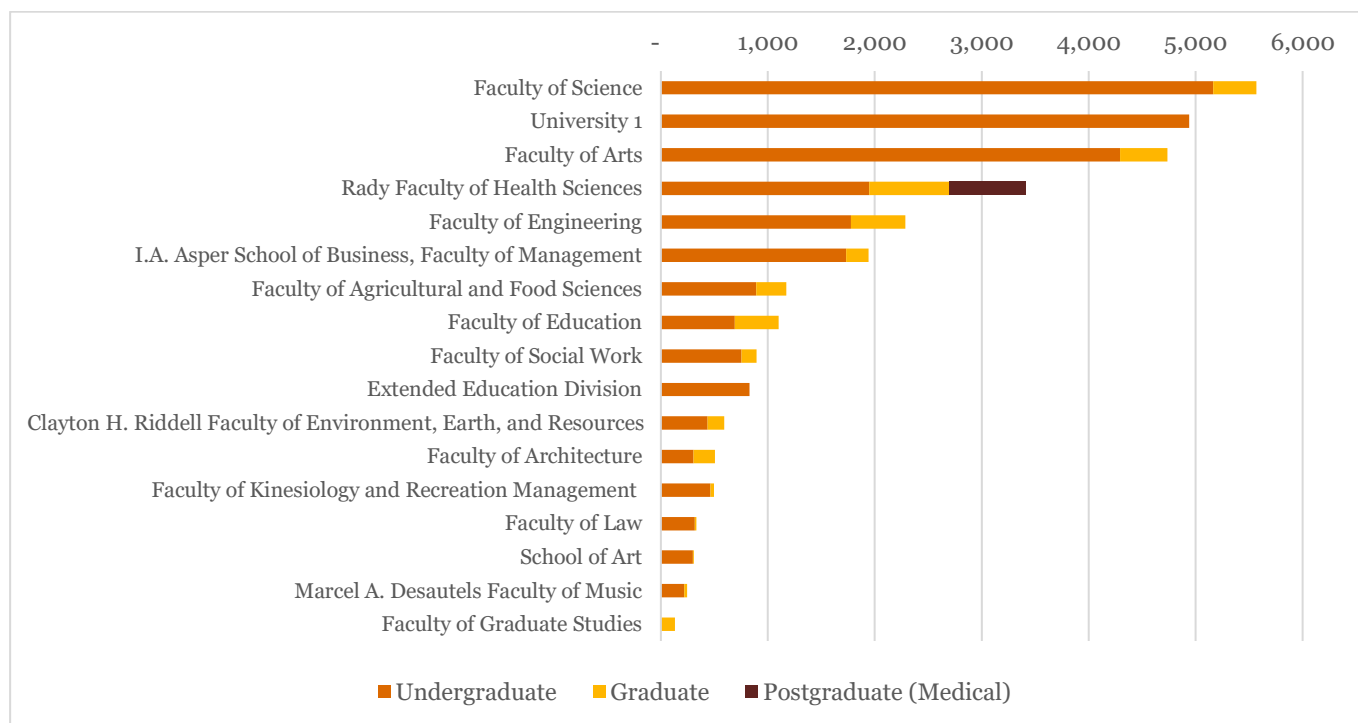
Table 2: University's employees by type of employment

	Full-time	Part-time	Total
Teaching Academic	1,840	362	2,202
Non-teaching Academic	327	2,932	3,259
Support	2,692	1,259	3,951
Total	4,859	4,553	9,412

Student body

The University offers more than 100 programs and most academic departments have graduate studies programs. The University has an enrolment of over 29,000, of which 25,065 are undergraduate students, 3,721 are graduate students, and 712 are postgraduate medical students. Student enrolment by academic unit in fall 2017 is presented in Figure 1 below.

Figure 1: Student enrolment by faculty and school, fall 2017⁷



International students

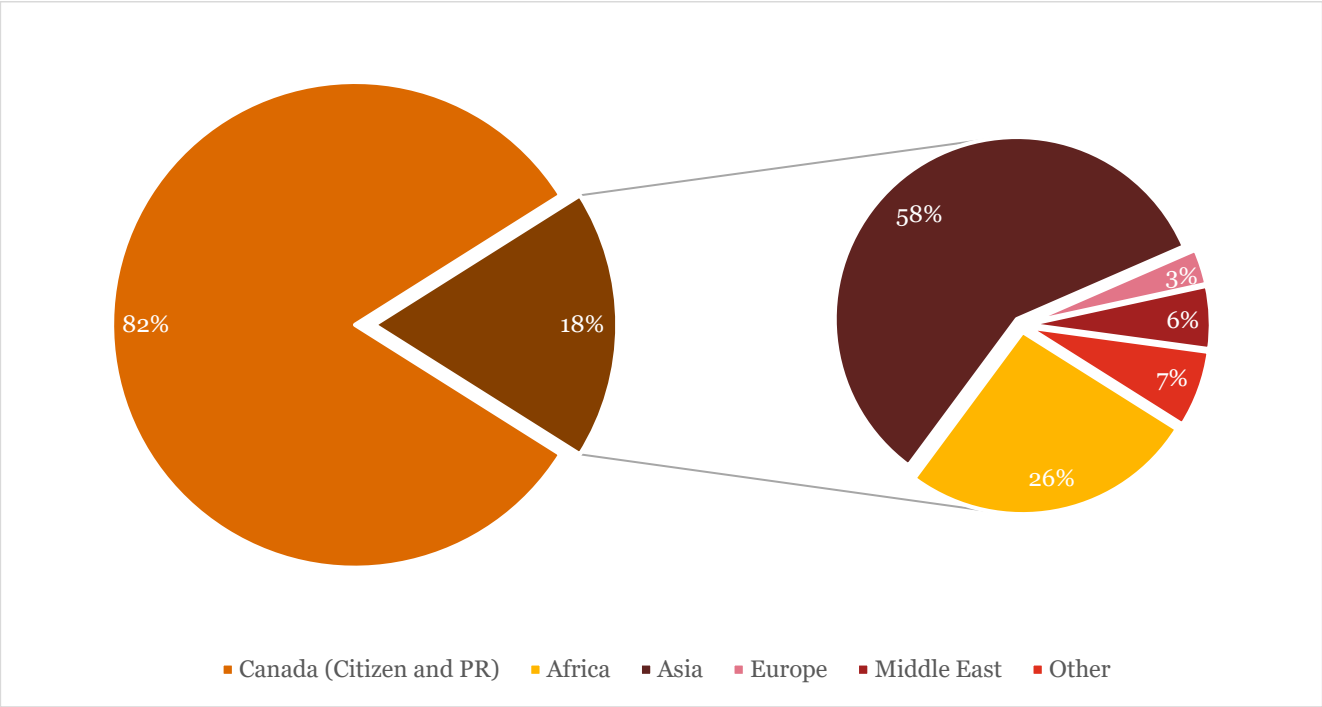
The University plays an important role in attracting international students to Manitoba. International students studying in Canada often choose to stay and work in Canada, contributing to the local economy. A study by Statistics Canada found that of 32% of international students at the undergraduate level and 49% of those at the graduate level had transitioned to permanent residence in Canada within 10 years.⁸ Out of the 29,498 enrolled students in fall 2017, 82% were Canadian citizens or permanent residents and 18% were international students. The

⁷ University 1 (U1) is a direct entry admission option for 1st year students. It is a general program that allows students to decide which program they want to study in the following years at the University.

⁸ 2000-2014 cohort. Statistics Canada (2015)

major sources of international students were Asia and Africa. Figure 2 shows the full breakdown of student citizenship. As discussed in the Benchmark with peers section, the University of Manitoba has a slightly higher percentage of international students compared to its peers.

Figure 2: Canadian and international students by citizenship, fall 2017⁹



⁹ University of Manitoba. Canadian students include both citizens and permanent residents (PR).

3. The University as a catalyst for economic growth

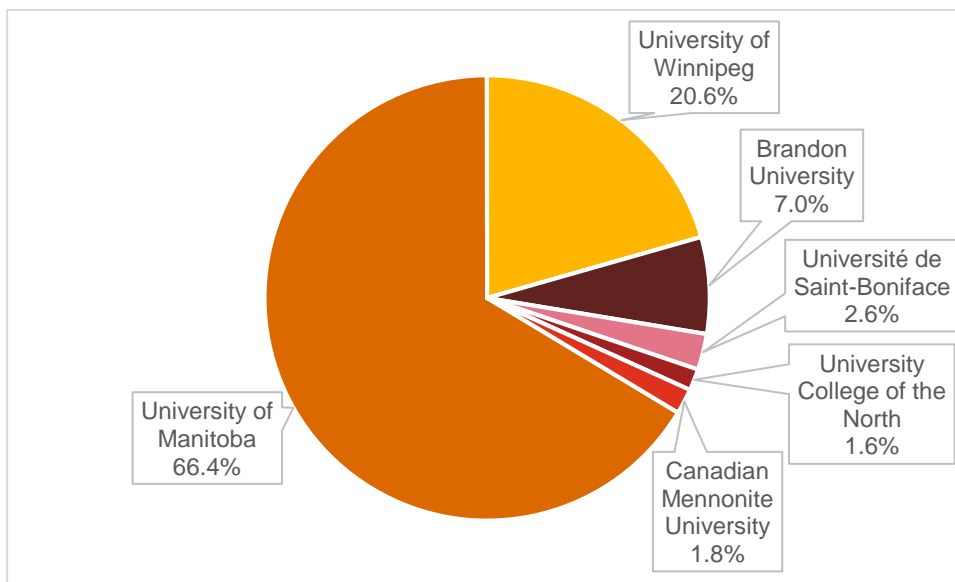
The University has a mission to create, preserve, communicate and apply knowledge, contributing to the cultural, social and economic well-being of the people of Manitoba, Canada and the world. Through this mission, the University’s impact extends well beyond its impact on spending. This section describes some of the ways that the University contributes to economic growth in Manitoba, outside of its contribution to spending.

Meeting the needs of the province of Manitoba

An educated population is essential to economic growth. The University of Manitoba plays a unique and substantial role through educating Manitobans in its academic programs, and through its other programs and research.

The University is the largest post–secondary institution in the province, educating approximately two thirds of Manitoba’s university students, as shown in Figure 3.

Figure 3: Enrolment in Manitoba Universities, 2016/17¹⁰



Professional training and education

In addition to being the largest university in the province, the University trains the majority of the province’s engineers, lawyers, medical professionals and community and business leaders. It is home to the province’s only engineering and law faculties, as well as medical, dental, pharmacy and rehabilitation science colleges. The University also hosts the Province’s largest nursing program which includes delivery in the north, in partnership with University College of the North. The University offers the only Manitoba-based degree programming in agriculture, architecture, occupational therapy, physical therapy, and accredited program in social work, among others. It also provides the vast majority of graduate education in the Province.

University of Manitoba graduates are employed in every sector of the economy of Manitoba including agriculture, transportation, manufacturing, mining, forestry, energy, tourism, and arts and culture. A key element of the

¹⁰ Government of Manitoba and Canadian Mennonite University

University's impact is providing education that is aligned with the needs of Manitoba's economy. In a recent example, the University has responded to needs of the province by developing a new entry-to-practice pharmacy program and a made-in Manitoba solution to midwifery training.

Attracting and retaining talent in Manitoba

As noted above, the University occupies a unique position as the largest and most comprehensive university in Manitoba. This position is important for retaining young people in the province, who would otherwise have to leave to complete their education in certain fields. The University also attracts students from outside of Manitoba including a substantial number of international students.

The University attracts many international students to the province each year through its academic programs and through its partnership with the International College of Manitoba. Notably, over 30% of graduate students at the University of Manitoba are international students. Many of which go on to settle in Manitoba following their education as discussed in Section 2 page 4.

In addition to attracting students, the University also plays an important role in bridging internationally qualified professionals to be able to practice in Manitoba. For example, the University offers tailored programs in dentistry and engineering that provide pathways to professionals with international credentials to become eligible for licensure/registration in their fields.

Access programs

Ensuring that Manitobans have access to university promotes both equality and economic growth. The University offers a number of Access programs which provide academic, personal, and financial supports to a select group of students who are from a group of Manitoba's population that have traditionally experienced barriers to post-secondary education. Barriers can include a lack of financial resources, lack of academic qualifications, remote location, marginalization, and/or cultural barriers. Access students include those from Indigenous, inner city, newcomer, and northern communities.

While Access programming is available to students in any academic program, the University also provides specific supports in the areas of engineering, social work and health (e.g. medicine, nursing, pharmacy, dentistry, dental hygiene, respiratory, occupational and physical therapy).

A community resource

Students at the University of Manitoba also provide the community with numerous services through their studies including dental clinics, teaching hospitals, Ongomiizwin Health Services (formerly known as the northern medical unit), and legal clinics. Students' contributions are formally recorded through a co-curricular record, which recognizes the importance of community involvement through service, volunteerism and participation. Students at the University also participate in the delivery of programs such as Mini-U, Science Rendezvous, Women in Science and Engineering (WISE) Kid-Netic Energy, and music classes.

The University's academic programs reach beyond the classroom and into the community. For example, the University is expanding opportunities in cooperative education and other experiential learning. These opportunities not only prepare students for work beyond graduation, but also connect them with local businesses, non-profit groups, and other organizations. In addition to the co-op opportunities traditionally found in business, computer science, agriculture, and health, the University is now making similar connections in areas such as physics, psychology, and labour studies. This programming provides benefits for both students and local businesses alike.

4. *Indigenous engagement*

Indigenous community

Responding to the needs of Indigenous students has been a major priority for the University. The Strategic Plan “Taking Our Place: University of Manitoba Strategic Plan 2015-2020” guides the University in creating pathways to Indigenous achievement.

Ensuring that Indigenous peoples have access to post-secondary education and that Indigenous cultures and languages are taught is important to promoting equality and social cohesion in Canada. This is a particularly important issue in Manitoba, which has the highest Indigenous population share of any province at 18%.¹¹ The University of Manitoba plays a key role in partnering with, and supporting Manitoba’s Indigenous communities through targeted scholarships and programming, outreach, and support for the National Centre for Truth and Reconciliation Centre.

As part of the implementation of its strategic plan, the University is engaged in a comprehensive effort to attract and retain more Indigenous students, faculty and staff; to incorporate Indigenous perspectives and knowledge in its program offerings; and to honour First Nations, Métis and Inuit traditions and cultures in its spaces. Within academic programs, this has led to a revision of curriculum, internships for Indigenous students, and the focused hiring of Indigenous scholars. In fall 2019, the University will begin new language concentrations in Cree and Anishinaabemowin (Ojibway).

