

MAPPING KNOWLEDGE SEEKING IN THE ST. JOHN'S AND CORNER BROOK ENTREPRENEURIAL ECOSYSTEMS

DR. BLAIR WINSOR & KEN CARTER
MEMORIAL UNIVERSITY
APRIL 2018

Mapping Knowledge Seeking in the St. John's and Corner Brook Entrepreneurial Ecosystems

Harris Centre Applied Research Fund

Final Report March 31, 2018

Principal Investigator:

Dr. Blair Winsor, Assistant Professor

**Faculty of Business Administration, Memorial University of Newfoundland
&**

Co-investigator:

Mr. Ken Carter, PhD Candidate, Department of Geography

**Director, Grenfell Office of Engagement
Memorial University of Newfoundland**

Contents

Acknowledgements	3
Executive Summary	4
Glossary and Acronyms	6
Introduction	7
Project Background, Rationale and Objectives	8
Research Methodology	11
Clearances	14
Project Findings	15
Discussion	18
Knowledge Mobilization	20
Recommendations	21
Conclusions	22
References	23
Appendix 1: Ecosystem Maps	28

Acknowledgements

Dr. Blair Winsor and Mr. Ken Carter gratefully acknowledge the continued support of the Harris Centre, its funders, and the Atlantic Canada Opportunities Agency (ACOA) for their generous funding of this research project.

This project would not have occurred without the inspiration, leadership, and support of Dr. Ellen Farrell and her team, in particular Mr. Nathan Dennison, at Saint Mary's University, Halifax, Nova Scotia. We would also like to thank Ms. Sandra Cook, Ms. Dana Feltham, Mr. Alex Guest, and Mr. David McCarthy for their assistance with this project.

Executive Summary

This is the final report for the Harris Centre Applied Research Fund project: Mapping Knowledge Seeking in the St. John's and Corner Brook Entrepreneurial Ecosystems. The research mapped the knowledge-seeking activity of actors at the micro-level in both regions using proven network theory and analysis methodology. The entrepreneurial journey can, in part, be summarized as a process of discovering and exploiting opportunities with knowledge seeking critical to this process. While work has examined firm-level knowledge seeking, little had been done to map ecosystems based on entrepreneurial knowledge seeking. Moreover, an examination of this kind had not been conducted in either region and was particularly important in light of recent efforts to enhance these ecosystems.

The research methodology and approach used can be divided into two main phases, data collection and data analysis. A survey was used to collect data, between October 2016 and June 2017, from 156 respondents - 51 in Corner Brook and 105 in St. John's. Data from these enable us to quantitatively map the knowledge-seeking behaviours of participants in both ecosystems. In particular, data was gathered on four elements of the respondent's knowledge-seeking: who they contacted; the importance of the interaction to the survey respondent; the frequency of interactions; and the type of information being sought (business/market/financial information or product/ scientific/technical information). The frequency of communication (including: phone, face-to-face, and electronic) was based on the previous 12 months activities, while importance was ranked on a seven-point Likert scale. Respondents described who they were seeking knowledge from based on eight given categories of ecosystem actors (i.e. entrepreneurial firm, support organization, venture capital/angel network, financial institution, university/college/ research, accounting firm, law firm, government agency).

Data examination revealed six main points. Firstly, encouragingly, overall both regions have many of the organizations and people needed for a thriving entrepreneurial ecosystem. Each region has entrepreneurial firms, support organizations, venture capital/angel network presence, financial institutions, higher education facilities, accounting and law firms, and government agencies, all of which appear to be playing, generally, a positive role. Secondly, most troubling is what appeared to be a lack of knowledge seeking among entrepreneurial firms in both regions. They were roughly four times more likely to seek knowledge from government and support organizations than their peers. Thirdly, the responses showed significantly higher knowledge seeking behavior related to business/market/financial rather than product/service/technical knowledge. This lack of knowledge seeking might reduce innovation in entrepreneurial firms. Fourthly, the amount of entrepreneurial firm-to-mature firm knowledge seeking was limited. Arguably, entrepreneurial firms should be leveraging mature firm knowledge. Fifthly, in addition to government, the maps show that entrepreneurial firms were also seeking knowledge from university/colleges and support organizations. This is a positive ecosystems role, though the issue of these relationships crowding out entrepreneurial firm peer relationships needs further examination. Finally, and also somewhat troubling, is that both ecosystems lacked external connections beyond their regions. Survey

respondents seldom referenced connections in Atlantic Canada and even fewer referenced any beyond Atlantic Canada to the rest of the world.

