Briefing Note

The Need to Better Unpack the Transaction Costs Associated with Northern Research in Canada

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Introduction

Governments in Canada have been steadily increasing their investments in scientific research to help support evidence-based decision-making for sustainable northern development (Carr, Natcher et al., 2013; ITK, 2018). Prominent examples include financial support for: ArcticNet (2003-2018; 113.2 million CAD), the Canada program for the International Polar Year (2006-2011; 150 million CAD), the Polar Continental Shelf Program (2006-2011; 88.9 million CAD), the Arctic Research Infrastructure Fund (2009; 85 million CAD), Sentinelle Nord (2015-2023; 98 million CAD), Natural Sciences and Engineering Research Council of Canada's (NSERC) Northern Chairs Program (2000-2017; 11 million CAD), the Canadian High Arctic Research Station (250 million CAD for construction; 2018 onwards 26.5 million CAD /year) and the Institut nordique du Québec (2018; 83.5 million CAD for construction).[1] Along with these investments, various knowledge co-production frameworks have been proposed and some have been adopted to help foster the production of scientific knowledge that is considered relevant to academia, communities and governments (e.g. participatory, community-based and action research) (Gearhead and Shirley, 2007; Burn, 2008; Pearce, Ford et al., 2009). While collaborative approaches to scientific research have seen some success in informing public policy directions (Armitage, Berkes et al., 2011), northern advocates have continued to call attention to gaps between scientific pursuits, community needs and northern policy outcomes (Burn, 2008; Ogden, Schmidt et al., 2016; ITK, 2018). Reports such as *Research Excellence in the Northwest Territories: Holistic, Relevant and Ethical Research in the Social Sciences, Humanities and Health Sciences* (ACUNS, 2018), *Research Excellence in Yukon: Increasing Capacity and Benefits to Yukoners in the Social Sciences, Humanities and Health Sciences* (ACUNS, 2017), and *A new Shared Arctic Leadership Model* (Simon, 2017) also suggest that equitable collaboration and

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participation in northern research processes has yet to be fully realized (see also Korsmo & Graham, 2002; Caine, Salomons et al., 2007; Gearhead & Shirley, 2007; Brunet, Hickey et al., 2014; Brunet, Hickey et al., 2017). Interestingly, despite the identification of these gaps, there has been relatively little systematic analysis of the northern research governance system that guide collaborative engagement, consultation practices, and overall co-productive capacity in Canada. In this Briefing Note, we consider how such an analysis might be approached by drawing on a transaction costs approach to help inform more strategic and integrated research policy frameworks across scale.

Transaction Costs in Research

Through the lens of social network theory, a transaction costs approach has the potential to provide insight into how existing institutions[2] either support or impede effective collaborative research endeavors (Landry & Amara, 1998). According to Landry and Amara (1998), a transaction costs approach predicts that when the perceived monetary and non-monetary costs (e.g. time and opportunity) of participating in formal collaborative research arrangements are relatively high, actors will tend to seek alternatives. Robust public research governance is inherently relational and often accrues costs associated with engaging in processes to exchange information, coordinate diverse actors and enforce reporting and monitoring requirements (Landry & Amara, 1998; Ruiter, 2005). The types of transactions that are associated with relational activities tend to be continuous and occur over an extended period of time, moving away from market transactions that aim to be both costless and instantaneous (Nahapiet & Ghoshal, 1998). It is often assumed that governance structures that lower transaction costs and control for the dimensions of transactions (e.g. uncertainty, frequency, specificity) will perform better than those that do not (i.e. those with higher transaction costs) (Croisier, 1998; Jobin, 2008). Therefore, 'organizing transactions in order to economize on transaction costs' is often considered a core aspect of effective public governance (Ruiter, 2005).

Research governance is often approached with the intent to minimize administrative requirements (e.g. reporting, managing collaborative research relationships) and maximize available resources for research efforts (i.e. minimizing transaction costs) (Landry & Amara, 1998; Boardman and Bozeman, 2006). However, Clark (2010) has suggested that despite government polices that aim to foster academic collaboration, institutional requirements at other levels of governance (e.g. university contract requirements) may unintentionally increase transaction costs (see also Kim & Bak, 2017; Widmark & Sandstrom, 2012). Therefore, an improved understanding of governance attributes (i.e. the distribution of resources and responsibility) and capacity is often needed in order to support arrangements for sustainable long-term collaborative research relationships (Sinnewe, Charles et al., 2016). In the Canadian context, Landry and Amara (1998) have examined how university researchers initiate, negotiate and coordinate inter-organizational collaborative research arrangements with other research partners (e.g. industry, governments, and special interest groups) in response to transaction costs. Their results suggest the need for more systematic and holistic approaches to research policy. That study and others have also shown that high transaction costs associated with collaborative research may offset the benefits of collaboration and contribute to suboptimal collective research and policy outcomes (Croisier, 1998; Landry & Amara, 1998; Boardman & Bozeman, 2006; Jobin, 2008; Clark, 2010; Sinnewe, Charles et al., 2016; Kim & Bak, 2017).