In addition to the above, the University supports programming in communities with significant Indigenous populations including the North through the Inter University Services (IUS) program, northern nursing programming in partnership with University College of the North at Thompson and the Pas, and the Inner City Social Work program in Winnipeg.

The University is home to one of the largest Indigenous student populations in Canada. In fall 2017, University of Manitoba student body included over 2,400 First Nations, Métis and Inuit students, of which more than 200 were graduate students. This figure amounts to 8.3% of total student enrolment, as shown in Table 3. Moreover, the degrees and diplomas conferred on Indigenous students have been on an increasing trend in recent years, as shown in

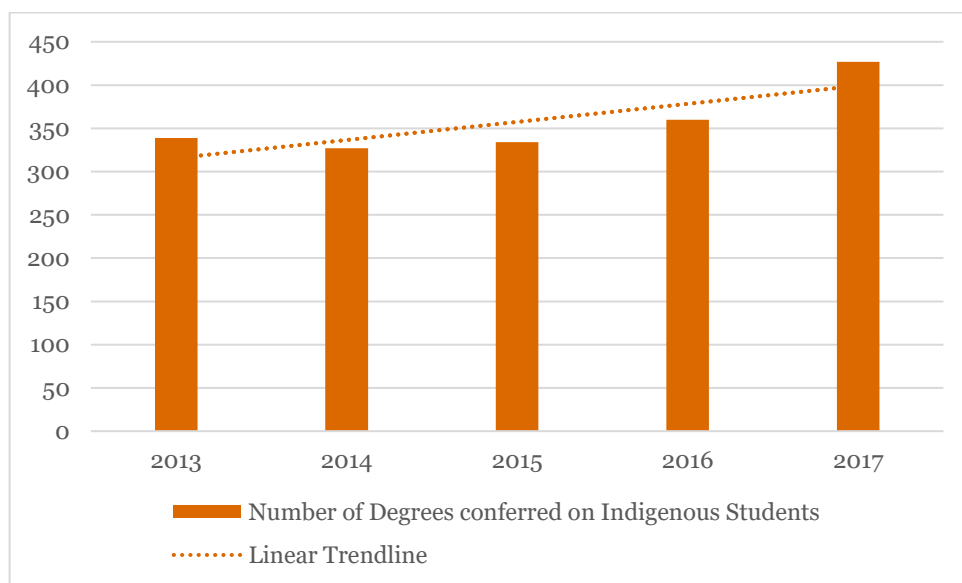
¹¹ Statistics Canada Aboriginal Population Profile, 2016 Census.

Figure 4 below.

Table 3: Number and percentage of Indigenous students, fall 2017

	Number	% of Total Students
Undergraduate	2,221	8.9%
Graduate and PostGraduate Medical Education	234	5.3%
Total	2,455	8.3%

Figure 4: Number of conferred degrees on Indigenous students, 2013-2017¹²



In 2017/18, the University of Manitoba had 239 Indigenous faculty and staff, or 2.5% of the total head count, as shown in Table 4.

Table 4: Indigenous faculty and staff, 2017/18

	Indigenous	Indigenous Share of Total Head Count
Academic	61	1.2%
Support	178	4.2%
Total	239	2.5%

Under the “Taking Our Place: University of Manitoba Strategic Plan 2015-2020,” the University introduced several initiatives to support Indigenous achievement. Below we have highlighted a few of these initiatives:

- **The Indigenous Scholars Fund** has helped to appoint Indigenous scholars to eight faculties, which will ensure that more graduates understand the importance and contributions of Indigenous peoples.
- **The Indigenous Initiatives Fund** was established in 2016/17, and has since supported 48 different initiatives across the University. Initiatives include course offerings, events, and building and strengthening relationships between the University and Indigenous communities.

In 2017/18, the University granted 1,643 awards to Indigenous students, with a total value of \$3.3 million (as shown in Table 5). These awards included scholarships, fellowship, and athletic awards such as the James Gordon Fletcher PhD Fellowship for research in aboriginal issues (\$16,000), Aboriginal Issues Press Scholarships and the Oakes-Riewe Aboriginal-Environmental Studies Research Award.

As shown in Table 5, awards to Indigenous students have been steadily increasing for the past four academic years.

¹² University of Manitoba

Table 5: Awards to Indigenous students¹³

Year	Awards	Value
2017/18	1,643	\$ 3,333,241
2016/17	1,268	\$ 2,254,955
2015/16	1,222	\$ 1,953,343
2014/15	1,072	\$ 1,763,280

The university is committed to ensuring that Manitoba becomes a centre of excellence for Indigenous achievement, leading to increased social, economic, and health outcomes for individuals, communities, and all Canadians.

¹³ University of Manitoba

5. *Sustainability strategy*

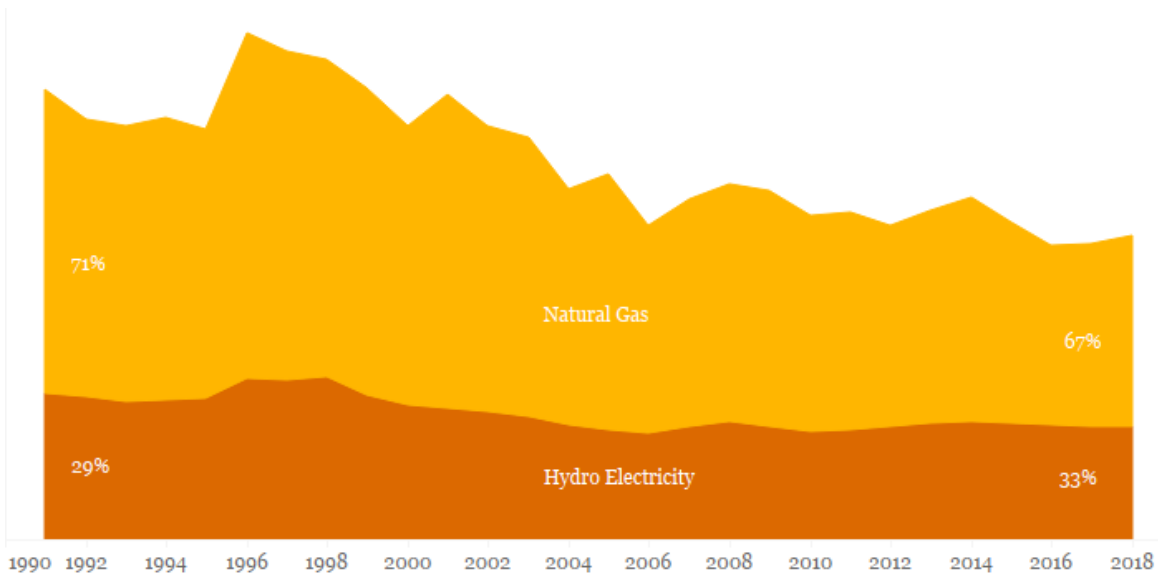
The University has made important contributions to Manitoba's efforts to reduce its resource usage and environmental footprint, and has been an early leader in this area. The University has shown leadership both through research on climate science and its implications, and through environmentally friendly initiatives on campus.

The guiding document for these efforts is the University's Sustainability Strategy 2016-2018. This strategy identifies plans to introduce new sustainability initiatives or expand the reach of existing initiatives. In 2017/18, the University implemented and continued projects in the areas of alternative transportation, waste reduction, and other sustainable development areas. The following is a sample of sustainability projects undertaken by the University:

- **The Pedestrian and Cycling Plan**, completed in January 2018, is a multi-year plan for pedestrian and cycling infrastructure improvements
- **GoManitoba** offers a free, convenient online forum for students and staff to find people interested in carpooling to the University
- **Parking Lot Design Guidelines** released in March 2018, provide direction for new construction, retrofits and maintenance of campus parking lots to minimize their impact on campus space and the environment
- **Residence Waste Reduction** improved waste management in residence buildings during moving out period

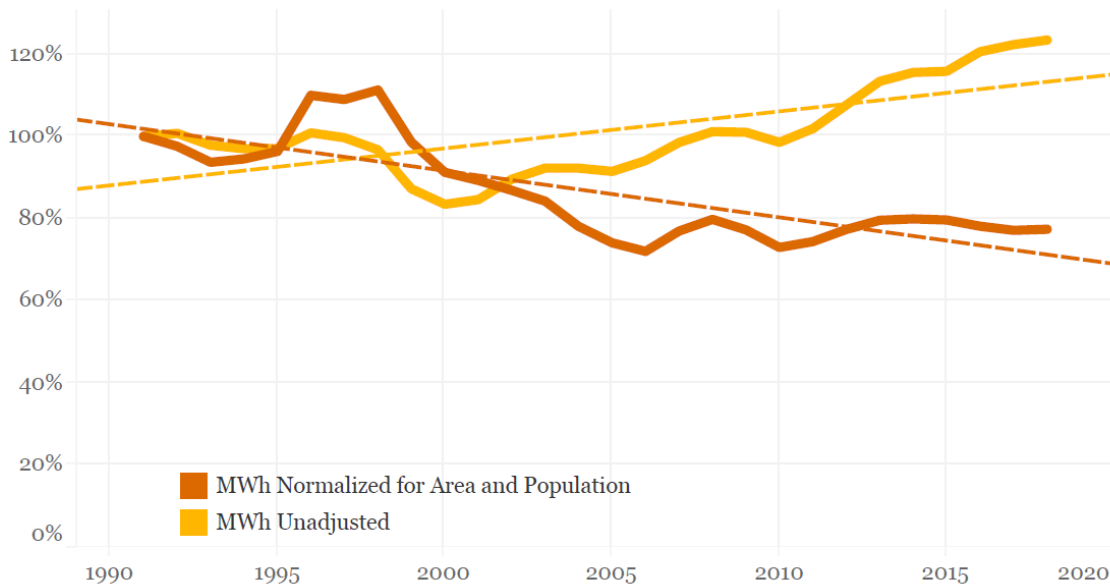
Over the last two decades, the University has worked to introduce new green practices to many aspects of building design and operations in an effort to reduce demand for resources. A long-term commitment to optimizing efficiency, promoting demand reduction, and prioritizing maintenance activities has resulted in some notable results. Campus-wide resource demands have been reduced significantly through reuse, recycling and reduction programs and strategies. As shown in Figure 4, total energy consumption of Fort Garry Campus has decreased significantly, and the share of renewable energy (hydroelectricity) has increased compared to the 1990s. Electricity, natural gas, and water consumption were reduced by 20%, 40%, and 70% respectively, compared to 1990.

Figure 5: Fort Garry Campus Energy Mix¹⁴



Overall, the University’s electricity consumption has increased. However, when considering the fact that the University has grown in student population and size, the energy usage has decreased, as shown in Figure 6.

Figure 6: Electricity Consumption of the University¹⁵



Similarly, the University’s natural gas consumption has decreased substantially on an adjusted basis, as shown in Figure 7.

¹⁴ University of Manitoba

¹⁵ Ibid

Figure 7: Natural Gas (NG) Consumption¹⁶

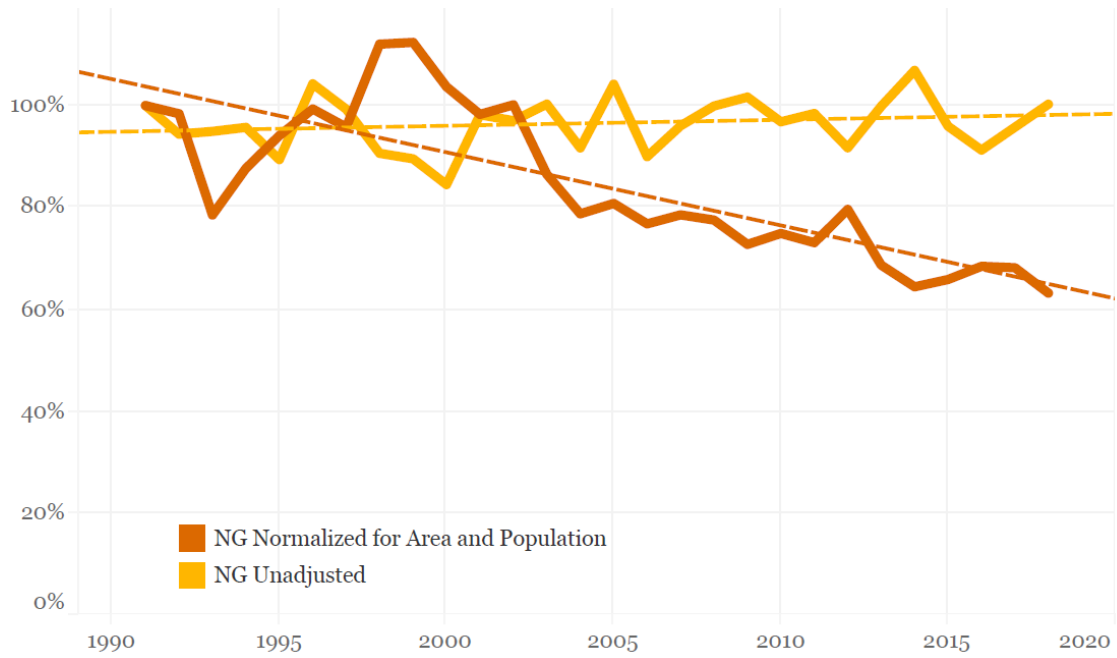
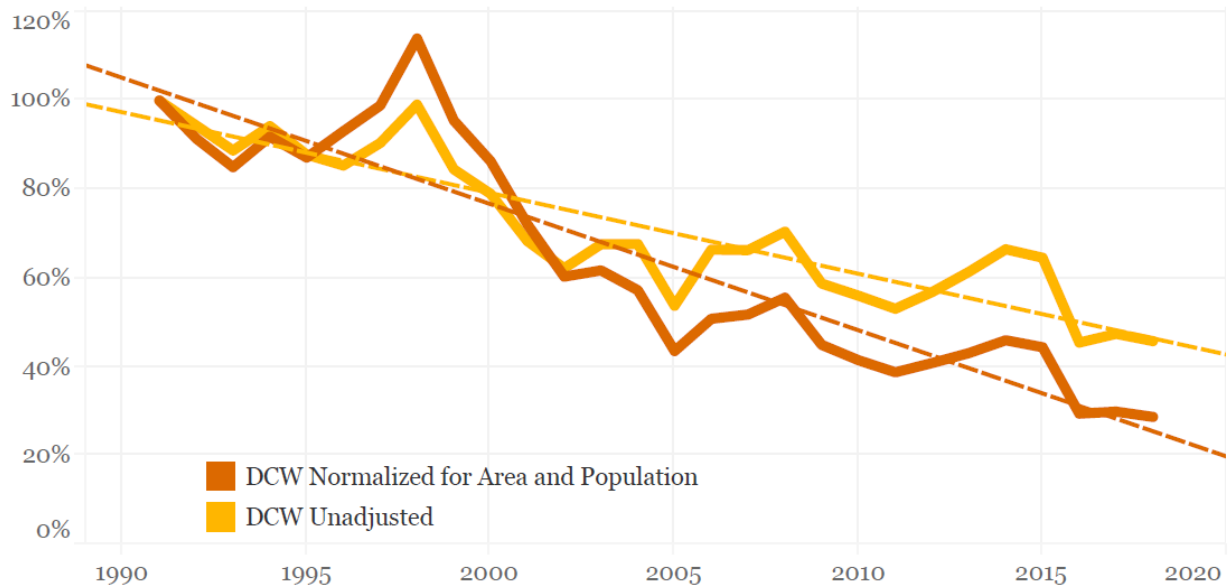


Figure 8: Fort Garry Water Consumption History¹⁷



¹⁶ Ibid

¹⁷ Ibid

6. *The University as a knowledge creator*

Research and innovation are crucial to the future wellbeing of the Canadian economy. The University of Manitoba plays a substantial role in the innovation performance of Winnipeg and Manitoba. Innovation activity at the University includes basic and applied research, research-intensive partnerships, and support for entrepreneurial activity. An independent assessment of Canada's top 50 research universities ranked the University of Manitoba thirteenth in overall sponsored research income, total publications, and publication impact in 2018.¹⁸ This section highlights the University's research contribution to the private sector, to economic growth and to society.

