



Submission to the Advisory Panel for the review of Federal Support for Fundamental Science

The Alliance of Comprehensive Canadian Research Universities (ACCRU) welcomes the opportunity to participate in defining the future of our country's research agenda. Established in 2011, the Alliance of Canadian Comprehensive Research Universities (ACCRU) brings together small- and medium-sized comprehensive universities from across Canada. Acting as a collaborative whole, ACCRU aims to identify best practices, encourage collaborative research and act as a voice for communications on research and scholarly activity issues important to its members with research funding agencies, policy makers, and the public at large. We acknowledge the importance of the Committee's role in setting the high level principles and strategies that will guide our fundamental research agenda for the next generation.

Considerations:

1. **Canada benefits from a highly effective research and innovation support system.** This system relies on three pillars: the granting councils (SSHRC, NSERC and CIHR) to support graduate and postdoctoral students as well as researchers in their endeavors; the Canada Foundation for Innovation (CFI) for the funding of research infrastructure; and the Research Support Fund to take into account the indirect costs of research that all institutions, small, medium and large, have to support.
2. **The capacity to adequately support the development of research and to foster innovations determines a country's position on the global stage and powers the development of all communities, be they metropolitan or regional.** Canada benefits from research arising from all its postsecondary institutions, a large ecosystem composed of small, primarily undergraduate institutions, specialized schools, mid-sized and large comprehensive institutions. Each of these institutions is an intrinsic part of its community and takes an active participation in today's global world. It is critical for Canada's future to maintain a strong fundamental research agenda in

order to preserve its ability to meet the ongoing needs of all communities and their cultural, economic and social development.

3. **Canada currently competes with jurisdictions of comparable geographic size with far more universities.** For Canada to remain competitive in all aspects of human endeavour, it is in the national interest to support research excellence in all of its universities rather than centralizing research and research funding to a few self-identified research-intensive universities.
4. **Learning and mastering research abilities and skills are required in every master and doctoral program offered throughout Canada.** It is also a growing learning strategy used in many undergraduate programs. Fundamental research investments play a crucial role in maintaining that strength and ensuring that all universities can offer a vibrant learning and research environment to their students – from undergraduate level up until doctoral and postdoctoral studies – and being able to fully contribute to the scientific enterprise as well to the social, cultural and economic enhancement of their community. All Canadian universities are on a journey of increasing their research intensity as research is an experiential learning strategy fully integrated within core business of university education.
5. **There are many examples throughout Canada of the challenges in obtaining grants for research that is perceived to be at the edge of a granting council’s mandate.** Research projects that are at the intersection of disciplines and sectors should have a place in the country’s research agenda. Indeed, promoting interdisciplinary and inter-sectorial research could propel Canada’s research endeavor at the forefront of many of the challenges the world is facing today. It should also be noted that many of today’s challenges, whether in health, science or applied science have a cultural, human and social dimension inherent to them, would benefit from being acknowledged and explored. We acknowledge that CIHR and NSERC councils, due to the size of their funding envelopes, have shown the ability to co-fund a certain level of inter-sectorial research. SSHRC, on the other hand, has not had the same flexibility.
6. **Over the past ten years, two tendencies have emerged in the funding of research in Canada: an erosion of success rates in all granting agencies coupled by a tendency to concentrate research investments in the hands of fewer researchers and institutions.** In 2015, in each granting councils, more than 50% of all research

resources available are allocated to less than 10% of funded researchers¹. There is evidence that we should never try to define or create an “elite class of researchers” or institutions as definitions of “elite” seem to vary greatly depending on the indicator used². Success rates in several Tri-Agency programs are at an historic low and that leaves many excellent research projects unsupported or unfunded. Moreover, the changes seen in the past decade have created significant challenges for high caliber researchers in small to medium size universities and many consider abandoning or have already abandoned efforts to apply to federal funding agencies. This trend has a negative impact on the vitality of the research portfolio in Canada as well as on the research careers of a large proportion of university professors – at every stage of their career – who are expected, rightfully, to remain active in research.