Reflecting on our findings we would make the following recommendations to actors in both ecosystems.

- Entrepreneurial firms, while maintaining their knowledge seeking relationships with others in the ecosystem, should consider doing more among themselves to enhance their ecosystem by taking a greater role in communicating, interacting, and supporting each other.
- Support organizations and government agencies should consider ways to increase knowledge seeking, especially product/service/technical, between entrepreneurial firms or other appropriate sources inside/outside the regions (e.g. directing knowledge seeking entrepreneurial firms to other entrepreneurial firms, hosting/funding entrepreneurial networking events).
- Government agencies, support organizations, and universities/colleges could organize events that bring mature firms and venture capital firms in regular contact with entrepreneurial firms and their ecosystem (e.g. hosting/funding hackathons and networking events, inviting mature firms and venture capital to attend).
- Mature firms could make more effort to interact/mentor entrepreneurial firms in their regions (e.g. include them in R&D efforts, provide office hours, lend resources and/or expertise, hosting/funding networking events, buying products from them, and introducing them to suppliers, customers, and industry partners)
- University/colleges should, with government funding, maintain their long term investment in supporting the knowledge seeking, particularly product/service/technical, in both ecosystems. Their boundary spanning, incubation, networking, research, and teaching activities are critical to ecosystem evolution and growth.
- All ecosystem actors should look to expand extra-local knowledge seeking (e.g. new international linkages could be shared with other ecosystem participants to forge new regional links to extra-local places, combining resources to attend trade missions and trade shows).

Glossary and Acronyms

ACOA - Atlantic Canada Opportunities Agency

NL - Newfoundland and Labrador

Introduction

This is the final report for the Harris Centre Applied Research Fund project: Mapping Knowledge Seeking in the St. John's and Corner Brook Entrepreneurial Ecosystems. The result of this project was to map both ecosystems based on the knowledge-seeking behavior of regional actors using proven network theory and analysis methodology (Borgatti, Everett, & Johnson, 2018). The project's data provided details of the knowledge seeking by ecosystem members leading to a deeper understanding of the nature and extent of this activity in St. John's and Corner Brook. This kind of examination had not been done in either region and was particularly important in light of recent efforts at ecosystem enhancement (e.g. the establishment of Common Ground Coworking, government funding for various industry groups, the creation of Memorial's Centre for Entrepreneurship, and the ongoing work of Navigate on Memorial's Grenfell campus). The fundamental reason for examining entrepreneurial firms, and here they are defined broadly and inclusively as any firm which had started within the previous ten years¹, in Newfoundland and Labrador (NL) is that it is a crucial aspect of economic development. Entrepreneurs have created the small and medium sized firms which provide approximately 92% of non-government employment and, depending on how it is measured 20-40% of provincial GDP (Government of Canada Small Business Statistics, 2016). From this perspective, entrepreneurship development should be, and is, an important element in NL's economic development efforts. In examining knowledge seeking in these two ecosystems this project contributes by offering insights into an important never examined aspect of their operation.