World-class research

Throughout its history, the University has conducted groundbreaking research. Research at the University has resulted in significant breakthroughs in the medical, agricultural, engineering, science, environmental and other fields, including the following:

- **Canola Breeding** – University researchers have been instrumental in the development and refining of canola, an oilseed crop that remarkably changed the Canadian agri-food industry and has become the third-most widely consumed vegetable oil worldwide. University of Manitoba breakthroughs include the first registered canola cultivar, the first herbicide-resistant canola variety and development of a high erucic acid rapeseed cultivar that serves as an important industrial lubricant. Key discoveries related to the nutritional, health and quality benefits of canola products were essential to achieving Generally Regarded As Safe status for consumption and to growing the yield, demand and added value of canola products.
- **Global Public Health** – Making advances and gaining knowledge that has significantly increased the understanding of HIV/AIDS, such as being the first group to discover that HIV could be transmitted heterosexually and through mother's breast milk. Most significantly, University of Manitoba researchers identified groups of sex trade workers in Kenya who are resistant to the virus. These results have received international recognition in hopes of developing a vaccine. In addition, the University is an international leader in helping to decrease the spread of HIV/AIDS through development of public health education programs in developing countries.
- **Systems Biology and Proteomics** – Developing new methods, tools and techniques in mass spectrometry, bioinformatics and performing high content analysis to examine biological samples at the molecular level with applications in medical, agricultural, and biological sciences.
- **Climate Change and Resilience** – Investigating the effects of climate change and predicting its future impacts on society. These include changes in the Arctic that will alter our ability to access and develop resources and disrupt fragile Arctic ecosystems. Research is also focused on developing remediation measures to counter the impact of melting permafrost on billions of dollars worth of public infrastructure and the effects on our water supplies that will impact our ability to produce clean, renewable hydroelectric power. Sociological and anthropological work on the sustainability and security of global fisheries and agriculture provides vital context for this research. Land and water stewardship expertise in the Canadian Prairies has been critical to effectively adapting to a changing climate with weather extremes and water excesses and deficiencies.
- **Advanced Manufacturing** – Investigating new techniques in automation, robotics, 3D printing, and material manipulation to support the Factories of the Future, which represent a merging of the internet and factories.

¹⁸ Research Infosource Inc. (2018).

- **Aerospace** – Research and design of new aerospace vehicles, systems and their components. This includes the use of advanced alloys and superalloys for aircraft construction and repair. It also includes new spacecraft components and control methods. The University is working with the space industry to accelerate the testing and adoption of new spacecraft technologies, which will enhance our capacity for space-based research and extraterrestrial exploration.
- **Biomedical Engineering** – Advances in instrumentation and technologies to support improved detection of disease and treatment methodologies. Key advances include breast cancer imaging, early diagnosis of dementia and sleep apnea, and developing nano-carriers and advanced fabrics for smart, targeted drug delivery.
- **Grain Innovation Hub** – Developing improved grain storage and drying techniques in order to better preserve grain in Canada and across the world to help combat global hunger.
- **Communication Technology** – Developing sophisticated wireless technologies to improve connectivity and access to the internet. The University is producing innovations that will help to usher in the fifth generation (5G) mobile network and will support the implementation of the Internet of Things, which will see the interconnection of billions of smart devices within the global network. Under development are many other technologies in remote sensing, telemedicine, smart vehicles, and navigation systems.
- **Immigration Data and Policy Research** – In the context of rapidly-shifting global migration patterns, providing governments with urgently-needed data on the settlement experiences and outcomes of newcomers to British Columbia, Alberta, Saskatchewan, Manitoba, Yukon, Nunavut, and Northwest Territories.

Global impacts of research

Research at the University continues to provide a global impact. In addition to significant discoveries, the University is also involved in many ongoing research opportunities that have earned international acclaim status. Some of these include:

- **Sustainable Agriculture** – Advancements in sustainable crop and livestock production systems, including agricultural greenhouse gas mitigation, integrated pest management and innovative soil nutrient management are contributing to building safe, healthy and sustainable food systems that are economically viable and adaptable to changing needs and challenges. Innovative environmentally-friendly products generated from renewable bioresources are helping diversify and strengthen the growth of Canada's bioeconomy.
- **Safe, Healthy, Just and Sustainable Foods** – Innovations in plant-based meat alternatives, nutrigenomics, functional foods and nutraceuticals, have helped Canada emerge as a leading global supplier of natural health products and foods with enhanced functional attributes.
- **Water Quality** – Investigating water quality by looking at water policy and protection, aquatic ecosystems, nutrient leaching, pollution, antimicrobial resistance, climate change, drought, and water infrastructure. The development of improved, sustainable water and wastewater treatment practices are leading to measurable economic benefits and improved water quality for municipalities of all sizes.
- **New Materials and Nanoengineering** – Developing stronger, lighter and less-expensive materials for multi-disciplinary use in areas such as aerospace, engineering and biomedicine. Recent investments in the Manitoba Institute for Materials have enabled a revolution in nanoscale materials research. Materials can now be manipulated at the atomic scale to produce nanomaterials with vastly superior physical and chemical properties when compared to current materials.
- **Energy Systems** – Exploring new sources of renewable energy and developing technologies that support the development of "smart grids," that can actively respond to power supply fluctuations, thereby ensuring a more efficient and reliable supply of electricity. Real-time simulation of energy grids is a major University of Manitoba contribution that has been exported around the world.
- **Regenerative Medicine** – Stem cell research is conducted in the regenerative medicine program to find ways to regenerate cells that have stopped functioning, which is currently one of the most sought-after fields in medical research.

- **Archaeology** – Making advancements in digital imaging technology in the Bioanthropology Digital Image Analysis Laboratory to reliably estimate demographic information from archaeological samples of human and animal bone or teeth.
- **Civil Societies/ Human Rights** – At the Arthur V. Mauro Centre for Peace and Justice, researchers examine the social, economic, and environmental aspects of peace and justice. The Geopolitical Economy Research Group and Immigration Research West contribute further expertise to international research projects.
- **Healthy Aging** – Researchers at the University examine our aging society and conduct age-related studies leading to new information in areas such as cardiovascular health, psychological and sociological aspects of health and illness in later life, geriatric medicine and domestic/elder abuse.
- **Family and Gender-Based Violence** – In connection with RESOLVE (formerly known as the Manitoba Centre for Family Violence and Violence Against Women), the University undertakes research that offers practical, action-oriented ways to help end family and gender-based violence. Recent research has focused on strategies to stop the intergenerational cycle of violence and developing interventions for children in adults in schools, shelters, community agencies, and correctional facilities.
- **Indigenous Health Research** – Collaborating with Indigenous communities and organizations to help measure the impact of social and environmental factors on health and using research results to strengthen the health care system and to improve lives.
- **Indigenous Research Methodologies** – Drawing on Indigenous knowledge and traditions (including ceremony, storytelling, and oral history) to develop qualitative and quantitative research methodologies that are culturally appropriate and sensitive to the colonial context in which research involving Indigenous peoples has historically taken place.
- **Sociolinguistics** – Preserving and documenting critically endangered Indigenous languages such as Michif.

In addition to these key research areas, the University has also identified a number of future research opportunities in its 2015 Strategic Research Plan.

Research chairs, centres, institutes, and facilities

The University is currently home to 48 Canada Research Chairs (CRCs). CRCs are research professorships established by the CRC Program, which is a program that supports Canadian universities in attaining excellence in research and enhances Canada's competitiveness in the worldwide knowledge-based economy. Chairholders are exceptional researchers who have been acknowledged either as world leaders or having the potential to lead in their field. A full list of the University's research chairs is available on the University of Manitoba website.

The University is also home or a partner to 37 research centres, institutes, and shared facilities that foster collaborative research and scholarship. These institutions reinforce the University's external profile as a key Canadian research institution and help to attract valuable research funding to the Province. A full list of the University's research centres, institutes, and shared facilities is available in Appendix C: Research institutes at the University of Manitoba.

Economic impact of research

University research supports and enhances economic growth through two main channels: the development and transfer of new knowledge, and improved technological capabilities. Through these channels, research undertaken by universities increases productivity and thereby stimulates GDP growth.¹⁹

We estimated the increases in productivity in Manitoba that are attributable to research conducted at the University of Manitoba. Our approach is based on Martin (1998), who developed a method to estimate GDP growth in Canada ascribed to productivity increases driven by university research. Several recent studies of universities' economic impact have adopted this approach in some form.²⁰ In total, we estimate that research at the University has added \$2.7 billion to GDP since 1971 through increasing productivity. Productivity refers to the overall efficiency with which inputs are turned into outputs. Our approach to measuring this number is explained in Appendix D: Methodology.

The University's role in commercialization

Commercialization refers to the process of turning research and innovation into commercial activity, and brings tangible benefits to the University and industry stakeholders. It includes the licensing of technologies and products, as well as the creation of spin-off companies. We present the economic impacts of spin-off companies in Section 11: Economic impact of spin-off businesses. This section focuses on disclosure, licensing and patent activities.

Technology transfer offices play an important role in facilitating strong collaboration between universities and industry. The office's receipt of an invention disclosure from researchers is the beginning of the collaboration between inventors and technology transfer professionals. In this sense, a disclosure is the raw material needed to generate patented products and economic benefits. When a license agreement is signed, it marks the beginning of a formal, long-term relationship between a research institution and its industry partner. Filing patents on research discoveries protects the researchers' intellectual property, encourages new research within the institution, and facilitates the adoption of new technologies in the marketplace. Moreover, patents offer protection to companies that invest resources and time to develop technologies into commercially viable products.

In 2015/16, researchers at the University of Manitoba filed 62 disclosures, 27 patent applications, and generated \$1.25 million license income.

Table 6: Commercialization of research of the University of Manitoba, 2015/16²¹

	2015/16
Number of Disclosures	62
Number of Patent Applications	27
Number of Total Licenses	6
Number of Start-ups	4
License Income	\$ 1,250,128

¹⁹ We note that this impact channel is in addition to the channel assessed in section 3 of this report. That analysis deals with the GDP impact of spending associated with research such as paying salaries and purchasing lab equipment.

²⁰ University of Ottawa (2016); Council of Ontario Universities (2017); Western University (2015); University of Alberta (2015).

²¹ AUTM (2017).

The social return of research

Research done by the University of Manitoba has broader benefits beyond that realized by the original researchers. These broader benefits are typically referred to as the “social return” of research, and refer to the full impact of research on society, as opposed to private benefits, which only account for the financial return. Social benefits include productivity spill-overs that benefit companies other than the original researcher. The productivity measure noted in the previous section is part of overall social return.

We have assessed the impact of social benefits resulting from academic research undertaken by the University of Manitoba. A growing body of empirical economic studies provide evidence that the social rate of return to academic research is between 20% and 60% depending on the type of research.²² Returns of these magnitudes are significant in the case of the University of Manitoba, which spends over \$100 million on research annually.

Table 7 illustrates the social return multipliers for a sample of given years per dollar of research expenditure. One dollar R&D expenditure by the University today creates a total of \$5.02-\$6.69 social return in present value over 32 years. In 2017/18, the University of Manitoba spent \$159 million in research, so this spending will contribute \$797-1,063 million in social return over the lifetime of the research.

Table 7: Cumulative social return per dollar research expenditure²³

Year	Low Return Rate (20%)	High Return Rate (60%)
10	1.74	2.31
15	3.53	4.70
20	4.44	5.92
25	4.86	6.48
32	5.02	6.69

Additional benefits of research: Centre for Global Public Health

The social return described in the previous sub-section does not include certain non-market benefits such as health benefits (e.g. reduced mortality). The scope of our study does not include an estimate of such benefits, but for illustration purposes, we describe and monetize the health impact of research and programming conducted by the University using an example from the Centre for Global Public Health.

The Centre for Global Public Health (“the Centre”) was created in 2008 and is housed at the Rady Faculty of Health Sciences. It carries out research and programming on global health issues such as maternal and child health and HIV/AIDS. The centre attracts research funding from international organizations such as the Bill & Melinda Gates Foundation, USAID, and World Bank, among others. Between 2008 and 2018, the Centre spent more than \$166 million on research and programming.

²² Frontier (2014); Hall et al. (2009); Salter and Martin (2008); Jones & Williams (1997); Mansfield (1991).

²³ To calculate these estimates we made the following assumptions:

1. Two scenarios of social rate of return are assumed: 20% and 60%
2. It takes 7 years for public researchers to commercialize their research
3. The average life of social benefit from research is 25 years, with a straight-line deterioration over those 25 years (i.e. 4% amortization per year)
4. An 8% discount rate is applied and all returns are discounted to present value

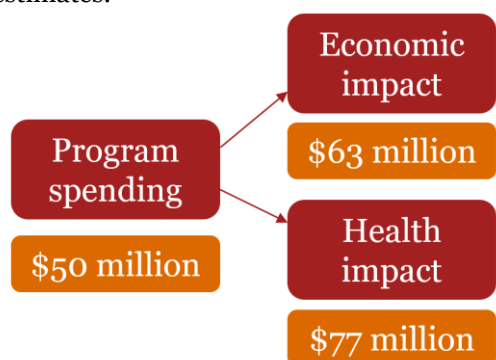
These are consistent with previous research including Frontier (2014); University of Ottawa (2016); Haskel et al. (2014); Morris et al. (2011).