7. **Success in obtaining grant tends to be overly influenced by the perceived institutional research environment instead of the originality and quality of the research project and the researcher’s individual research achievements.** Research environments can refer to the number of experts in a single field at a given university, the institutional reputation for research in a given area, access to all the research infrastructures in a given area but these may not necessarily be linked to the project, etc. By putting too much emphasis on aspects not directly related to the researcher’s performance in research or the quality and originality of her/his research project, excellent research by excellent researchers is not getting funded in Canada, to the detriment of moving fundamental science forward in the country. Furthermore, as many younger researchers start their career in smaller institutions, this tendency bears the risk of weakening the overall research system in the country. Moreover, efforts are needed to remove bias from grant evaluation committees, which disadvantage smaller institutions. For example, a bias has been demonstrated against success rates of smaller institutions in the NSERC Discovery Grant program and that this bias is caused by inappropriate evaluation of criteria related to “merit of the proposal” since it is the most subjective and least accountable portion of the grants being evaluated. To eliminate bias in this case, bibliometric should be retained for “excellence of the researcher” and “training of

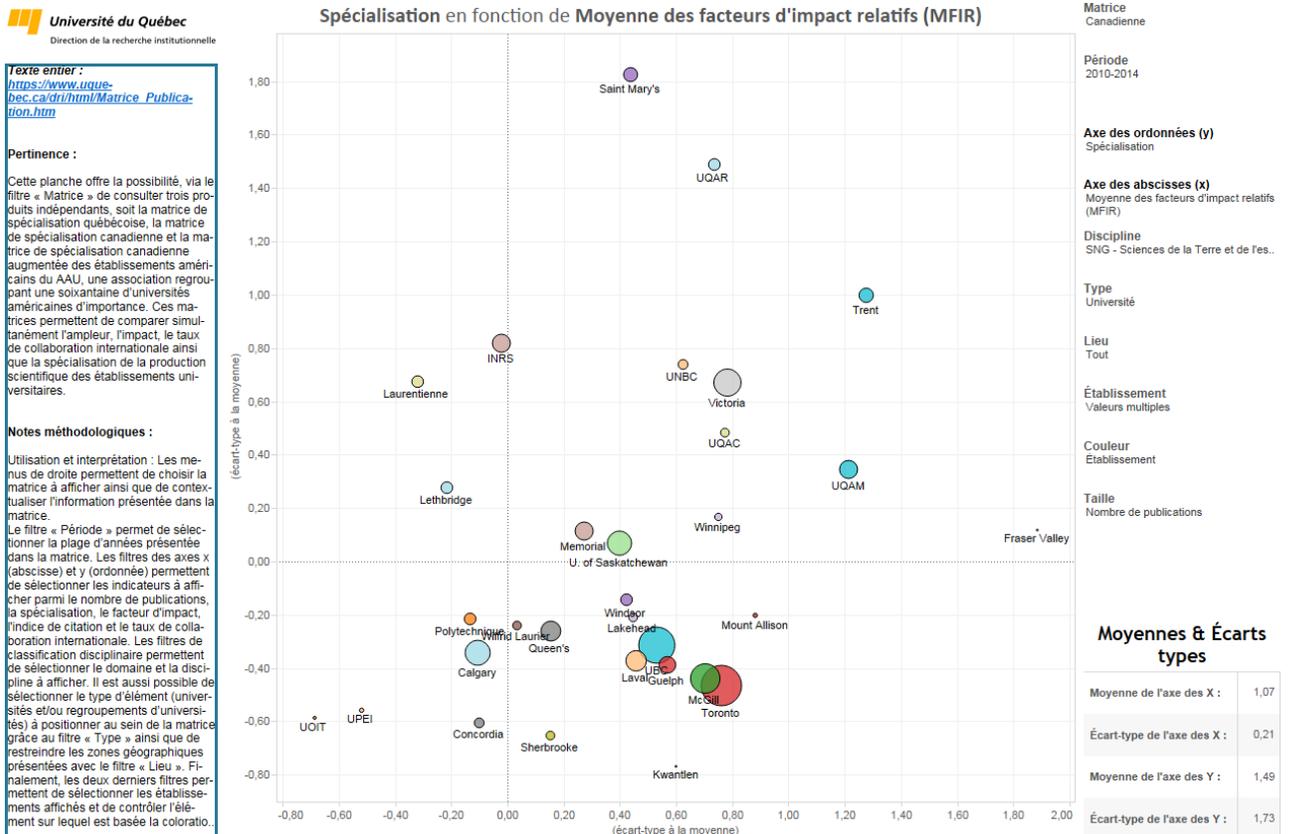
¹ Larivière V. Macaluso B., Archambault E, Gingras Y. (2015), Observatoire des sciences et des Technologies. Which Scientific Elite? On the Concentration of Funding, Productivity and Citations. http://www.science-metrix.com/pdf/ISSI_Paper_Concentration.pdf

² ibid. http://www.science-metrix.com/pdf/ISSI_Paper_Concentration.pdf

highly qualified personnel”. However, the research proposal itself should be presented in a blind manner to reviewers/panelists.