Generally, many argue that facilitating entrepreneurship is a key to generating strong economic performance (Audretsch, 2015; Ribeiro-Soriano, 2017). There has been a heightened interest in studying entrepreneurial ecosystems over the past number of years in an attempt to understand and even emulate the entrepreneurial successes of the better known ecosystems (see for example: Acs, Stam, Audretsch, & O'Connor, 2017; Malecki, 2018). An entrepreneurial ecosystem is a unique, complex, self-sustaining environment that supports entrepreneurial activity (Feld, 2012; Malecki, 2018; Spigel, 2017). Ahmad & Hoffman (2008) suggest that it is a combination of three factors: opportunities, skilled people, and resources, while Isenberg (2010) proposes that ecosystems encompass six

¹ As this project was part of a wider pan-Atlantic ecosystems mapping project, we have used the agreed wider project definition which was explained by Farrell as follows:

"The definition of entrepreneurship varies from study to study and its methodological operationalization is equally varied. Hence there is no known population of all entrepreneurs or entrepreneurial firms. One accepted method to operationalize a sample of the population is to use those who currently own or manage a young business (i.e. as in the Global Entrepreneurship Monitor, Reynolds, et al. 2005). A sample was created from those who currently own or manage a young business was drawn from a variety of sources based on methodologies from other studies including: our own list of start-ups created within the past 10 years (i.e. Parker & van Praag 2006; Lee & Marvel 2014); regional development authorities (i.e. Ayala & Manzano 2014); rural development authorities (i.e. Stefan 2014); carefully evaluating personal contacts of the lead researcher; firm names drawn from media sources such as Entrevestor.com (an entrepreneurial news service)...LinkedIn; and universities, venture capital colleagues and government and incubation organizations who were asked to participate in the survey." (2017, p. 9).

domains: policy, finance, culture, supports, human capital, and markets. Usually, the study of ecosystems has focused on more qualitative approaches using cases, ethnographic, and historical methods (see for example, Korsgaard, Ferguson, Gaddefors, 2015). While the body of ecosystem research has been growing over the past decade, the quantitative mapping of ecosystems, as done here, is in its infancy.

This project was organized, using the same methodology, in collaboration with St. Mary's University (overall project lead), Memorial University of Newfoundland, Cape Breton University, the University of Prince Edward Island, and Université de Moncton. We employed a quantitative approach using network theory (Farrell & Dennison, 2015; Motoyama & Knowlton, 2014). Combining entrepreneurial ecosystems research with network analysis, as demonstrated by Dr. Farrell's work in Nova Scotia, offers a new and important perspective and has shown promise as a means to enhance our knowledge of ecosystems. Previous work by Lam et al. (2013) and Vodden, Tucker, Gibson, & Holley (2011) on this province's West Coast and Northern Peninsula have shown the contribution network analysis can make to better understanding Newfoundland and Labrador's (NL) regional development dynamics. This study will build on the previous use of network analysis in regional development studies and broaden its use to mapping entrepreneurial firm knowledge seeking activity in the two regions.

The report is divided into three main sections, the first provides the project's background, rationale, objectives, and research methodology. The second discusses the data and presents findings, while recommendations are outlined in the final main section.

Project Background, Rationale and Objectives

The entrepreneurial ecosystems literature provides a useful background for our work. Ecosystems study is a rapidly developing area of scholarship and there are still limitations with the approach (Malecki, 2018). Generally, Spigel (2017) has argued that the emerging focus on entrepreneurial ecosystems has been undertheorized and lacks evidenced-based research. More specifically, much of the ecosystems work, while very good at mapping ecosystem participants, has failed to examine the relationships between participants at the micro or granular level (Motoyama & Knowlton, 2016). Knowledge seeking between ecosystem participants and outside ecosystem boundaries is, arguably, a key activity especially for knowledge-based innovation driven entrepreneurial firms. Research in a variety of areas clearly shows that knowledge, networks, and social capital are important in the entrepreneurial process (see for example: Aldrich & Zimmer, 1986; Stuart & Sorenson 2005).