The Centre’s programming is an example of where societal benefits from University spending go beyond the traditional economic impacts. The main impacts of the Centre’s programs are improvements in health outcomes and decrease in mortality rates, which are not captured in traditional economic impact analysis. The following case study illustrates an assessment of the social benefits of this research.

Case study: HIV prevention in India (Avahan program)

We estimate the economic and health impact of the Avahan program. The Avahan program is an initiative of the Bill & Melinda Gates Foundation that aims at reducing AIDS prevalence in India. The University of Manitoba participated in this program by playing a key role in in the overall design and implementation of the program, and by leading its implementation in certain districts. A 2014 research paper (Vassal et al, 2014) assessed the health impacts of this program in 22 districts. Program spending in those districts was \$50 million USD between 2004 and 2008.

This program spending had two main effects: economic impact and health impact. The economic impact occurs because program spending has a multiplier effect, as described elsewhere in this report and measured by traditional economic impact assessments. The other impact is on health outcomes, which is not included in economic impact estimates.



We calculated economic impact of the program spending based on employment generated in Manitoba and India. Based on this measurement, the economic impact of the program was \$63.4 million USD over four years, with 19% of the impact in Canada and the rest in India.

There are multiple approaches to measuring health impact. Here, we use averted lifetime health care costs. Based on Vassal et al (2014), the cost savings in terms of lifetime averted antiretroviral treatment was \$77 million USD. Another approach would be to count the number of lives or disability-adjusted life years and assess the value of those based on statistical methodology.

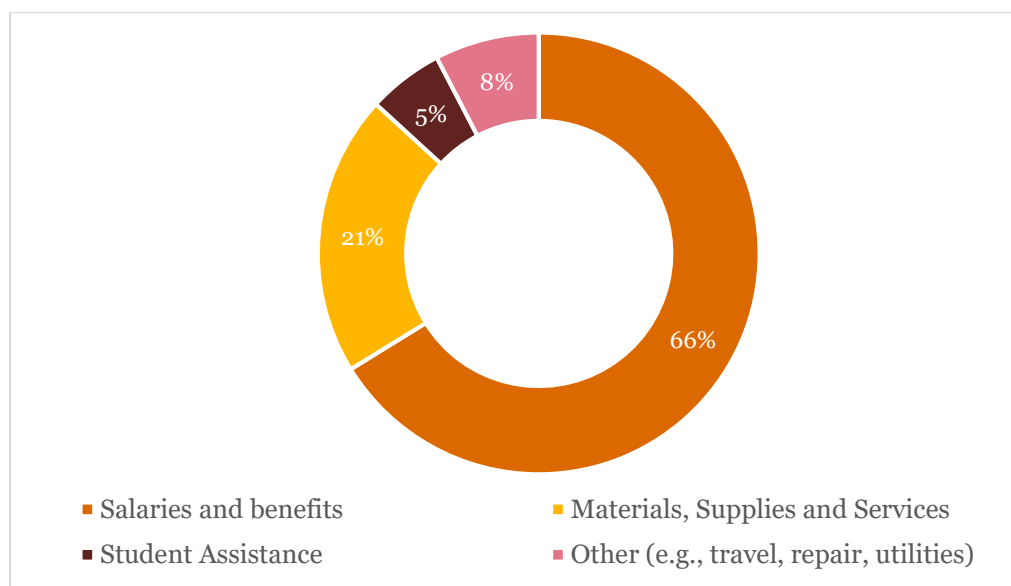
Based on the above figures, we calculate the economic return of the program as \$1.25 per \$1 spent, and the social return at \$1.52 per \$1 spent. This is within the estimated range of social return of 20%-60% discussed earlier. There will be similar effects from other programs run by the Centre. A recent example is the Uttar Pradesh Technical Support Unit. This is a partnership between the University and the government of Uttar Pradesh, a province in India with relatively high maternal and neonatal mortality rates. The program has been successful in increasing the number of doctors’ visits by pregnant women and the share of births that take place in institutions rather than at home. These outcomes are likely to decrease maternal and neonatal mortality.

7. *Economic impact of operating and research spending*

One way that the University creates economic impact is through its day-to-day spending on teaching, research and other campus activities. This spending is referred to as operating and research spending, and includes employee payroll and purchases of goods and services. In 2017/18, operational and research spending was \$713.4 million.

The majority of this spending was on compensation for staff and faculty (66%) and to purchases of goods and services (21%). Student assistance such as scholarships and fellowships amounted to \$40.0 million in 2017/18, or about 5% of total expenses. Figure 9 illustrates the composition of operating and research expenses.

Figure 9: University of Manitoba operating and research expenditures, 2017/18²⁴



Total operating and research spending was \$713.4 million in 2017/18. However, some of this spending does not generate economic impact in Manitoba. For this reason, we have removed the following types of spending:

1. Spending that occurred outside of Manitoba, which was about 16% of the University’s operating and research expenses. This includes, for example, expenses of contracted services by research projects in foreign countries.
2. Expenses that do not generate economic impacts, such as interest payments.
3. Expenses that may be “double counted.”²⁵

After applying these adjustments, the relevant operational and research expenses for 2017/18 were estimated \$618.1 million.

²⁴ University of Manitoba

²⁵ Double counting happens when expenditures are included twice (such as tuition paid by students that is also in the University’s operating spending. We excluded \$19.78 million in operating expenses to account for this effect. We minimized double counting by including scholarships and bursaries as gross operating surplus and adjusted graduate student expenses in Section 3.3.

Economic impact of operating and research spending

Using Statistics Canada's input output model, we estimated the economic impact of the University's operating and research spending in Manitoba, which was \$618.1 million in 2017/18. Through direct, indirect, and induced impacts, this spending generated a total impact of \$966.9 million in output, \$673.0 million in GDP, 7,730 jobs, and \$514.4 million in labour income. Every \$1 in operational and research spending generates \$1.6 in output in Manitoba.

Table 8: Economic impact of operating and research expenses, 2017/18

	Direct	Indirect	Induced	Total	Multiplier ²⁶
Output (million \$)	618.1	117.0	231.8	966.9	1.6
GDP (million \$)	451.8	70.2	151.0	673.0	1.5
Labour income (million \$)	412.7	40.9	60.8	514.4	1.2
Employment (FTE)	6,018	634	1079	7,730	1.3

The above economic footprint in turn generates a tax impact. As shown in Table 9, operations and research spending generated \$113.3 million in tax revenue to the federal government, \$87.0 million to the Manitoba government and \$11.5 million to municipalities in Manitoba. The total tax impact for all levels of government was \$211.8 million. These tax impacts include estimated federal and provincial personal and corporate income tax as well as taxes on production and products, which include GST, PST, and property taxes.

Table 9: Tax impact of operating and research expenses, 2017/18

Tax (million \$)	Federal	Manitoba	Municipal	Total
Taxes on production and products	17.8	30.6	11.5	59.9
Corporate income tax	8.3	4.2	-	12.5
Personal income tax	87.2	52.2	-	139.3
Total	113.3	87.0	11.5	211.8

Summary

Operating and research spending by the University in Manitoba was \$618.1 in 2017/18. This spending generated the following total economic impacts in Manitoba, which include direct, indirect, and induced effects:

- \$966.9 million in output
- \$673.0 million in GDP
- \$514.4 million in labour income
- 7,730 jobs
- \$211.8 million in total tax revenue

²⁶ Throughout the report, multipliers have been calculated by dividing total economic impact by the direct economic impact. In other words, these represent the magnitude by which total economic impact is a multiple of direct economic impact.

8. Economic impact of capital spending

A substantial share of the University's overall spending is in the form of capital spending. This includes capital acquisitions such as vehicles, furniture, computing infrastructure, machinery and equipment, as well as major building renovations, repair and new construction.

It is important that the University maintain its building infrastructure in order to continue to support the needs of its over 29,000 students, as well as the Manitoba community as a whole. Like other Canadian Universities, the University of Manitoba is facing a deferred maintenance backlog currently estimated at over \$300 million. Approximately 55% of the University's campus buildings were constructed between 1956 and 1972 and have major systems and components that are at, or nearing end of life. As such, spending on major renovations and repair such as fire/life safety, asbestos, sewer and water upgrades, renewal, and mechanical systems are required at an increasing rate.

Capital spending also expands the University's capabilities, enabling it to increase and deepen its program offerings to better meet the needs of Manitoba's economy. Two recent examples of this are the Engineering Innovation Centre and the Smartpark Innovation Hub, both of which were built with support from the Federal Government's Strategic Investment Fund. In addition, the Churchill Marine Observatory is being constructed with support from the Federal and Provincial governments.

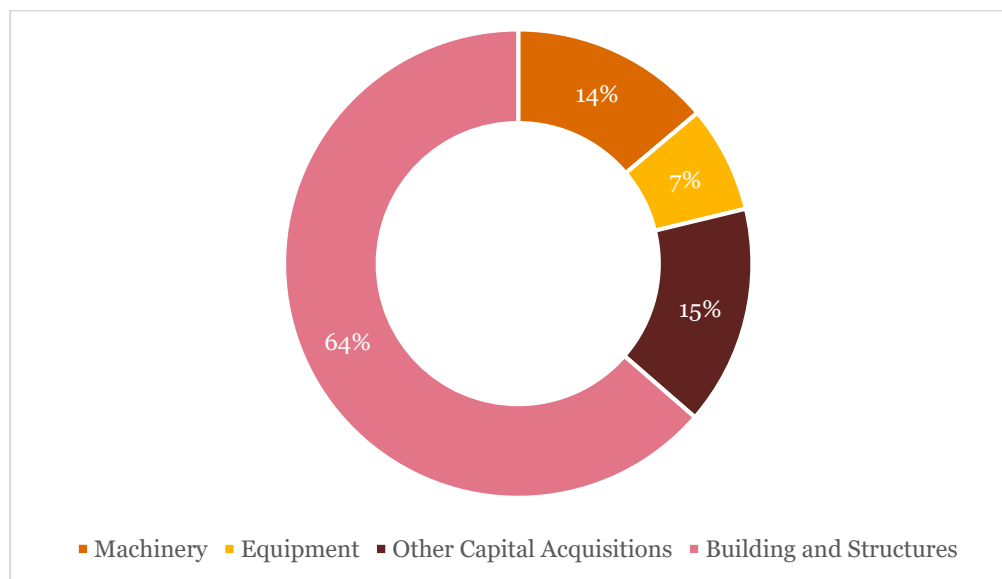
In April 2015 the University's Active Living Centre opened its doors to students and members of the community. This investment in infrastructure contributes to building a strong, sustainable and healthy community, promoting healthy living, and providing programming for both the university community and the community at large.

Other recent major capital projects are the Campus Day Care Addition, Tache Hall redevelopment and major teaching lab and classroom renewals.

This spending stimulates the local economy and supports the construction and repair industries. Jobs are created and employees in these sectors spend money in Manitoba, which in turn supports other businesses. In addition, purchases of materials, equipment, furniture and supplies support local businesses.

The University's cumulative capital spending amounted to \$485.1 million between the years 2014/15 and 2018/19. Figure 10 shows the breakdown by item. As described above, the majority of spending was in buildings and infrastructure renewal.

Figure 10: Capital expenditures of the University of Manitoba²⁷



Economic impact of capital spending

We used Statistics Canada’s input output model to estimate the economic impact of the University’s capital spending in Manitoba. Through direct, indirect, and induced impacts, this spending generated a total impact of \$667.9 million in output, \$266.5 million in GDP, 3,156 jobs, and \$189.3 million in labour income. Every \$1 capital project spending generates \$1.40 in output in Manitoba. Table 10 shows the full economic impact of capital spending over the five years from 2014/15 to 2018/19.

Table 10: Economic footprint of capital expenditures

	Direct	Indirect	Induced	Total	Multiplier
Output (million \$)	485.1	39.0	143.8	667.9	1.4
GDP (million \$)	111.6	81.3	73.6	266.5	2.4
Labour income (million \$)	94.3	50.4	44.7	189.3	2.0
Employment (FTE)	1,532	937	688	3,156	2.1

The total tax impact of capital spending over five years for all levels of government was \$70.0 million. This includes \$32.4 million in federal taxes, \$30.4 million in provincial taxes, and \$7.2 million in municipal taxes. These tax impacts include estimated federal and provincial personal and corporate income tax as well as taxes on production and products, including GST, PST, and property taxes.

²⁷ Cumulative breakdown over 2014/15 to 2018/19

Table 11: Tax footprint of capital expenditures

Tax (million \$)	Federal	Manitoba	Municipal	Total
Taxes on production and products	6.7	13.9	7.2	27.8
Corporate income tax	2.5	2.0	-	4.5
Personal income tax	23.2	14.5	-	37.8
Total	32.4	30.4	7.2	70.0

Summary

The University generates economic impact through spending on capital including repairs and construction, and purchases of machinery and equipment. Over a five year period, the University's capital spending generated the following economic impact in Manitoba:

- \$667.9 million in output
- \$266.5 million in GDP
- 3,156 jobs
- \$189.3 million in labour income
- \$70.0 million in taxes to all levels of government

9. *Economic impact of student expenditures*

The University attracts students from outside the City of Winnipeg who spend money while they attend the University. We have assumed that without the presence of the University, this spending would not take place in Manitoba. Therefore, these expenses produce a net economic impact for the Province.²⁸ Students spend money on items such as rent, groceries, transportation, and entertainment, all of which supports economic activity in Manitoba.

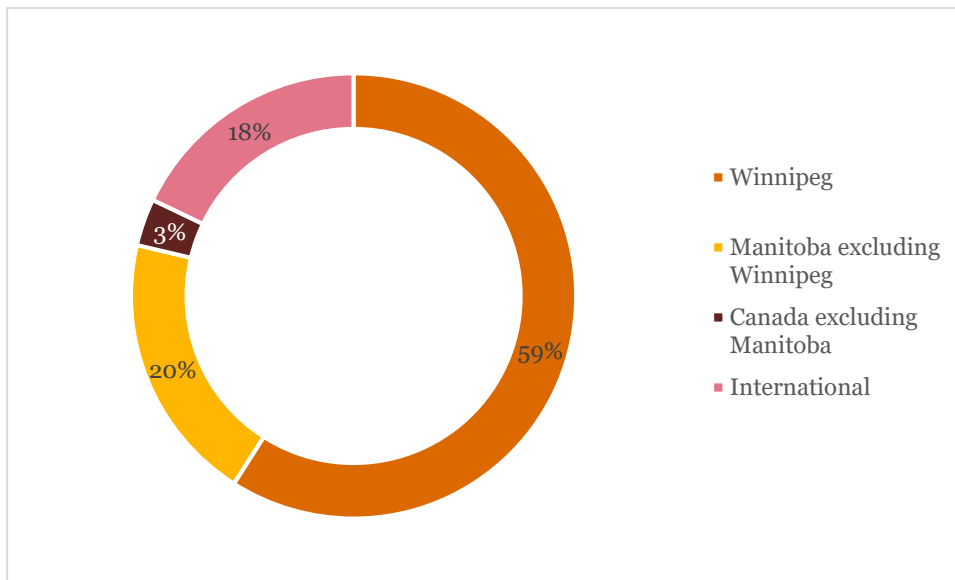
Because it is the largest and most comprehensive post-secondary institution in the Province, the University of Manitoba retains students in the Province who would otherwise leave, and attracts students from outside the Province and outside of Canada who would otherwise not be in Manitoba. This has impacts in terms of generating spending, and longer-term economic benefits when students stay in the Province to work after graduating.