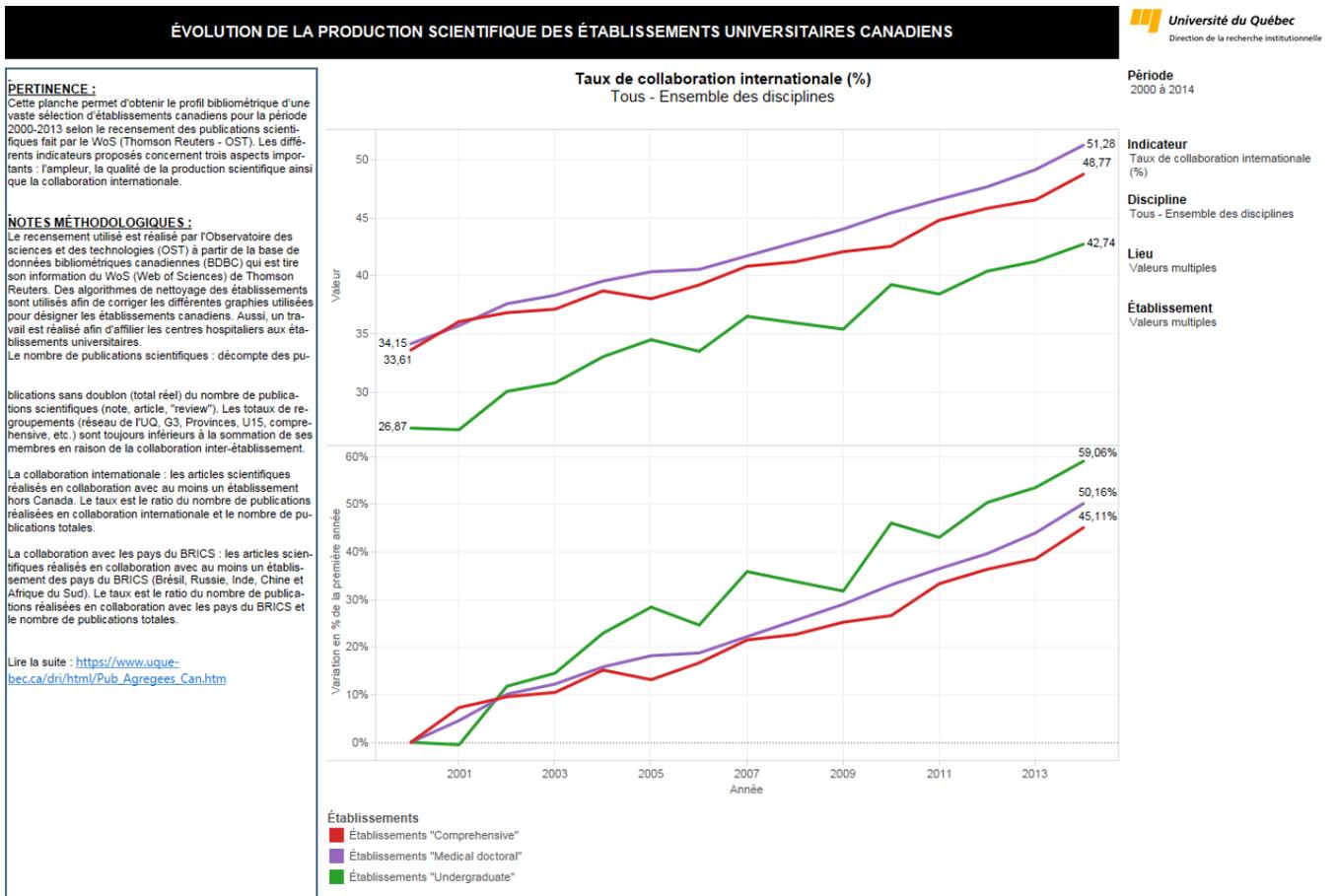
8. **Researchers from all universities do contribute to Canada’s scientific endeavor and to its excellence.** We are familiar with the use of total research funds to assess the perceived quality or “research-intensity” of universities. Due to the amount of funding awarded in health fields in comparison to their overall faculty and student sizes, this tends to overshadow accomplishments of other fields. Comparing the scientific outputs of publications – one of the main output of funded research – by scientific discipline provide a good alternative to measure impact. Figure no 1 shows, for the discipline shown – Earth and Atmospheric Sciences – the index of specialization of each university relative to the output of scientific production in terms of the citation index (average relative impact factor – ARIF) of all the publications done in the past 5 years in a large sample of Canadian universitiesⁱ. It shows that researchers in all type of institutions contribute to Canada’s competitiveness and reputation in science at the international level. We find similar patterns of distribution in all domains making really evident that great scientific impact comes from researchers from universities of all type and of all sizes.