The use of the ecosystem metaphor is meant to invoke the idea that "entrepreneurship takes place in an interdependent community of actors" (Stam, 2015: p. 2). This represents a shift from typical research on entrepreneurship, distinguishing between on the one hand; research on entrepreneurs themselves and, on the other, studies of the broader contexts in which entrepreneurs operate (e.g. Autio et al, 2014). It is increasingly recognized that there is a need to think of entrepreneurship and economic development

at the system level (Acs, Autio, & Szerb, 2012). The ecosystems approach is similar to cluster and learning regions, innovation systems, triple/quadruple helix, and creative class models in that it focuses on the spatial environment and the interaction of key actors in the region (Stam 2017; Spigel 2017). However, the ecosystem model differs from these in its sharper focus on the entrepreneurial firm/entrepreneur instead of on the relationships or interactions among the constituent actors (e.g., firms, governments, and universities) (Stam, 2015). Consequently, the ecosystem model offers a fuller analysis of entrepreneurship and its impact (Audretsch, 2015; Motoyama & Knowlton, 2014). Examining entrepreneurial firms using an ecosystems lens, therefore, offers a more focused and important developing perspective.

Aspects of the ecosystems literature relevant to this project relate to policy, stage of development, and university involvement. The focus of ecosystem policy is the subject of some debate. For example, Isenberg (2011), and Mason and Brown (2013a & b) suggest the entrepreneurial ecosystem policy should be focused on high-growth entrepreneurs since their impacts on innovation, employment and economic growth are dramatic. Stam (2015, see also Stam et al, 2012) argues that entrepreneurial employees and innovative startups can also have economic benefit and should be included in the ecosystem approach. Researchers have recognized that ecosystems can move through a life cycle. Brown and Mason (2017) distinguish between embryonic and scale-up ecosystems, while Cukier, Kon and Krueger (2015) have developed a four stage model of startup ecosystems including; nascent, evolving, mature, and self-sustainable. The point here is that not all ecosystems are alike, that sustainability is based on constant renewal via new startups (Malecki, 2018), and that development depends on the actions of a range of actors, with entrepreneurs and their firms in the lead (Autio et al., 2014; Feld 2012). Interestingly, universities are often invoked as hubs and central actors of successful entrepreneurial ecosystems, with only entrepreneurs considered more critical to ecosystem success (Bramwell & Wolfe, 2008; Malecki, 2018; Motoyama & Knowlton, 2017). The success of university involvement is often based on intermediaries including technology transfer offices, incubators, research centres, and makerspaces that support the local ecosystem(s). Of course, universities and colleges also provide highly qualified personnel who play important roles in entrepreneurial ecosystems (Bramwell & Wolfe, 2008).

The key focus of this study is the knowledge seeking behaviour of ecosystem participants as it is seen as critical to entrepreneurial firm success. According to the ecosystems view, many of the resources needed for success exist at the regional level versus within the firm itself (Spigel, 2017). These resources would include knowledge held by local and non-local supports including suppliers, universities, lawyers and accountants, government officials, and other entrepreneurs. This view aligns with the wider literature where knowledge seeking activities have attracted considerable research interest over the past few decades, and the capacity to search, find, and exploit opportunities is also seen as critical to innovation in a knowledge-based economy (Wu & Wang, 2017). The entrepreneurial journey can be summarized, in part, as a process of discovering and exploiting opportunities which is accomplished using firm knowledge seeking capacity (Alvarez & Barney, 2007). Knowledge seeking, then, is a key

ingredient in entrepreneurial success.

There is a variety of work relevant to entrepreneurial firm knowledge seeking. The Schumpeterian view of entrepreneurship places significant emphasis on the individual entrepreneur and internal knowledge capacity of the entrepreneurial firm, including research and development through the firm's own resources (Schumpeter, 1934). More recent research suggests that firms interacting with universities and colleges, research and governments agencies, suppliers, and customers produces more valuable innovation outcomes than insular intra-firm R&D efforts alone (Hall, Walsh, Vodden, & Greenwood, 2014; Tappeiner, Hauser, & Walde, 2008). The growth of complexity in innovation also reduces the adequacy of internal firm knowledge, causing firms to involve more partners and sources of knowledge in their innovation processes (Wu & Wang, 2017). Generally, research on firm knowledge seeking has highlighted the importance of external knowledge to firms (Chiang & Hung 2010). The literature also posits that a firm's ability to seek and recognize value in external knowledge is based on the firms' internal knowledge. In order to use it, the new knowledge needs to be assimilated with what the firm already knows (Cohen & Levinthal, 1990). This view raises the critical importance of a firm's understanding of external knowledge and capacity to guide their knowledge seeking in fruitful ways (Cohen, & Levinthal, 1990; Grimpe & Sofka, 2009).