Profile of student origins

Of the University’s 29,000 students, the majority (59%) come from Winnipeg. A further 20% come from other regions of Manitoba, and the remaining 21% come from elsewhere in Canada and abroad. Figure 11 shows the breakdown of student origins, which we calculated based on administrative data.

As noted previously, we assume that without the presence of the University, Canadian students outside Winnipeg and international students would not have attended a university in Manitoba.

Figure 11: Origins of undergraduate students of the University of Manitoba, 2017/18

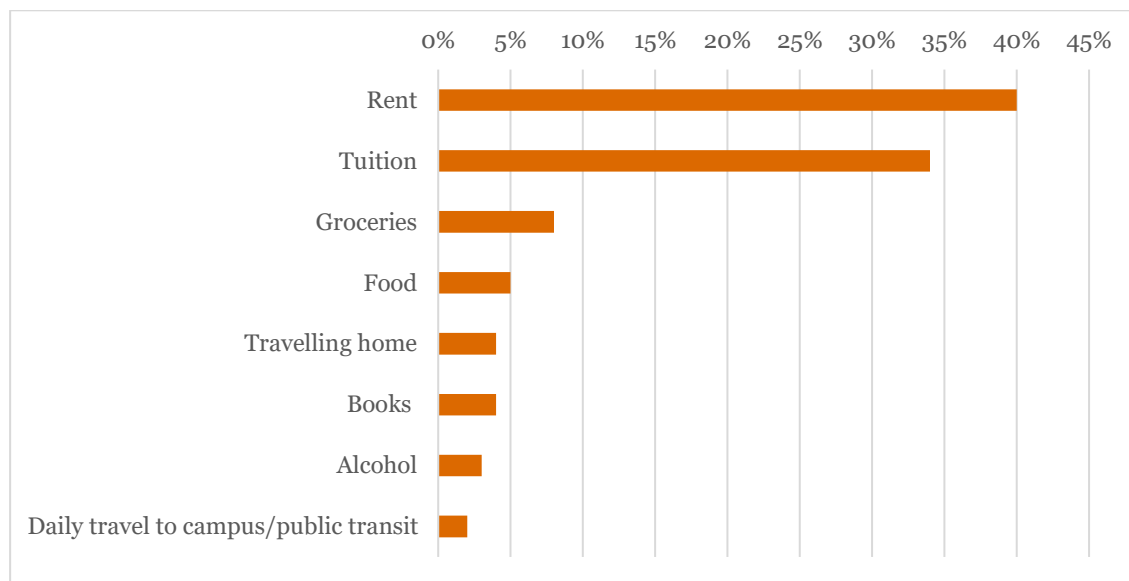


²⁸ We note that that without the University of Manitoba, students from Winnipeg may also have left the province to attend university outside Manitoba. However, data limitations make it impossible to estimate this effect with reasonable confidence. Therefore, we do not estimate the footprint of Winnipeg-based students.

Estimating student spending

We used a survey conducted by Maclean’s magazine to estimate students’ spending. Per the survey, average annual spending is \$19,499, the majority of which is spent on rent and tuition, as shown in Figure 11.²⁹

Figure 12: Annual expenditure structure of a college/university student



In order to estimate total student spending, we first estimated the number of students by origin and by full-time or part-time status. We then estimated the living expenses of students in each category such as rent, groceries, and transportation. Tuition was not included in student spending because its impact is already reflected in the University’s operational and capital spending, which we have assessed separately. Our detailed methodology is presented in Appendix C.

Economic impact of student spending

Based on our calculations, total student spending attributable to the University was \$129.3 million in 2017/8. We estimated the total direct, indirect, and induced impact of this spending at \$192.1 million in output, \$121.6 million in GDP, 1,619 jobs, and \$57.7 million in labour income. Every \$1 of student spending generates \$1.5 in output in Manitoba. Table 12 shows the full economic impact of student spending in 2017/18

Table 12: Economic footprint of students’ spending

	Direct	Indirect	Induced	Total	Multiplier
Output (million \$)	129.3	37.1	25.6	192.1	1.5
GDP (million \$)	83.4	21.5	16.7	121.6	1.5
Labour income (million \$)	38.3	12.6	6.7	57.7	1.5
Employment (FTE)	1,196	258	165	1,619	1.4

²⁹ Maclean’s (2018)

The tax impact generated by student spending was \$39.2 million to all levels of government. This includes \$13.8 million to the federal government, \$14.8 million to the provincial government, and \$10.6 million to municipal governments.

Table 13: Tax footprint of students' spending

Tax (million \$)	Federal	Manitoba	Municipal	Total
Taxes on production and products	1.3	6.8	10.6	18.7
Corporate income tax	2.3	1.4		3.7
Personal income tax	10.2	6.5		16.7
Total	13.8	14.8	10.6	39.2

Summary

Spending by students that can be attributed to the University was \$129.3 million in 2017/18. This spending generated the following economic impact including direct, indirect and induced effects:

- \$192.1 million in output
- \$121.6 million in GDP
- 1,619 jobs
- \$57.7 million in labour income
- \$39.2 million in tax revenue to all levels of government

10. Economic impact of visitors

The University contributes to Winnipeg’s tourism sector by attracting out-of-town visitors attending University-hosted events, and visitors to students and faculty. These visitors generate economic impacts through spending on food, lodging, transportation, recreation, and retail in Winnipeg and Manitoba. This section estimates the economic impact generated by visitor spending.

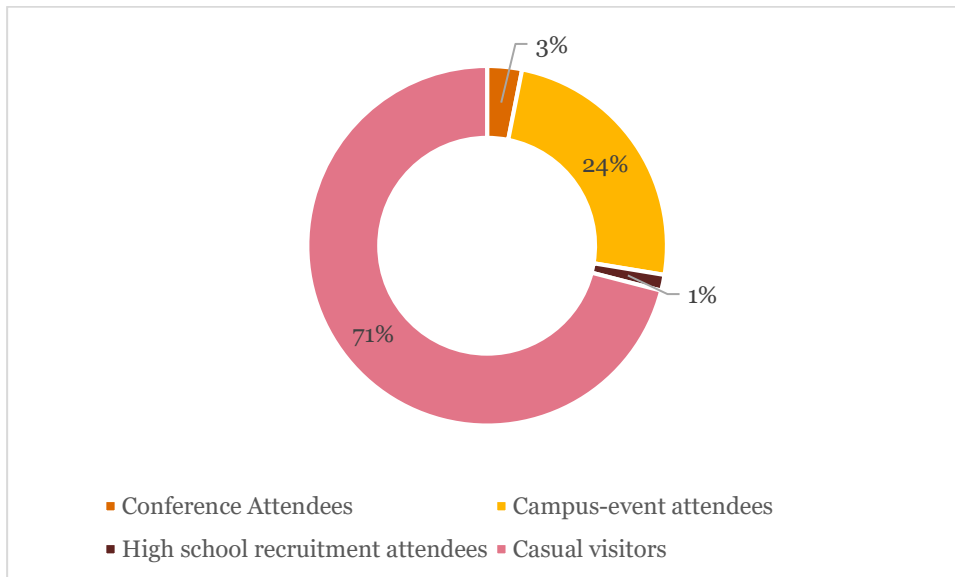
Profile of visitors to the University

To estimate the economic impact of visitors, we first identified the number of visitors. We identified the following categories of visitors attributable to the University:

- **Conference attendees** consist of out-of-town visitors to the University of Manitoba for conferences, seminars and workshops
- **Attendees at campus events** consist of out-of-town visitors attending events such as convocation, sporting events, Mini University, homecoming, and reunions of alumni
- **High school recruitment** consists of overnight out-of-town high school students, parents, and high school counsellors who attend various recruitment activities on campus, such as campus tours, counsellor’s seminar, and information day events
- **Casual visitors** consist of people visiting and staying with faculty, support staff, and students

Figure 13 shows the share of out-of-town visitors in each category. In 2017/18, we estimated the total number out-of-town visitors to be 161,146. The largest group was casual visitors, at 71%, followed by campus-event attendees at 24%.

Figure 13: Out-of-town visitors in 2017/18



We collected data on visitors to University events from the University. We estimated spending by out of town visitors using data from Tourism Winnipeg and Statistics Canada. Our detailed methodology for estimating spending and number of casual visitors is presented in Appendix D.3. Out-of-town visitors

Economic impact of visitors

We estimated that visitors to the University spent \$77.4 million in 2017/18. The total economic impact of this spending including direct, indirect, and induced impacts was \$118.5 million in output, \$62.7 million in GDP, 1,342 jobs, and \$37.8 million in labour income. Every \$1 of visitor spending generates \$1.5 in output in Manitoba. Table 14 shows the full economic impact of visitor spending.

Table 14: Economic footprint of out-of-town visitor spending

	Direct	Indirect	Induced	Total	Multiplier
Output (million \$)	77.4	23.8	17.3	118.5	1.5
GDP (million \$)	38.5	12.9	11.3	62.7	1.6
Labour income (million \$)	26.2	7.1	4.5	37.8	1.4
Employment (FTE)	1,076	154	111	1,342	1.3

The total tax footprint of visitors to the University was \$19.1 million in 2017/18. This includes \$9.0 million to the federal government, \$7.6 million to the Manitoba government, and \$2.5 million to municipal governments. Table 15 shows the full tax impact of visitor spending.

Table 15: Tax footprint of out-of-town visitor spending

Tax (million \$)	Federal	Manitoba	Municipal	Total
Taxes on production and products	0.9	2.6	2.5	6.0
Corporate income tax	1.2	0.6	-	1.8
Personal income tax	6.9	4.4	-	11.4
Total	9.0	7.6	2.5	19.1

Summary

Visitors to the University spent \$77.4 million in 2017/18. This spending generated the following total economic footprint in Manitoba including direct, indirect, and induced impacts:

- \$118.5 million in output
- \$62.7 million in GDP
- 1,342 jobs
- \$37.8 million in labour income
- \$19.1 million in taxes to all levels of government

11. *Economic impact of spin-off businesses*

One of the ways that the University contributes to innovation and economic growth in Manitoba is through supporting the creation of spin-off businesses. For the purposes of this report, we define a spin-off business as a company that the University had any kind of role in creating. Spin-off companies benefit from the University through various channels including technology transfer, teaching relevant skills, and providing office space.

Spin-off companies are linked to the University of Manitoba on one or more of the following dimensions:

- **Creation of the business:** These spin-off companies use technology that was facilitated by the University and is a key value driver for them. This includes University sponsored ventures, licensed or unlicensed technology, and companies created at the University by University graduates or faculty.
- **Development of human capital:** Most spin-off companies have workforces with a significant share of University of Manitoba alumni. The University supports a highly skilled workforce that is essential to the success of spin-off companies.
- **Collaboration to develop new technology:** These spin-off companies collaborate with the University to research and innovate new technology. These collaborations include contract research, research partnerships, and joint ventures. These spin-off companies are not necessarily a direct result of the University, but the involvement of the University supports those spin-offs by enabling them to improve their product and/or service and to expand their operations.

Measuring spin-off activity

In order to measure the economic activity of spin-off companies, we conducted interviews with nine of these companies in October 2018, based on a list of companies identified by the University. All the spin-offs identified were successful enterprises with growth potential within the Province. Through our interviews, we collected the following information:

- The type of relationship with the University and how it evolved over time
- The degree to which the spin-off's existence can be attributed to the University
- Current financial information including revenues and capital expenditures

Our survey and detailed methodology are described in Appendix D.4. Spin-off businesses Four of the spin-offs identified by the University are large companies with revenues of over \$100 million. Overall, the companies we interviewed employ over 7,189 employees within Manitoba, of which 24% are University graduates. These companies generated \$2.7 billion in revenues in Manitoba in 2017.³⁰ Table 16 classifies the spin-off companies included in our assessment by industry.

³⁰ We approximated in-province revenues for three spin-off firms whose financial information was not disclosed. We estimated the output based on reported employee numbers using output to employment ratios from Statistics Canada.

Table 16: Industry distribution of spin-offs

Category	Number of Spin-offs
Engineering	3
Health	3
Scientific research and development services	2
Energy	1

We measured the economic footprint attributable to the University based on information collected from spin-offs and the closeness of their relationship with the University. During the interviews, we asked respondents to assess to what extent the University is responsible for their existence.³¹ Table 17 shows the companies' classification of the role played by the University in their creation.

Table 17: Spin-offs' relationship with the University of Manitoba³²

Role of University of Manitoba	Number of Respondents
"But for" (80-100%)	2
"Primary" (60-79%)	1
"Relied" (40-59%)	1
"In part" (20-40%)	3
Other	2

Based on the information collected through the interviews, we assessed the economic impact of these spin-off companies and quantified the share that was attributable to the University. To estimate the share of companies' economic impact that is attributable to the University, we used the mid-point of the attribution ranges shown in Table 17. We applied these attribution ratios to the total economic impact of the spin-off companies, which we calculated based on their current revenues and employment. On that basis, we attributed \$355.4 million in spending in Manitoba to the University.

Economic impact of spin-off businesses

The direct economic impact of spin-off businesses attributable to the University is \$355.4 million in output and 1,207 jobs. This direct impact in turn creates indirect impact, through the supply chain of businesses' purchases, and induced impact, through employees of the spin-off businesses and businesses in their supply chain. The total economic impact based on these effects was \$466.1 million in output, \$277.6 million in GDP, 1,981 jobs, and \$122.5 million in labour income. Every \$1 of spin-off business spending generates \$1.4 in output in Manitoba. Table 18 shows the full economic impact of spin-off businesses.

³¹ Details are provided in Appendix D

³² The percentages reflect the estimated share of the University in the company's creation based on the companies' responses to our questions.