Transaction Costs in Northern Collaborative Research

A range of direct and indirect transaction costs have already been reported in association with northern collaborative research processes (see Table 1). For example, the financial costs associated with collaborative Arctic science can be more than eight times higher than similar research conducted in southern Canada, prompting northern researchers to ask, *"Why conduct research in the Arctic, when you can do more work for less money in the South?"* (Mallory, Gilchrist et al., 2018), a question that has been echoed elsewhere (e.g. Brook, 2009). Northern researchers have also expressed concern over the need to negotiate conflicting demands between dominant academic reward systems (e.g. the 'publish or perish' phenomenon) and calls for more community-engaged research (e.g. participatory methods, outreach, training) (Korsmo & Graham, 2002; Gearhead & Shirley, 2007; Tondu, Balasubramaniam et al., 2014). While formal requirements for community engagement can require up to one quarter of a research budget (Mallory, Gilchrist et al., 2018) they also place significant demands on northern communities which often face challenges associated with limited research capacity. For example, local communities are often required to commit resources for participation in pre-project consultations, data collection, managing community-researcher interactions, and assessing scientific licenses, projects and reports (Gearhead & Shirley, 2007; Ogden, Schmidt et al., 2016; ITK, 2018). These challenges can be confounded by organizational and regional variation among formal approval processes (e.g. licencing and ethical approvals) (George, 2011), often leading to redundancies and barriers for implementation when projects span multiple regions, years or institutions.

To date, existing research into the transaction costs associated with northern science has largely focused on project-level outcomes, providing a 'snapshot' of the types of transaction costs that can be incurred by researchers and communities. However, this approach misses the inherent complexity of northern innovation systems and the related impacts of scale, feedback and memory. Recognizing that northern scientific research operates within dynamic and multi-layered governance contexts, there is a need for research-related policies, organizations and actors to pay closer attention to the broader research system in order to help co-deliver public value (Pigford, Hickey et al., 2017). This is particularly pressing for northern governance actors in the context of sustainable northern development, as existing institutional arrangements appear to produce a range of direct and indirect effects that cumulatively impact overall outcomes (Burn, 2008; Ogden, Schmidt et al., 2016; ITK, 2018).

Table 1. Project-level collaborative activities associated with transaction costs in the Canadian North

Activity	Associated Transactions	References
Relationship Building	**Time & Opportunity** - Extended physical presence and "idle time" in the community to identify appropriate authorities for community representation and facilitate the development of local networks and friendships (i.e. build trust) - Dedicated time for pre-project consultation with the community (or research team) - Communication in multiple formats (plain language, policy briefs) **Financial & Opportunity** - Travel for pre-project consultation - Provision of food & refreshments at meetings	(Korsmo & Graham, 2002; Carr, Natcher et al., 2013; Brunet, Hickey et al., 2014; Tondu, Balasubramaniam et al., 2014; Carr, 2017; Mallory, Gilchrist et al., 2018)

Location-specific Investments	**Time & Opportunity** - Involving communities in research design, including the time for necessary training - Involving community members in dissemination activities - Writing proposals to acquire extra resources for outreach **Financial & Opportunity** - Provide local training and employment - Provide honoraria for knowledge holders - The pursuit of collaborative funding	(Gearhead & Shirley, 2007; Pearce, Ford et al., 2009; Carr, Natcher et al., 2013; Tondu, Balasubramaniam et al., 2014; Carr, 2017; Mallory, Gilchrist et al., 2018)
Licencing & Ethics	**Time, Financial & Opportunity** - Community review of ethical and license documentation - Navigating the differences between formal informed consent and community practices - Obtaining consent at multiple levels (e.g. community, region, territory)	(Davison, Brown et al., 2006; Davidson-Hunt & Michael O'Flaherty, 2007; George, 2011)
Reporting, Outreach, and Knowledge Sharing	**Time & Opportunity** - Communication in multiple formats (plain language, policy briefs, academic outputs) - Disseminating research to the community first **Financial & Opportunity** - Outreach workshops (e.g. half of annual budget- see Mallory et al., 2018)	(Pearce, Ford et al., 2009; Tondu, Balasubramaniam et al., 2014; Mallory, Gilchrist et al., 2018)
Academic Expectations	**Time & Opportunity** - Navigating partner interests that may not align with academic science designed to serve a greater society - The need to publish findings for personal (tenure and promotion) and scientific reasons - Participating in interdisciplinary and international approaches to address complex issues	(Korsmo & Graham, 2002; Kraft Sloan & Hik, 2007; Gearhead & Shirley, 2007; Tondu, Balasubramaniam et al., 2014; Mallory, Gilchrist et al., 2018)