Other work suggests the need within the entrepreneurial firm for broadly based wide ranging knowledge seeking strategies. These strategies include, 'how to search' or breadth and depth of searches (Laursen and Salter 2006). Wider breadth searches implies multiple sources, while depth alludes to fewer sources and a more intensive search. Research has noted that firms with wider breadth search strategies tend to be more innovative, but that there are decreasing returns (Ferrerias-méndez, Newell, Fernández-mesa, & Alegre, 2015; Laursen & Salter, 2006). Search strategies also comprise 'where to search' or the importance of local versus non-local knowledge search (Bathelt, Malmberg & Maskell, 2004). Knowledge spillovers in clusters reveals the importance of local buzz and local knowledge, while the concept of global pipelines stresses exchanges with external actors (Rodriguez-Pose, 2010). Other research shows that regionally located technological laggards spend more effort learning from local sources of information than non-local sources (Giuliani & Bell, 2005; Wang, 2015). Accessing non-local knowledge, then, seems to lead to greater firm innovation. A third difference in search strategies distinguishes between relatedness/ unrelatedness in innovation, or the overlap between external knowledge searches and the firm's existing knowledge. Wu and Wang (2017) found that related knowledge search helps low-tech firms while unrelated knowledge search supports product innovation in high-tech firms.

While the literature on ecosystems and firm-level knowledge search is informative and strongly argues for the importance of knowledge in entrepreneurial firm creation and development, little research has been done specifically on the knowledge seeking activities of entrepreneurial firms. This work begins to address this gap in our understanding.

The rationale for mapping the evolving St. John's and Corner Brook ecosystems is that this had not been done previously. So this project promised useful insights into their functioning. Further, as this work will, in the future, be compared with other studies being conducted by our project partners across the Atlantic region, there was the distinct possibility of learning from other similar regions. As such, this project will be valuable to ecosystem members and supporters, policy makers, academics, and other stakeholders. Moreover, the work will have practical implications for how these ecosystems can be understood, their strengths and weaknesses, and what can be done to improve them, especially as it relates to their knowledge seeking activities.

This work's objective was to map the knowledge seeking activity in the St. John's and Corner Brook entrepreneurial ecosystems, using social network methodology. In particular, we identified a number of the participants in each ecosystem, mapped their knowledge seeking activity and analyzed these to better understand their dynamics with a view to recommending improvements to ecosystem participants and other stakeholders. Before discussing the details of our methodology it is important to note that we were not attempting to map the entire ecosystem, but rather we gathered a representative sample of the entrepreneurial firms in each ecosystem and mapped their relationships (for more details on this sampling method and its rigour, see: Grosser & Borgatti, 2013).

Research Methodology

The research methodology used in this work can be divided into two main phases, data collection and data analysis. Data collection was based on a quantitative survey instrument developed by Dr. Farrell at St. Mary's University and adapted for the St. John's and Corner Brook regions (to request a copy of the survey instruments, please contact the Principle Investigator). The surveys were designed to provide data that would enable us to map the knowledge-seeking behaviours of participants in the two ecosystems. The surveys collected data on four elements of the respondent's knowledge-seeking: who they contacted; the importance of the interaction; the frequency of interactions; and the type of information being sought (i.e. business/market/financial information or product/scientific/technical information). The frequency of communication (including phone, face-to-face, and electronic) was based on the previous year's activities, while importance was ranked using a seven-point Likert scale. Respondents described who they were seeking knowledge from based on given eight categories of ecosystem actors (i.e. entrepreneurial firm, support organization, venture capital/angel network, financial institution, university/ college/research, accounting firm, law firm, and government agency).