Table 18: Economic footprint of spin-off businesses

	Direct	Indirect	Induced	Total	Multiplier
Output (million \$)	335.4	74.7	55.9	466.1	1.4
GDP (million \$)	203.1	38.1	36.4	277.6	1.4
Labour income (million \$)	83.5	24.4	14.6	122.5	1.5
Employment (FTE)	1,207	414	360	1,981	1.6

The total tax footprint of spin-off businesses attributable to the University was \$41.9 million to all levels of governments. This includes \$21.9 million in federal taxes, \$17.1 million in provincial taxes and \$2.9 million in municipal taxes.

Table 19: Tax footprint of spin-off businesses

Tax (million \$)	Federal	Manitoba	Municipal	Total
Taxes on production and products	2.2	4.7	2.9	9.7
Corporate income tax	3.1	1.9	-	5.1
Personal income tax	16.6	10.6	-	27.1
Total	21.9	17.1	2.9	41.9

Summary

Spin-off businesses generated \$355.4 million in annual spending that is attributable to the University. This spending supports the following total economic impact:

- \$466.1 million in output
- \$277.6 million in GDP
- 1,981 jobs
- \$122.5 million in labour income
- \$41.9 million in total taxes going to all levels of government

12. Summary of economic impact

Sections 7 through 11 assess the economic impact of different types of spending associated with the University: operating and research spending, capital spending, spending by students, spending by visitors, and spending by spin-off businesses. In total, \$1.6 billion in spending is directly attributable to the University through these channels.

The total economic impact of this spending including direct, indirect, and induced impact is \$2.4 billion in output, \$1.4 billion in GDP, 15,828 jobs, \$921.6 million in labour income. Every dollar spent by the University generates \$1.5 in economic output. Table 20 shows the total economic impact of all of the University's activities.

Table 20: Total economic footprint

	Direct	Indirect	Induced	Total	Multiplier
Output (million \$)	1,645.4	291.6	474.5	2,411.5	1.5
GDP (million \$)	888.5	224.0	288.9	1,401.4	1.6
Labour income (million \$)	655.0	135.4	131.3	921.6	1.4
Employment (FTE)	11,028.2	2,396.4	2,402.9	15,827.6	1.4

The total tax impacts from all the University's activities were \$400.3 million, including \$190.5 million to federal governments, \$173.1 million to the provincial government, and \$36.7 million to municipal governments.

Table 21: Total tax footprint

Tax (million \$)	Federal	Manitoba	Municipal	Total
Taxes on production and products	28.9	64.2	36.7	129.9
Corporate income tax	17.4	10.9		28.4
Personal income tax	144.1	97.9		242.0
Total	190.5	173.1	36.7	400.3

13. *Benchmark with peers*

This report has assessed the overall importance of the University for Manitoba's economy. However, to contextualize this impact, it is useful to benchmark the University of Manitoba with other post-secondary institutions in Canada. This section compares key metrics of the University of Manitoba with two comparable peers, and the U15 group.³³ In consultation with the University of Manitoba, we selected two peer Canadian universities that share characteristics with the University of Manitoba: University of Saskatchewan and Queen's University.

In this section, we use the following key metrics to compare the University of Manitoba with other universities:

- **University demographics:** number and proportion of international and Indigenous students
- **Income sources:** breakdown of funding from federal and provincial governments, tuition, and donations
- **Research expenditure** and its share in university total expenditure
- **Economic impact** of operating and capital expenditures (including direct, indirect, and induced impacts)

We conducted the comparison between the universities for 2017/18 or the most recent year with available data.

University demographics

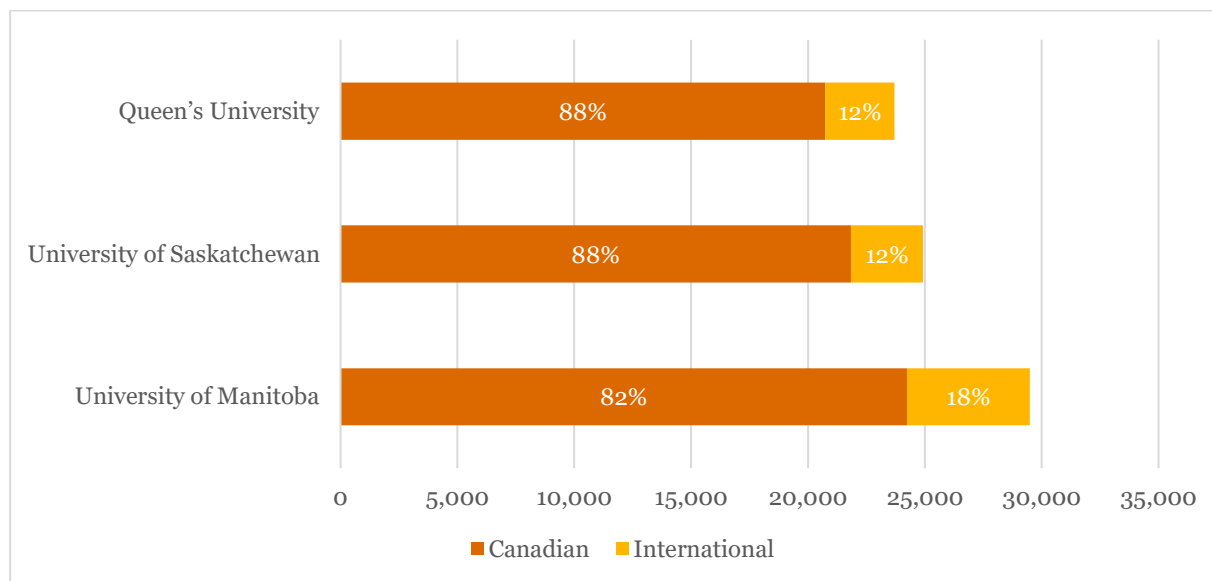
Universities play an important role in attracting international talent to their regions. International students benefit local economies by consuming locally produced goods and services and attracting domestic and international visitors. Since all or most of their consumption creates new economic value to the university's region, international students have a relatively high net economic impact. Moreover, many international students choose to stay and work in the region where they attend school after graduation, thereby providing long-term benefit to the local economy by stimulating consumption and building human capital.

³³ U15 is a group of 15 of Canada's research-intensive universities. The members of this group are: University of Alberta, University of British Columbia, University of Calgary, Dalhousie University, Université Laval, University of Manitoba, McGill University, McMaster University, Université de Montréal, uOttawa, Queen's University, University of Saskatchewan, University of Toronto, University of Waterloo, and Western University.

Figure 14 shows the number and percentage share of Canadian and international students at the University of Manitoba and peer institutions. In 2016/17, the average share of international students at Canadian universities was 13.6%.³⁴ Among the comparison group, the University of Manitoba had the highest student enrolment and the largest share of international students (17.9%), which is also above the national average.

³⁴ Statistics Canada, Table 37-10-0018-01 (excluding non-reported status)

Figure 14: Canadian and International Students, Fall 2017³⁵



Post-secondary education institutions have historically underserved Indigenous people. According to the 2016 Census, 10.9% of Indigenous people aged 25 to 64 had a Bachelor’s degree or higher, compared to 28.5% of all Canadians. In recent years, Canadian universities have taken steps toward greater inclusion of Indigenous students, focusing on reversing past trends and removing obstacles to university education. Of the University of Manitoba and its peers, The University of Saskatchewan has the largest Indigenous student community, with 3,119 Indigenous students or 14.3% of Canadian student population. The University of Manitoba had the second largest number, 2,455 Indigenous students or 10.1% of Canadian student population.

Table 22: Comparison of Indigenous Students, 2017/18³⁶

	Indigenous Students	All Canadian students	% of Indigenous Students
Queen’s University	371	20,750	1.8%
University of Saskatchewan	3,119	21,840	14.3%
University of Manitoba	2,455	24,230	10.1%

Income sources

Universities depend on a combination of funding from governments, tuition, grants, donations, and other sources. In this section we analyse the income composition of universities, including government and non-government sources, as defined below.

- **Government sources** include federal, provincial, and other government agencies

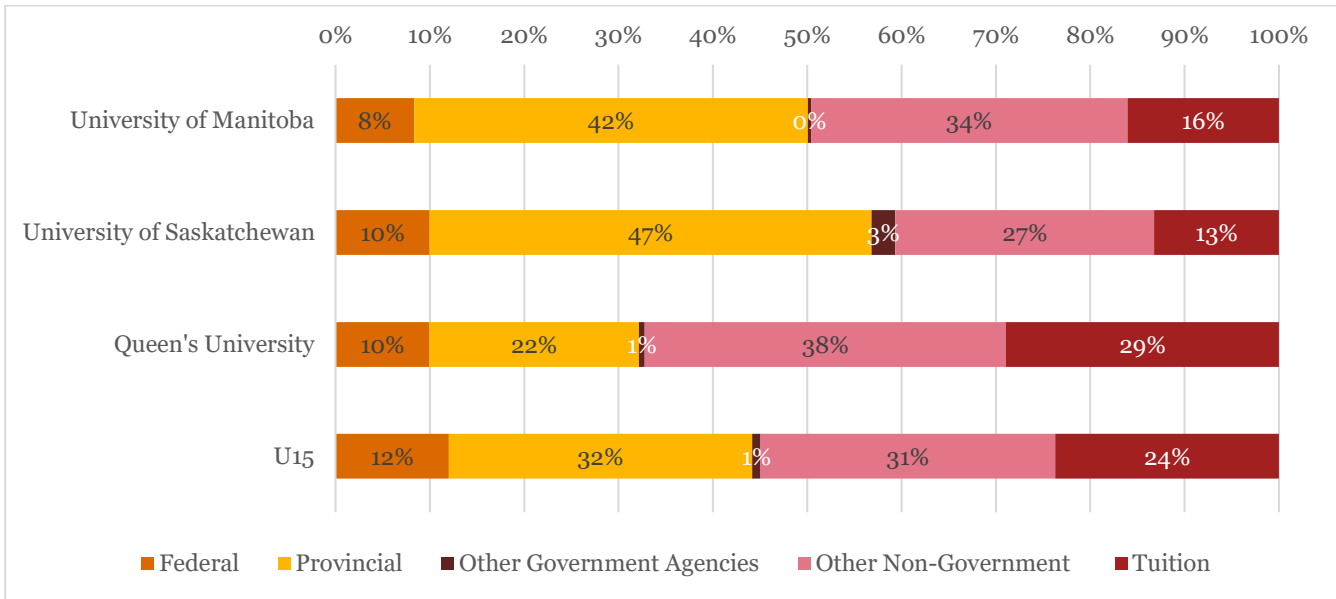
Non-government sources include tuition, donation, non-government grants and contracts, and other sources

³⁵ University of Manitoba, Queens University 2017/18 Enrolment Report, University of Saskatchewan 2017 Academic Year Snapshot

³⁶ Ibid

Figure 15 shows income sources for the three universities and the average of U15 universities. For U15 universities, an average of 45.0% of funding came from governments. Of our three comparison universities, the University of Saskatchewan is the most reliant on government funding, with 59.3% of its funding coming from government sources. The University of Manitoba is more heavily reliant on government funding than its peers and the U15 average, with 50.4% of its funding coming from government sources. Of the comparison group, Queen’s University is the least reliant on government funding, with a higher share of funding coming from tuition.

Figure 15: Income sources as a share of total funding, 2016/17³⁷



³⁷ CAUBO (2018).

Table 23 lists the percentage share of each income by source for the three universities and U15.

Table 23: Comparison of income sources (% of total funding), 2016/17³⁸

	University of Manitoba	University of Saskatchewan	Queen's University	U15 (average)
Government	50.4%	59.3%	32.8%	45.0%
Federal	8.3%	10.0%	9.9%	12.0%
Provincial	41.7%	46.9%	22.2%	32.2%
Other governments and agencies	0.3%	2.5%	0.6%	0.9%
Non-Government	49.6%	40.7%	67.2%	55.0%
Tuition	16.1%	13.2%	28.9%	23.7%
Donations	4.3%	3.0%	6.7%	4.1%
Grants and contracts	8.8%	4.0%	7.4%	8.3%
Investment	11.6%	8.4%	14.0%	9.0%
Miscellaneous	8.8%	12.0%	10.1%	9.9%
Total	1,018,662	1,063,194	1,107,759	365,977

Research expenditure

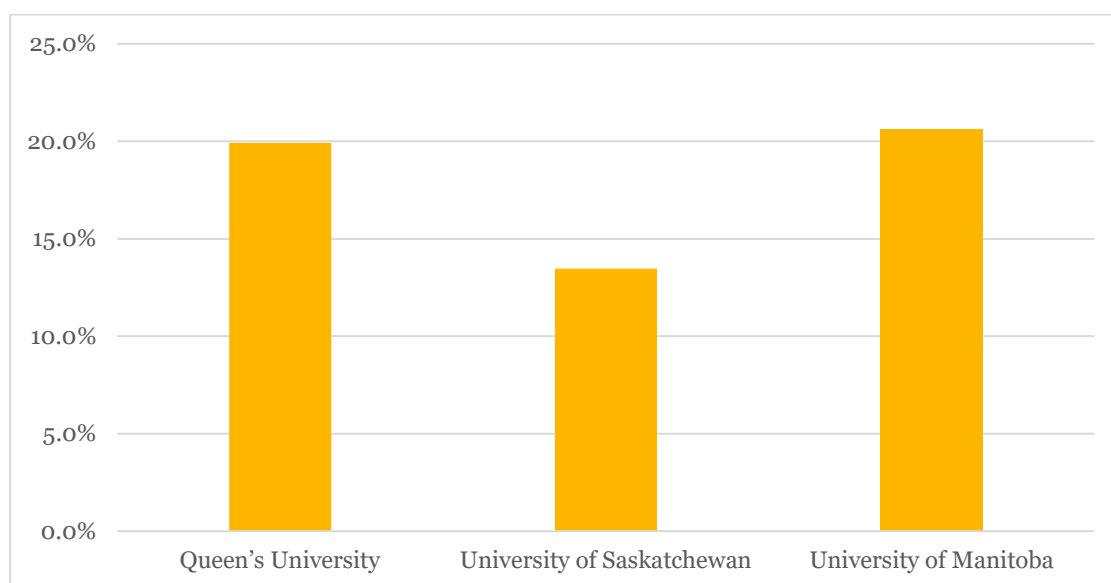
As described elsewhere in this report, research spending by universities benefits economies through increasing productivity, spurring development of new companies, and providing health and social benefits. It also provides learning opportunities for students, enhancing their university experience.

On average, research spending accounted for 19.7% of all expenditures by Canadian universities and 25.9% of U15 Universities.³⁹ As shown in Figure 16, compared to the other two universities in our sample group, the University of Manitoba had the second-highest absolute research expenditure, and the highest research share of total spending, at 20.6%.

Table 24 shows research expenditure and research share of total spending.