Future Directions

Ultimately, there is a need for the actors involved in Canada's northern research governance system (e.g. academics, northern communities, funding agencies, government departments, licencing bodies, universities and northern research institutes) to design 'path-breaking' policies that facilitate coordination and communication across the system to help minimize associated transaction costs. Attempts to better manage the impacts of research-related transaction costs in non-northern contexts have so far focused on the importance of knowledge brokers and boundary organizations, which could be further explored in northern contexts (Kowalski & Jenkins, 2015). A more systematic and coordinated approach to northern research governance could build on existing Canadian bridging efforts, such as the territorial "pan-northern" approach to science policy (Government of Yukon, 2016), the ArcticNet Network of Centres of Excellence (ArcticNet, 2017), Polar Knowledge Canada (Government of Canada, 2017), and Canada's participation in the Arctic Council. Future studies could, for example, examine how the policies that shape the science-policy-community interface in northern Canada might become more integrated, complementary and effective in achieving desired collective outcomes. An improved understanding of the nature of transactions (e.g. uncertainty, frequency, specificity) (Croisier, 1998) as well as the formal and informal dimensions of transaction costs (Landry & Amara, 1998) is also needed to more fully understand the diverse transaction costs associated with northern research. Building on previous

studies on research-related transaction costs conducted in non-northern collaborative environments, we can identify a number of themes and associated propositions that may act as useful starting points for further policy reflection, examination and experimentation in the northern research policy context, summarized below.

- Theme 1: Opportunism:
    - *Proposition:* In larger institutional arrangements, research actors will be more likely to engage in opportunistic behaviour (i.e. secure more resources for themselves) (Landry & Amara, 1998);
- Theme 2: Acquaintance:
    - *Proposition:* Transactions where actors are amicably acquainted (i.e. have higher levels of trust) will diminish the probability of opportunism and reduce the need for monitoring (Putnam, 1993; Nahapiet & Ghoshal, 1998; Boardman & Bozeman, 2006);
- Theme 3: Incentives:
    - *Proposition:* Extrinsic institutional reward structures designed to incentivize collaboration (e.g. resource sharing, co-learning) will be confounded by intrinsic individual reward incentives (e.g. personal motivations) (Boardman & Bozeman, 2006);
    - *Proposition:* In more formal institutional arrangements, research actors will be less likely to fully engage in collaboration due to the potential for reduced returns or 'shrinking costs' (Sinnewe, Charles et al., 2016);
- Theme 4: Research Stage:
    - *Proposition:* Collaborative transactions that occur earlier in the research process are more likely to foster equitable participation (versus sub-contacting) (Croisier, 1998);
    - *Proposition:* The adaptive capacity of an institutional arrangement will become more valuable, the longer the duration of the collaboration because of increasing probability that research actors will need to renegotiate their arrangements (Croisier, 1998);
- Theme 5: Collaborators:
    - *Proposition:* The greater the heterogeneity among research actors, the more likely that institutional arrangements will be formal and hierarchical (Boardman & Bozeman, 2006);
    - *Proposition:* The larger the number of partners, the more difficult it will be for research actors to distribute tasks and control efforts (Croisier, 1998; Boardman & Bozeman, 2006);
- Theme 6: Geography:
    - *Proposition:* The larger the geographical scope of transactions, the more difficult it will be for research actors to coordinate tasks and control efforts (Boardman & Bozeman, 2006);
- Theme 7: Governance & Change:

- *Proposition:* When the distribution of transaction costs become too expensive and/or unbearable research governance will make adjustments (Croisier, 1998; Landry & Amara, 1998; Widmark & Sandstrom, 2012); and
- *Proposition:* A better understanding of the different transaction costs incurred by research actors will improve the ability to predict and promote effective long-term research relationships (Sinnewe, Charles et al., 2016).