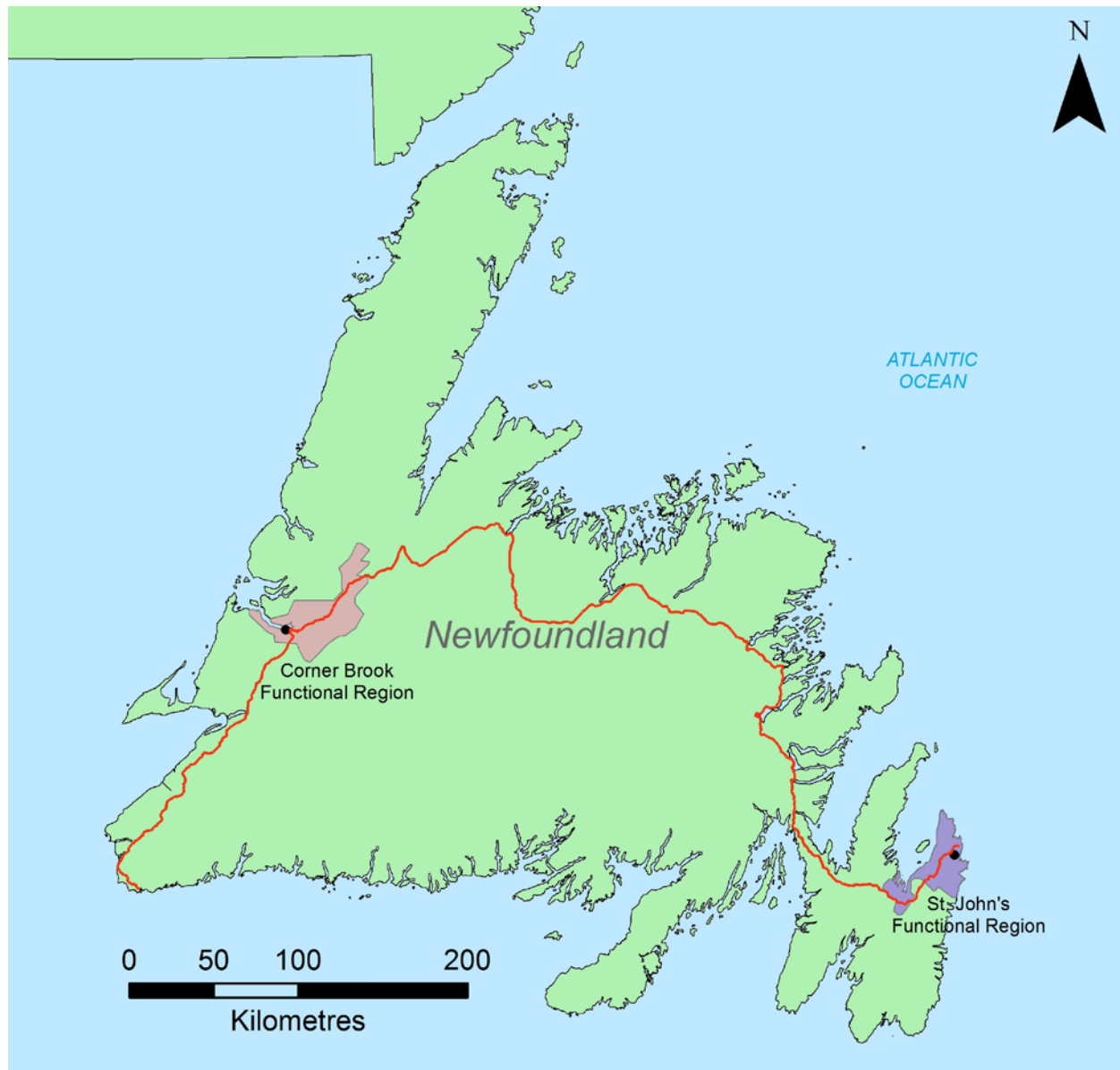
This study was focused on two urban regions, Corner Brook and St. John's, on the island portion of the province of Newfoundland and Labrador. These regions are based on the Functional Economic Regions, defined by Freshwater, Simms, & Ward (2014) as an area delineated by the commuting patterns of people working/living in the locality. The St. John's functional region is the largest urban centre in the province, and includes all of the