Figure 1. Number of publication, Specialization index and scientific impact – Earth and Atmospheric Sciences



9. Another measure of quality in research is the intensity of international collaborations undertaken by researchers. Figure 2 shows the proportion of articles Canadian academics published with an international partner. In 2014 researchers from all types and sizes of universities have high level of international collaboration: 51 % of all papers published in medical universities were in collaboration with an international partner, this proportion is 49% in comprehensive universities and 43% in mainly undergraduate universities. Indeed, researchers from small, medium and large institutions across the country are actively engaged in international collaborations and contribute highly to our overall international performance in science.

Figure 2: Rate of international collaboration by type of universities



10. **There is growing scientific evidence that scientific impact does not increase as an accelerating function of grant size^{3 4}.** “Impact was generally a decelerating function of funding. Impact per dollar was therefore lower for large grant-holders. This clearly shows the inconsistency of the hypothesis that larger grants lead to larger discoveries⁵”. Sustaining an overall orientation of the fundamental research portfolio towards a small number of highly funds projects allocated to a limited number of researchers and institutions risks lessened scientific impacts and diminished research results at local, national and international levels. Indeed, national funding strategies that support a large and diversified system are more productive.
11. **Developing and maintaining research infrastructures is a prerequisite for every institution to attract and retain top faculty and researchers, offer students the appropriate learning and research environment they need and to make relevant research.** Maintaining an appropriate balance between funds available to acquire new infrastructure and operating funds to cover the ongoing utilization are crucial to the health of Canada’s research ecosystem. Currently, universities struggle to cover for the growing cost of medium-sized to large infrastructures. In addition, it is difficult to get funding for the acquisition of up-to-date but standard equipment in many fields and programs, which cover these costs should find sufficient place in the fundamental research portfolio.
12. **Research Support Program is exemplary in the sense that it recognizes the incompressible indirect research costs small to medium size institutions have to cover.** The appropriateness of this approach was confirmed by the two evaluations undertaken in the past years. It is the position of ACCRU that the RSP formula is appropriate and should be maintained.

³ Abt, H. (2007) ‘The Publication rate of Scientific Papers Depends Only on the Number of Scientists’, *Scientometrics*, 73/3: 281–8.

⁴ Mongeon, P. Brodeur C., Beaudry, C. Larivière V. (2016) Concentration of research funding leads to decreasing marginal returns, *Research Evaluation*, 1–9.

⁵ Fortin J-M, Currie DJ (2013) Big Science vs. Little Science: How Scientific Impact Scales with Funding. *PLoS ONE* 8(6): e65263. doi:10.1371/ journal.pone.0065263;

Recommendations:

1. ACCRU recommends that federal government emphasizes the national importance of supporting research in all Canadian universities and that the federal government preserves the support of research at all universities, irrespective of size or location, as a fundamental principle of research policy.
 - a. The federal government adopt as scientific policy that national programs remain fully inclusive and support fundamental research in the full spectrum of Canadian's universities, irrespective of size, location and type of institution.
 - b. The Tri-Agencies and CFI assess the how the design, criteria application and peer review processes reflect research excellence in the context of the full diversity of the Canadian university ecosystem.
2. ACCRU recommends that the envelopes dedicated fundamental research within each granting council be upgraded significantly in order to have an impact on success rates observed in the basic programs, open to all.
3. ACCRU recommends that the Tri-Agencies dedicate funding to interdisciplinary and inter-sectoral fundamental research and foster collaboration among researchers from different institutions and regions of the country, as well as international collaborations.
 - a. In order to develop a stronger culture of inter-sectoral, international and collaborative research, the Tri-Agencies should 1) recognize the impact of research in the social sciences and humanities, and not simply as an add-on to health, science or engineering research projects; 2) dedicate specific funds, within each of the granting councils' allocations to interdisciplinary and inter-sectoral research; and 3) enhance the peer review adjudication process from a disciplinary to a thematic approach for such dedicated funds.
 - b. Every researcher should be able to employ a portion of her/his research funding to international collaborations.
 - c. When possible, Tri-Agencies should be encouraged to provide opportunities for researchers to co-finance international research projects through partnerships between the Tri-Agencies and other international granting agencies (e.g., EU).
4. ACCRU recommends that the Tri-Agencies and CFI maintain an appropriate balance between funds available to acquire new infrastructures and additional funding to cover ongoing utilization is crucial. All universities struggle to the growing costs of medium to large size infrastructures.
5. ACCRU recommends to maintain the Research Support Program's formula.
6. ACCRU recommends that an increase in direct funds available to granting councils be matched by a proportional increase in the Research Support Program for the indirect costs undergone.