³⁸ CAUBO (2018).

³⁹ Ibid. We used total sponsored research to measure research spending. The unsponsored research expenditure (e.g., salary to faculties) is inseparable from instruction and teaching and hence not included in the calculation of research expenditure

Figure 16: Research spending as a share of total expenditure, 2016/17*Table 24: Research expenditure in 2016/17⁴⁰*

	Research Expenditures (Million \$)	Share of research Expenditures in total expenditure
Queen's University	174.3	19.9%
University of Saskatchewan	133.9	13.5%
University of Manitoba	172.9	20.6%
U15 (total)	5,502.2	25.9%
Canadian University Average	65.9	19.7%

Economic impact of operation

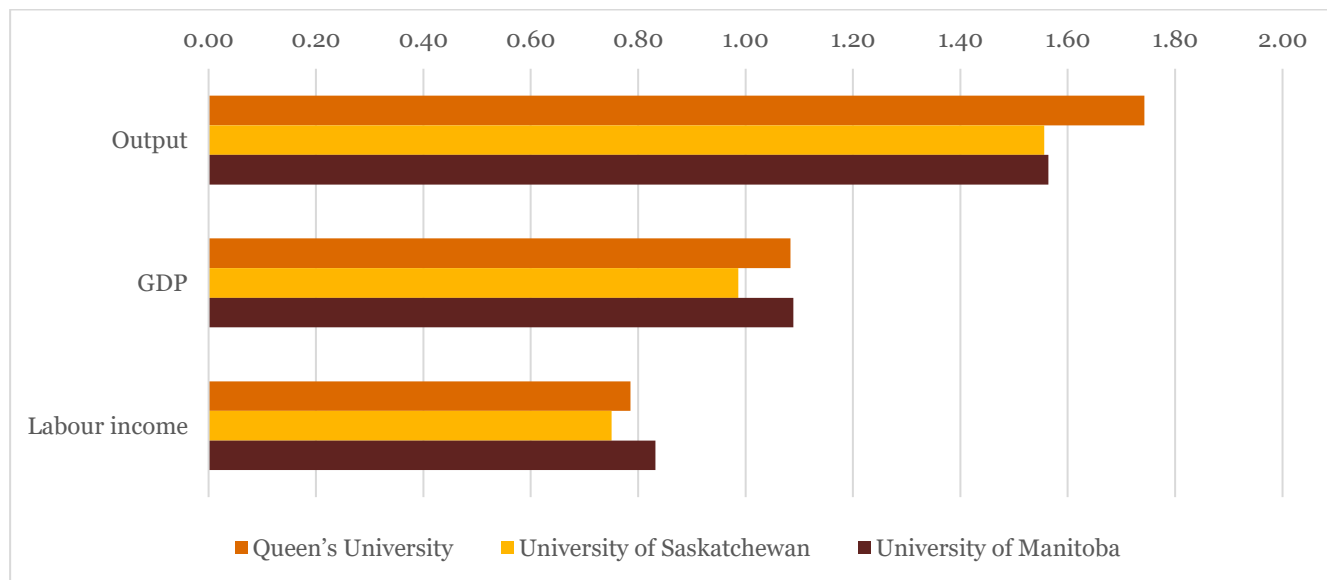
As noted previously in this report, a key way that universities support local economies is through capital and operating expenditure. This section compares the economic impact of the three peer universities.

To identify the economic footprint of the two peer comparison institutions, we collected spending data from Canadian Association of University Business Officers (CAUBO). We then compared the total economic impact (direct, indirect, and induced) at the provincial level with total expenditure. This comparison gives the total economic impact per dollar spent by the university, which varies based on the economic structure in the province where the university is located. For example, provinces with larger population and more diversified economy maintain most of the activities within the province, and hence, all other things being equal, the indicator (at the provincial level) will be larger for universities located in such provinces. Our detailed methodology and estimated economic impact are provided in Appendix D.6. Benchmarking against peers: economic impact of operation The University of Manitoba generates \$1.6 in provincial output per dollar spent, similar to \$1.6 by the University of

⁴⁰ CAUBO (2018).

Saskatchewan and \$1.7 by Queen’s University. Impacts on additional economic indicators are show in Figure 17 and Table 25.

Figure 17: Total economic footprint per dollar expenditure⁴¹



The University of Manitoba also generated and facilitated the highest tax contribution to federal and provincial governments at \$0.18 to federal government and \$0.16 to provincial government per dollar expenditure.

Table 25: Total impact on output, GDP, labour income, employment, and tax per dollar expenditure⁴²

	Queen's University	University of Saskatchewan	University of Manitoba
Output	1.7	1.6	1.6
GDP	1.1	1.0	1.1
Labour income	0.8	0.8	0.8
Employment (FTE per million \$)	10	8	11
Tax-Federal	0.2	0.2	0.2
Tax-Provincial	0.1	0.1	0.2

⁴¹ PwC analysis based on spending.

⁴² Ibid.

14. Conclusion

The University of Manitoba plays a key role in the economic and community well-being of the Province. This report has assessed these impacts both qualitatively and quantitatively.

We assessed that the economic impact attributable to spending generated by the University is \$2.4 billion. This consists of:

- Operating and research expenditures by the University
- Capital spending by the University over five years from 2014/15 to 2018/19
- Spending by visitors and students
- Spending by spin-off companies

In addition to generating spending, the University contributes to economic growth through meeting Manitoba's labour market needs and conducting productivity-enhancing research. Key components of meeting labour market needs are attracting and retaining international students, supporting under-represented groups in their post-secondary education, and partnerships with industry that benefit both companies and students. Research conducted at the University has contributed to enhanced productivity in Manitoba and globally, including internationally significant breakthroughs such as canola breeding and revolutionary HIV research.

The University is also an important community resource for Manitobans, and Indigenous communities in particular. The University provides community resources such as health services, and is home to the National Truth and Reconciliation Centre (NCTR), which houses the largest collection of curated material on the Residential School system in Canada. The NCTR place an active role in the process of reconciliation, providing a safe, respectful and trustworthy space for survivors and their families to gain access to records and collect information about their history.

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Appendix B: Limitations

Data limitations: PwC has relied upon the completeness, accuracy and fair presentation of all the information, data, advice, opinions or representations obtained from various sources, which we did not audit or otherwise verify. These sources (collectively, the “Information”), include:

- Data provided by the University of Manitoba;
- The University of Manitoba website;
- Interviews with spin-off companies;
- Popular media publications and academic literature;
- Statistics Canada;
- Other various public sources; and
- Prior post-secondary institution economic impact studies.

The findings in this report are conditional upon such completeness, accuracy, and fair presentation, which have not been verified independently by PwC. Accordingly, we provide no opinion, attestation or other form of assurance with respect to the results of this study. Where the information or data provided is not sufficient to conduct the analysis that has been requested, we have made assumptions, as noted throughout the report.

Receipt of new data or facts: PwC reserves the right at its discretion to withdraw or revise this report should we receive additional data or be made aware of facts existing at the date of the report that were not known to us when we prepared this report. The findings are as of May 2019 and PwC is under no obligation to advise any person of any change or matter brought to its attention after such date, which would affect our findings.

Input-output analysis: Input-output analysis (a model used to estimate output, Gross Domestic Product (“GDP”) and employment impact) does not address whether the inputs have been used in the most productive manner or whether the use of these inputs in this industry promotes economic growth by more than their use in another industry or economic activity. Nor does input-output analysis evaluate whether these inputs might be employed elsewhere in the economy if they were not employed in this industry at the time of the analysis. Input-output analysis calculates the direct, indirect and induced economic impacts that can reasonably be expected to affect the economy based on historical relationships within the economy. This analysis does not take into account fundamental shifts in the relationships within the economy that may have taken place since the last estimation of multipliers by Statistics Canada, nor shifts that may take place in the future.

Use limitations: This report has been prepared solely for the use and benefit of, and pursuant to a client relationship exclusively with the University of Manitoba. We understand that The University of Manitoba may share our report with third parties. The University of Manitoba can release this report to third parties only in its entirety and any commentary or interpretation in relation to this report that The University of Manitoba intends to release to the public either requires PwC’s written consent or has to be clearly identified as the University of Manitoba’s own interpretation of the report. PwC accepts no duty of care, obligation or liability, if any, suffered by The University of Manitoba or any third party as a result of an interpretation made by The University of Manitoba of this report.

Further, no other person or entity shall place any reliance upon the accuracy or completeness of the statements made herein. In no event shall PwC have any liability for damages, costs or losses suffered by reason of any reliance upon the contents of this report by any person other than The University of Manitoba.

This report and related analysis must be considered as a whole: Selecting only portions of the analysis or the factors considered by us, without considering all factors and analysis together, could create a misleading view of our findings. The preparation of our analysis is a complex process and is not necessarily susceptible to partial

analysis or summary description. Any attempt to do so could lead to undue emphasis on any particular factor or analysis.

We note that significant deviations from the above listed major assumptions may result in a significant change to our analysis.

Appendix C: Research institutes at the University of Manitoba

- Aerospace Materials Engineering Facility
- Applied Electromagnetics Facility
- Canadian Centre for Agri-food Research in Health and Medicine (with St. Boniface General Hospital and Agriculture and Agri-food Canada)
- Canadian Wheat Board Centre for Grain Storage Research
- Centre for Aboriginal Health Research (with Health Sciences Centre)
- Centre for Architectural Structures and Technology (C.A.S.T.)
- Centre for Defence and Security Studies
- Centre for Earth Observation Science (CEOS)
- Centre for Global Public Health
- Centre for Globalization and Cultural Studies
- Centre for Higher Education Research and Development (CHERD)
- Centre for Human Models of Disease
- Centre for Human Rights Research
- Centre for Professional and Applied Ethics
- Centre for the Research and Treatment of Atherosclerosis
- Centre on Aging
- Crystallography and Mineralogy Research Facility
- Digital Image Analysis Facility
- Great-West Life Manitoba Breast Cancer Research and Diagnosis Centre (with CancerCare Manitoba)
- Health, Leisure and Human Performance Research Institute
- Institute of Cardiovascular Sciences (with St. Boniface General Hospital)
- Institute for the Humanities
- Legal Research Institute
- Manitoba Centre for Health Policy
- Manitoba Centre for Nursing and Health Research (MCNHR)
- Manitoba Centre for Proteomics and Systems Biology (with Health Sciences Centre)
- Manitoba Institute for Materials
- Manitoba Institute of Cell Biology (with CancerCare Manitoba) [now called the Research Institute in Oncology and Hematology]
- Manitoba Regional Materials and Surface Characterization Facility
- Manitoba Research Data Centre
- National Centre for Livestock and the Environment
- National Centre for Truth and Reconciliation
- Nuclear Magnetic Resonance (NMR) Facility
- RESOLVE (Prairie Research Network on Family Violence)
- Richardson Centre for Functional Foods and Nutraceuticals (RCFFN)
- Spinal Cord Research Centre
- Transport Institute
- Winnipeg Institute for Theoretical Physics (with University of Winnipeg)
- W.R. McQuade Structural Engineering Laboratory

Appendix D: Methodology

D.1. Input output

The fundamental philosophy behind economic impact analysis is that spending on goods and services has attendant impacts throughout the economy. For instance, universities generate demand for goods and services (such as equipment, software, construction, renovation, staff and teaching faculty) that in turn generates additional demand that extends beyond the initial spending. Our analysis permits the estimation of this cascading effect by using the input-output model based on inter industry relationships calculated by Statistics Canada.

The input-output model used for the purpose of this report estimates the relationship between a particular economic activity for a given good or service and the resulting impacts throughout the economy (including demand for other goods and services and tax revenues).

Economic impact is estimated in terms of the following measures of economic activity:

- **Output** – the total gross value of goods and services produced, measured by the price paid to the producer.⁴³ Output double counts the value of intermediate inputs and so GDP is usually a preferable measure of economic activity.⁴⁴
- **Value added or GDP** – the value added to the economy, or the output valued at basic prices less intermediate consumption⁴⁵ valued at purchasers' prices. GDP includes only final goods to avoid double counting of products sold during a certain accounting period.
- **Employment** – the number of jobs created or supported. It is expressed as the number of full-time equivalent ("FTE") jobs indicated in person years.
- **Multipliers** – it is a ratio of total economic impact by direct economic impact. In other words, these represent the magnitude by which total economic impact is a multiple of direct economic impact.
- **Taxes on Production and Products** – the amount of tax revenues generated from taxes on products (e.g., trading profits, gas tax, sales taxes, and excise taxes) and taxes on production at the federal, provincial and municipal levels (e.g., property taxes).
- **Personal Income Tax** – the amount of provincial tax revenues generated from taxes on the income of employees and self-employed individuals.
- **Corporate Income Tax** – the amount of provincial tax revenues generated from taxes on the profits of corporations.

D.1. Tax Calculation

The following federal taxes on production and imports are included in the estimates:

- Taxes on production and products that were collected from direct, indirect and induced economic activity in all provinces;
- Corporate income tax that was collected from direct, indirect and induced economic activity in all provinces; and
- Personal income tax that was collected from total labour income in all provinces.

⁴³ Note that for imported goods and services, only the margins realised above and beyond the initial payment to the foreign supplier have an effect on the Canadian economy.

⁴⁴ For example, when a consumer purchases a car, the value of the car is added to GDP, but the measure "Output" would include the value of the car, as well as the value of items that were purchased by the car manufacturer from other suppliers such as tires, steering wheel, and engine (i.e., intermediate inputs), thus double-counting these values.

⁴⁵ Defined as the value of goods and services used or transformed as inputs by a process of production.

The following provincial taxes are included in the estimates:

- Taxes on production and products that were collected in Manitoba;
- Corporate income tax that was collected in Manitoba; and
- Personal income tax that was collected in Manitoba.

The following municipal taxes are included in the estimates:

- Taxes on production and products collected at the municipal level within Manitoba.

Taxes on production are taxes that are paid by business and non-business entities, including persons, that are not linked to any productive activity.⁴⁶ Indirect taxes on production are levied by all three levels of government. Examples of federal taxes include capital taxes levied against corporate entities, Canada Deposit Insurance Corporation premiums, and Canadian Dairy Commission levies. Provincial taxes include (personal and commercial) motor vehicle license fees, land transfer taxes, and capital taxes. Local taxes include real property taxes, developers lot levies, and deed transfer taxes. The taxes on production was calculated in the input-output model from Statistics Canada.

Taxes on products are the sum of taxes levied on goods and services beyond the producers' price valuation level. They are paid by business and non-business industries on their current purchases and by final users such as households on all their expenditures. Examples include the Goods and Services Tax (GST), the Harmonized Sales Tax (HST), provincial sales taxes, federal excise taxes, import duties, and fuel taxes. The taxes on products was calculated in the input-output model from Statistics Canada.