These themes and propositions provide a variety of potential research paths that may inform the development of revised institutional arrangements capable of more strategically managing transaction costs in the northern research system. A more deliberate, multi-dimensional and shared understanding of the various transaction costs associated with northern scientific research and the implications of these costs for collective research policy outcomes is needed. Such an understanding has the potential to usefully inform efforts of different actors to disrupt the *status quo* of northern research governance while also helping to realise more effective, systemic and reflexive northern research policy.

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Notes

1. Sources for financial estimates:

   ArcticNet: http://www.nce-rce.gc.ca/_docs/reports/NCEReport-2015-RaportRCE_eng.pdf

   Arctic Research Infrastructure Fund: http://www.aadnc-aandc.gc.ca/eng/1100100037415/1100100037416

   Canadian High Arctic Research Station: https://www.canada.ca/content/canadasite/en/polar-knowledge/CHARScampus.html
   Institut nordique du Québec: https://www.newswire.ca/news-releases/the-governments-of-canada-and-quebec-support-the-sustainable-and-ethical-development-of-the-north-691110821.html

   International Polar Year: http://www.api-ipy.gc.ca/pg_IPYAPI_008-eng.html#q1.1http://www.api-ipy.gc.ca/pg_IPYAPI_008-eng.html#q1.1

   Natural Sciences and Engineering Research Council of Canada (NSERC) Awards Database: http://www.nserc-crsng.gc.ca/ase-oro/index_eng.asp

Polar Continental Shelf Program: http://www.nrcan.gc.ca/evaluation/reports/2012/796
Sentinelle Nord: https://www.ulaval.ca/fileadmin/ulaval_ca/Documents/sentinelle-nord/Sentinel_North_-_21_research_sub-projects.pdf

2. Institutions are the 'rules of game' and can include formal or informal customs, norms, standards, policies and laws.

References

ACUNS. (2017). *Research Excellence in Yukon: Increasing Capacity and Benefits to Yukoners in the Social Sciences, Humanities and Health Sciences*. Retrieved from

ACUNS. (2018). *Research Excellence in the Northwest Territories: Holistic, Relevant and Ethical Research in the Social Sciences, Humanities and Health Sciences* Retrieved from http://acuns.ca/wp-content/uploads/2018/07/2018-NWT_English-Web.pdf

ArcticNet. (2017). ArcitcNet About Us. Retrieved from http://www.arcticnet.ulaval.ca/aboutus/rationale.php

Armitage, D., Berkes, F., Dale, A., Kocho-Schellenberg, E., & Patton, E. (2011). Co-management and the co-production of knowledge: Learning to adapt in Canada's Arctic. *Global Environmental Change, 21*(3), 995-1004.

Boardman, C., & Bozeman, B. (2006). Implementing a 'bottom-up,' multi-sector research collaboration: The case of the Texas air quality study. *Economics of Innovation and New Technology, 15*(1), 51-69. doi:10.1080/1043859042000332196

Brook, R. K., Kutz, S.J., Veitch, A.M., Popko, R.A., Elkin, B.T. and Guthrie, G.,. (2009). Fostering community-based wildlife health monitoring and research in the Canadian North. *EcoHealth, 6*(2), 266-278.

Brunet, N., Hickey, G., & Humphries, M. (2014). The evolution of local participation and the mode of knowledge production in Arctic research. *Ecology and Society, 19*.

Brunet, N. D., Hickey, G. M., & Humphries, M. M. (2014). Understanding community-researcher partnerships in the natural sciences: A case study from the Arctic. *Journal of Rural Studies, 36*, 247-261.

Brunet, N. D., Hickey, G. M., & Humphries, M. M. (2017). How can research partnerships better support local development? Stakeholder perceptions on an approach to understanding research partnership outcomes in the Canadian Arctic. *Polar Record, 53*(5), 479-488.

Burn, C. (2008). Opinion: Science in the Changing North. *Northern Review*(29), 7-20.

Caine, K. J., Salomons, M. J., & Simmons, D. (2007). Partnerships for social change in the Canadian north: revisiting the insider–outsider dialectic. *Development and change, 38*(3), 447-471.

Carr, J. (2017). *Natural Resources Canada Departmental Plan*. Retrieved from

Carr, K., Natcher, D. C., & Olfert, R. (2013). Measuring the economic impact of publicly funded research in Northern Canada. *Polar Geography, 36*(4), 291-304.

Clark, B. Y. (2010). The effects of government, academic and industrial policy on cross-university collaboration. *Science and Public Policy, 37*(5), 314-330.