7. ACCRU recommends that The Federal government invests in programs that enable every university to leverage research to help education and train the next generation of highly qualified personnel and researchers. These programs should include specific measures to support students at the undergraduate, graduate and postdoctoral levels as well as researchers in their early career stage.

For instance, undergraduate research summer scholarships should be available to students in all field – from the arts, humanities and social sciences to the natural and physical sciences, engineering and medical sciences. Similarly, Canada should increase in the number of graduate student scholarships and fellowships and a number of these scholarships should be dedicated to inter-regional and international experiences for selected students.

Conclusion

In conclusion, we want to reiterate that upholding a large and diverse research portfolio in all of Canada's universities is in the higher interest of Canada and all Canadians. It not only contributes to building Canada, it maintains Canada's universities' ability, from coast to coast and in all sectors and in all of Canada's regions, to react promptly and adequately to diversity full range of economic, social, demographic, natural and/or technological challenges which continue to face our country both in short and the long run. Maintaining a diverse research portfolio is congruent with what Canadians expect from a strong scientific ecosystem. Only by maintaining and strengthening the research capacity of all of Canada's universities will a strong ecosystem exist which serves Canada's higher interests, both by exploring ideas arising from the insight and inquisitiveness of researchers but also by addressing the needs and challenges of its different organizations and communities at the local, regional, national and international level.

ⁱ Methodological note on the graphs shown. They are extracted from a dashboard, produced by Université du Québec that enables users to compare simultaneously the number of publications, the impact, the international collaboration rate and the scientific specialization of universities. To enable the comparison of universities in the different disciplines, the specific indicator value is computed for each university. The average of all universities is then calculated using each university's value (each university is weighted as one regardless of its number of publications in each discipline). The standard deviation for each university in each discipline is computed to permit the display relative to an average university in each discipline of the group selected.

Number of publications: (Reflected in the size of each dot). The number of publications is the number of scientific articles in the selected discipline (not university specific department) and the selected years for the selected university or group of universities as compiled by the Observatoire des sciences et des technologies (OST) using the ThomsonReuters WoS (Web of Sciences) data bases after standardization of addresses. OST counts one publication per different address inventoried in the publication location field. Therefore, the total number of publications per production location counted may overestimate the actual number of publications (except in the rare case where no collaborators are present).

Specialization index: (Shown in axis Y) This index presents the relative concentration of the scientific publications of a university in a specific discipline in comparison to a group of universities (for example, a province). The specialization index is calculated for each discipline category. Method: (share (%) of the publications of university X in the Y discipline) / (Share (%) of the publications of the selected group of universities, in the Y discipline).

A specialization index greater than 1,0 indicates that the X university is more specialized in the selected discipline compared to the total publications of the reference group of universities. The reference group in the matrix shown is Canadian.

Impact factor: (Shown in axis X) the average relative impact factor (ARIF-MFIR in French) presents the potential impact factor of the scientific articles produced by a university given the measured impact of the journals in which they are published in. First, the impact is calculated for each journal on a yearly basis by deriving the average number of citations attributed to articles it published in the previous two years. Each scientific article then receives the annual impact of the journal in which it was published. The calculated impact attributed to each scientific article is then compared and adjusted based on the world average impact of all the articles published in the same discipline and year. A relative impact greater than 1,0 (world average) indicates that a scientific article in a specific discipline was published in a journal that received more citations than the average journals in that discipline and year. To calculate the average relative impact factor (ARIF) of a university in a specific field over a given number of years, an average of all the impact factors of all the scientific articles published by the university in that field for the same years.

SOURCE :

BDBC (OST-Thomson Reuters (WoS); compilation Université du Québec-Direction de la recherche institutionnelle; juin 2013