Corporate income tax was calculated by applying the federal and provincial corporate income tax rates to profit, which was calculated by using the share of profit and the gross operating surplus estimated in the input-output model.

Personal income tax was calculated from total compensation and the share of personal income tax in the household sector of the national accounts.⁴⁷ The total personal income tax was divided to federal and provincial governments based on the ratio of federal and provincial income tax revenue.⁴⁸

D.2. Student Expenditures

The student expenditures by category are based on a Maclean's survey, and are listed in Table 26. Estimated monthly expenditure is \$1,072 excluding tuition. This amount is within the range of estimations from the University of Manitoba. Spending estimates are based on living costs for single students with no dependants. Thus, the total out-of-town student spending is likely to be underestimated as it does not capture students who relocate with partners and/or dependants.

⁴⁶ Please find more details about the definitions from Statistics Canada
<https://www.statcan.gc.ca/eng/nea/gloss/ia>

⁴⁷ Statistics Canada. Table 36-10-0224-01 Household sector, current accounts, provincial and territorial, annual

⁴⁸ Statistics Canada. Table 10-10-0015-01 Statement of government operations and balance sheet, government finance statistics

Table 26: Average Annual Cost of Post-secondary Education⁴⁹

Item	Percentage	Amount
Rent	40%	\$7,799.50
Tuition	34%	\$6,629.58
Groceries	8%	\$1,559.90
Food	5%	\$974.94
Travelling home	4%	\$779.95
Books	4%	\$779.95
Alcohol	3%	\$584.96
Daily travel to campus/public transit	2%	\$389.98
Total	100%	\$19,498.75

Our estimate of student counts was based on the student origin and enrolment information provided by the University. Table 27 shows the monthly average number of students based on enrolment in Summer, Fall and Winter 2017/18.

Table 27: Monthly Average Number of Students by Origin and Full-time Status

	Undergraduate		Graduate	
	Full-time	Part-time	Full-time	Part-time
Winnipeg	10,453	1,276	1,555	170
Manitoba (outside Winnipeg)	3,510	392	522	52
Canada (outside Manitoba)	513	166	76	22
International	1,866	1,675	278	223
Total	16,342	3,509	2,431	466

We made the following assumptions to student spending (summarized in Table 28):

- **Tuition** was not included in the analysis of student expenditure since the impact was captured in the analysis of the University's operation.
- **Book Expenditure:** the expenditure for books were split as half from the University Bookstore and half from other sources. The purchases from the bookstore was counted in the University's operation analysis. Therefore, only 50% of the spending on books was accounted in the analysis of student spending.
- **On-campus residence:** On-campus residence is comprised only by full-time students from outside Winnipeg. On-campus residence is based on the share of full-time students by origin. Expenditure of on-campus students excluded 100% rent and 50% of food spending since these services were already counted in the analysis of the University's operational expenses.
- **Part-time students:** expenditures of part-time students that is attributable to the University were counted as half of full-time students.
- **Graduate students:** partial or full funding is provided to the majority of graduate students to cover tuition and/or living expenses. The funding comes from various sources such as scholarships, bursaries, and part-

⁴⁹ Maclean's (2018).

time employment on campus. To avoid double counting with the University's operation, we assume that half of the living expenditure came from sources other than the University, and we only included this share of living expenditures of graduate students in our analysis.

Table 28: Living expenditure assumptions of Students

Item	Expenditure	Full-time			Part-time	
		On-campus	Off-campus	Winnipeg	Off-campus	Winnipeg
Rent	\$7,799.50	0%	100%	0%	50%	0%
Tuition	\$6,629.58	0%	0%	0%	0%	0%
Groceries	\$1,559.90	50%	100%	100%	50%	50%
Food	\$974.94	50%	100%	100%	50%	50%
Travelling home	\$779.95	100%	100%	0%	50%	0%
Books	\$779.95	50%	50%	50%	25%	25%
Alcohol	\$584.96	100%	100%	100%	50%	50%
Daily travel to campus/public transit	\$389.98	0%	100%	100%	50%	50%

D.3. Out-of-town visitors

We collected the number of conference attendees, campus-event attendees and high school recruitment attendees from the University of Manitoba. Casual visitors are difficult to quantify since they do not have to register their campus presence. To estimate the number of casual visitors, we relied developed assumptions with the University and based on recent studies for other universities.⁵⁰⁵¹ Table 29 illustrates the number of casual visits attracted per person by each category. Given the total number of faculty, staff, and students in 2017/18, we calculated the total casual visitor of 144,753 people.

Table 29: Casual Visits Associated with the University of Manitoba

Type	Number of out-of-town visitors
Faculty (full- or part-time)	6
Support Staff (full- or part-time)	6
Full-time students originating from outside Canada	2
Full-time students originating from outside of Winnipeg	6
Full-time students originating from Winnipeg	2
Part-time students originating from outside Canada	1
Part-time students originating from outside of Winnipeg	3
Part-time students originating from Winnipeg	1

⁵⁰ University of Ottawa (2016); Council of Ontario Universities (2017); Western University (2015).

⁵¹ PwC (2009), Lakehead (2017), APLU (2014).

Table 30 shows the out-of-town visitors attributable to the University in each category:

Table 30: Number of Out-of-town Visitors

Category	Number of visitors
Conference Attendees	5,032
Campus-event attendees	39,441
High school recruitment attendees	2,289
Casual visitors	114,384
Total	161,146

We calculated the expenditures based using per person spending information sourced from Tourism Winnipeg and decomposed the expense by category using Travel Survey of Residents of Canada from Statistics Canada. On average, same-day visitors to Winnipeg spent \$98.6/day and over-night visitors spent \$329/day.⁵² Furthermore, we collected visitor spending by category in Manitoba from Statistics Canada and calculated the total expenditure by category.⁵³

In order to calculate the expenditures by out-of-town visitors, we made the following assumptions in consultations with the University and consistent with and recent studies for other universities⁵⁴:

- Overnight visitors were assumed to stay for two nights in Winnipeg on average;
- Conference attendees usually have accommodation and some meals arranged on campus. We used same-day visit to approximate their spending in Winnipeg. This assumption excluded accommodation expenses and some food expenses for conference attendees and avoid double counting of the economic impact from the University's operations;
- University faculty, support staff, and/or students were assumed to host 50% of casual visitors in their homes. Casual visitors hosted at home were assumed to have a spending structure similar to same-day visitors; and
- Each group of visitors is assumed to be exclusive and hence there is no double counting of visitors between the different visitor categories.

Table 31 illustrates the spending composition for home-hosted and regular overnight visitors based on the spending data of same-day and overnight visits. The total expenditure of all visitors was \$77.4 million.

⁵² Tourism Winnipeg (2017)

⁵³ Statistics Canada: Table 24-10-0024-01 Type of expenditures made by Canadian residents.

⁵⁴ University of Ottawa (2016); Council of Ontario Universities (2017); Western University (2015).

Table 31: Type of Expenditures by Host Type

Category	Home-hosted Visits and Conference attendees	Regular Overnight Visits
Accommodation	0%	20.56%
Vehicle rental	0.15%	1.70%
Vehicle operation (including gas and repairs)	34.18%	18.54%
Local transportation	0.35%	0.89%
Transportation fares (plane, bus, etc.)	2.22%	19.15%
Food and beverage, in restaurants and bars	22.29%	17.14%
Food and beverage, in stores during trip	11.44%	9.77%
Recreation	5.42%	1.84%
Entertainment	3.49%	2.48%
Clothing	12.79%	6.06%
Other expenditures	7.66%	1.87%
Total	100%	100%

D.4. Spin-off businesses

The University identified fourteen spin-offs, and we conducted phone and online interviews with nine of these spin-off companies in October 2018. All the spin-offs identified were credible enterprises demonstrating growth potential within the Province. During the interview, respondents were asked the following questions:

- What types of products/services do you provide?
- What type of relationship do you have with the university? How does it evolve over time?
- Which of the following statements most accurately reflects the degree to which the company is influenced by or depends on the University of Manitoba? (Spin-off attribution weighting in brackets)
 - a) This Company would not exist but-for the University of Manitoba (80-100%)
 - b) This Company is primarily a result of the University of Manitoba (60-79%)
 - c) This Company has a significant degree relied on the University of Manitoba (40-59%)
 - d) This Company has, at least in part, developed as a result of the University of Manitoba (20-39%)
 - e) Other weights. Please specify the weight and reasons.
- Do you have any branches outside Winnipeg/Manitoba?
- How many employees do you have (current and/or in 2017)?
- What was your revenue in the most recent fiscal year?
- What was your capital expenditure in the most recent fiscal year?

We synthesized the information and generated indicators such as employment, share of the University of Manitoba graduates. Using the information provided by respondents, the degree to which the spin-off's existence was influenced by the University of Manitoba can be attributed. We estimated the attribution share using the midpoint of the relationship range. Table 32 lists the University attribution in the spin-off companies. Based on the information collected through the interviews, we assessed the economic impact from these spin-off companies and quantified the impact attributable to the University.

Table 32: Spin-offs' Relationship with the University of Manitoba

Relationship with the University of Manitoba	Number of Respondents
"But for" (80-100%)	2
"Primary" (60-79%)	1
"Relied" (40-59%)	1
"In part"(20-40%)	3
Other	2

D.5. Research impacts on productivity

This appendix reviews our methodology in explaining the increase in Manitoba's GDP generated by productivity-increasing research at the University. We estimate that research at the University has added \$2.7 billion to GDP since 1971 through this channel.

It is first useful to define productivity. Growth occurs either through of increases in inputs (i.e. labour and capital) or because of increases in productivity. Increases in productivity lead to a more efficient use of inputs, leading to higher output per unit of input.

Our calculations are illustrated below and in Table 33. To calculate the share of GDP growth attributable to the University of Manitoba, we note the following:

- Since 1971, Manitoba GDP has grown by \$46.5 billion
- 20% of all GDP growth is attributable to increases in productivity, i.e. \$9.3 billion since 1971 ($\$9.3 = \$46.5 \times 20\%$)
- 69% of productivity-enhancing research occurred in the province in which it is applied, which leads to \$6.4 billion ($\$6.4 = \$9.3 \times 69\%$)
- 45% of productivity-enhancing research in Manitoba was conducted at universities, leading to \$2.9 billion ($\$2.9 = \$6.4 \times 45\%$)
- 94% of University-based research done in Manitoba was conducted at the University of Manitoba, leading to \$2.7 billion ($\$2.7 = \$2.9 \times 94\%$)

Based on this approach, research at the University of Manitoba has had a cumulative impact of \$2.7 billion in Manitoba GDP since 1971.

Table 33: Economic Impact of University of Manitoba, 1971-2017

	GDP (\$ Billion)
GDP growth in Manitoba since 1971 ⁵⁵	46.5
Growth attributable to increase in productivity (20%) ⁵⁶	9.3
Exclusion of international and other provincial R&D effects (100%-31%) ⁵⁷	6.4
Share of R&D in Manitoba by universities (45%) ⁵⁸	2.9
Share of Manitoba university R&D by University of Manitoba (94%) ⁵⁹	2.7

D.6. Benchmarking against peers: economic impact of operation

To analyse the economic impact of university operations, we collected financial data from CAUBO for Queen’s University and University of Saskatchewan and used input-output model to calculate the economic impact. University expenditures vary substantially across Canadian universities depending on their location, size, and research level. Although these three universities are all U15 research universities, comparison of total expenditure and total economic impact cannot provide directly the marginal effect of expenditure changes. Therefore, where possible we express these comparisons on a per-student or per-dollar basis. We note that our methodology has the following limitations:

- **Provincial economy:** The total impact indicators are also influenced by the **economic structure in the province where the university locates**. For example, provinces with larger populations and more diversified economy maintain most of the activities within the province, and hence, all other things being equal, the indicator (at the provincial level) will be larger for universities located in such provinces.
- **Fiscal year differences:** the multipliers for University of Manitoba were derived from financial information in fiscal year 2017/18. Since the most recent CAUBO report in 2018 discloses financial information in 2016/17 fiscal year, data for Queen’s University and University of Saskatchewan are from 2016/17.
- **Out-of-province share of expenditures:** although the University of Manitoba provided estimation of out-of-province share of expenditure, similar information is not available for the Queen’s University and the University of Saskatchewan. Therefore, our assumption in this section is that the direct operating expenditure all occurred within the province where the university is located. The provincial-level impact may be overestimated in this case, but the comparison on a relative basis is not.

D.6.1. Queen’s University

The total expenditure was \$875 million in 2016/17. Table 34 provides the detailed impact on output, GDP, labour income and employment. Total taxes to different level of governments are reported in Table 35.

⁵⁵ Statistics Canada Table 36-10-0325-01, Table 36-10-0222-01, and Table 18-10-0005-01.

⁵⁶ OECD (1996).

⁵⁷ Martin (1998).

⁵⁸ Statistics Canada. Table 27-10-0273-01 Gross domestic expenditures on research and development, by science type and by funder and performer sector (x 1,000,000)

⁵⁹ CAUBO (2018); CAUBO(2017).

Table 34: Economic footprint of total spending, 2016/17

	Direct	Indirect	Induced	Total	Multiplier
Output (million \$)	873.99	272.18	377.15	1,523.31	1.74
GDP (million \$)	576.93	148.45	221.75	947.13	1.64
Labour income (million \$)	486.26	97.08	103.60	686.95	1.41
Employment (FTE)	5,522	1,478	1,682	8,683	1.57

Table 35: Tax footprint of total spending, 2016/17

Tax (million \$)	Federal	Ontario	Municipal
Taxes on production and products	20.13	40.50	31.37
Corporate income tax	9.50	6.30	-
Personal income tax	113.35	45.82	-
Total	142.97	92.62	31.37

D.6.2. University of Saskatchewan

The total expenditure was \$994 million in 2016/17. Table 36 provides the detailed impact on output, GDP, labour income and employment. Total taxes to different level of governments are reported in Table 37.

Table 36: Tax footprint of total spending, 2016/17

	Direct	Indirect	Induced	Total	Multiplier
Output (million \$)	985.61	222.20	325.87	1,533.68	1.56
GDP (million \$)	641.18	122.93	208.46	972.58	1.52
Labour income (million \$)	581.75	76.00	81.92	739.66	1.27
Employment (FTE)	5,460	1,160	1,376	7,996	1.46

Table 37: Tax footprint of total spending, 2016/17

Tax (million \$)	Federal	Saskatchewan	Municipal
Taxes on production and products	25.24	39.06	12.32
Corporate income tax	11.33	6.32	-
Personal income tax	122.88	65.38	-
Total	159.45	110.76	12.32

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