Croisier, B. (1998). The governance of external research: empirical test of some transaction-cost related factors. *R&D Management, 28*(4), 289-298.

Davidson-Hunt, I. J., & Michael O'Flaherty, R. (2007). Researchers, indigenous peoples, and place-based learning communities. *Society and Natural Resources, 20*(4), 291-305.

Davison, C. M., Brown, M., & Moffitt, P. (2006). Student researchers negotiating consent in northern Aboriginal communities. *International journal of qualitative methods, 5*(2), 28-39.

Gearhead, S., & Shirley, J. (2007). Challenges in Community-Research Relationships: Learning from Natural Science in Nunavut. *ARCTIC, 60*(1), 62-74.

George, M. A. (2011). Review of procedures for approval of health studies in northern Canada. *International journal of circumpolar health,, 70*(4), 354-362.

Government of Canada. (2017). P. K. *Polar Knowledge Canada, 2016-17 Report on Plans and Priorities*.

Government of Yukon, G. N. T., Government of Nunavut. (2016). *A pan-northern approach to science*. Retrieved from http://www.anorthernvision.ca/documents/A16_Brochure_PanNorthernApproachtoScience_71402_English_WEB-Final.pdf

ITK, I. T. K. (2018). National Inuit Strategy on Research.

Jobin, D. (2008). A transaction cost-based approach to partnership performance evaluation. *Evaluation, 14*(4), 437-465.

Kim, D. H., & Bak, H.-J. (2017). Incentivizing research collaboration using performance-based reward systems. *Science and Public Policy, 44*(2), 186-198. doi:10.1093/scipol/scw050

Korsmo, F. L., & Graham, A. (2002). Research in the North American North: action and reaction. *ARCTIC*, 319-328.

Kowalski, A. A., & Jenkins, L. D. (, 2015). The role of bridging organizations in environmental management: examining social networks in working groups. *Ecology and Society, 20*(2), 16.

Kraft Sloan, K., & Hik, D. (2007). International Polar Year as a catalyst for sustaining Arctic research. *Sustainable Development Law & Policy 8, 4*.

Landry, R., & Amara, N. (1998). The impact of transaction costs on the institutional structuration of collaborative academic research. *Research Policy, 27*(9), 901-913.

Mallory, M. L., Gilchrist, H. G., Janssen, M., Major, H. L., Merkel, F., Provencher, J. F., & Strøm, H. (2018). Financial costs of conducting science in the Arctic: examples from seabird research. *Arctic Science*.

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital, and the organizational advantage. *Academy of Management. The Academy of Management Review, 23*(2), 242.

Ogden, A. E., Schmidt, M., Van Dijken, B., & Kinnear, L. (2016). Science in the Yukon: Advancing a Vision for Evidence-based Decision Making. *ARCTIC, 69*(2), 210-221.

Pearce, T. D., Ford, J. D., Laidler, G. J., Smit, B., Duerden, F., Allarut, M., . . . Elee, P. (2009). Community collaboration and climate change research in the Canadian Arctic. *Polar Research, 28*(1), 10-27.

Pigford, A.-A., Hickey, G. M., & Klerkx, L. (2017). Towards Innovation (Eco) Systems: Enhancing the Public Value of Scientific Research in the Canadian Arctic. In: Heininen, L., H. Exner-Pirot and J. Plouffe (eds.) (2017). Arctic Yearbook 2017. Akureyri, Iceland: Northern Research Forum.

Putnam, R. D. (1993). The prosperous community: Social capital and public life. *The american prospect, 4*(13), 35-42.

Ruiter, D. W. (2005). Is transaction cost economics applicable to public governance? *European journal of law and economics, 20*(3), 287-303.

Simon, M. (2017). *A new Shared Arctic Leadership Model.* Retrieved from

Sinnewe, E., Charles, M. B., & Keast, R. (2016). Australia's Cooperative Research Centre Program: A transaction cost theory perspective. *Research Policy, 45*(1), 195-204.

Tondu, J., Balasubramaniam, A., Chavarie, L., Gantner, N., Knopp, J., Provencher, J., . . . Simmons, D. (2014). Working with northern communities to build collaborative research partnerships: perspectives from early career researchers. *ARCTIC, 67*(3), 419-429.

Widmark, C., & Sandstrom, C. (2012). Transaction costs of institutional change in multiple-use commons: the case of consultations between forestry and reindeer husbandry in Northern Sweden. *Journal of Environmental Policy & Planning, 14*(4), 428-449.