Northeast Avalon. Both, though quite different, are examples of regions within the province capable of sustaining entrepreneurial ecosystems. St. John's is one of Atlantic Canada's 11 urban centres and Corner Brook is one of 29 Atlantic Canadian small cities and regional towns (Freshwater, Simms, & Ward, 2014). The regions were selected based on the premise that the research could provide recommendations for strengthening each and that they likely had good comparability to other similarly sized regions in Atlantic Canada.

St. John's is located on the Avalon Peninsula at the province's eastern end (see Map 1 for details). In 2011 the St. John's region (Northeast Avalon) population was 203,325. The population increased 8.0% between 2006 and 2011 (Community Accounts, 2018). The median age in 2011 was 40 compared to 44 for the province. The region's income per capita in 2013 was \$39,800, the province average was \$34,500 (Community Accounts, 2018). Key occupations include sales and service, business, finance and administration, education, law, and government services.

Corner Brook is a regional centre on the island's west coast (see Map 1 for details). In 2011 its population was 41,125, which represents an increase of 0.4% since 2006 (up from 40,970). Over the same period, the entire province experienced a population increase of 1.8% (Community Accounts, 2018). The median age in the region was 46 and average income per capita was \$31,600 for 2013 (provincial average \$34,500) (Community Accounts, 2018). Occupations with the highest employment included sales and service, trades, transport and equipment operators, education, law, and government services.

Map 1: St. John's and Corner Brook Regions



Source: Office of Public Engagement

The surveys were sent in two rounds, in a modified snowball sampling process, and completed between October 2016 and June 2017. There was no single readily accessible list of ecosystem actors, so choosing potential survey respondents was based on researcher and key informants' expertise. Initially respondents were drawn from the local entrepreneurial community and then further respondents were drawn from government officials, entrepreneurial support organizations, and universities/colleges. A drawback of this approach was the possibility of missing key ecosystem participants, though it is likely that most of those missed were named in the first round and contacted in the second survey round. As when initial survey participants named new actors they were then sent

a survey in the second round (only, though, after their contact details were obtained through public sources). Originally surveys were sent as a fillable PDF document, however, some difficulties were discovered in participants' ability to complete the survey using this format, so a web-based survey was developed and used by most respondents (see Table 1 for details). Ultimately 156 surveys were completed by 51 respondents in Corner Brook and 105 in St. John's (Table 1 summarizes the survey responses from both regions).

Table 1: Completed Surveys (Web and PDF based)

Corner Brook Web	35
Corner Brook PDF	16
Corner Brook Total	51
St. John's Web	67
St. John's PDF	38
St. John's Total	105
Overall Total	156

All survey emails were addressed to respondents under the principal investigator's (Blair Winsor) name/email for the St. John's portion of the study and the co-investigator (Ken Carter) for Corner Brook in order to take advantage of their relationships in the respective ecosystems and to add credibility to the survey invitation. Both the PDF surveys and the web-based surveys were exported to a CSV file. The data was then cleaned by the researchers/research assistants and coded.

In the second phase of the research methodology the data was analyzed using Gephi software employing proven and generally accepted social network analysis techniques (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008; Borgatti, Everett & Johnson, 2018; Lambiotte, Delvenne, Barahona, 2015). The software created edges (or lines) for each interaction in the dataset showing connections between any two nodes (i.e. actors in the ecosystem: entrepreneurial firm, support organization, venture capital/angel network, financial institution, university/college/research, accounting firm, law firm, and government agency). The nodes named by different respondents were consolidated in a map where size and centrality reflects the node's importance and frequency to knowledge seekers within the ecosystem. Each actor type was coded with a unique colour. The resulting maps (see Appendix 2 for examples) show the region's knowledge flows and highlight the central players in these knowledge flows.

Clearances

The project was initially vetted and approved through Memorial University's Interdisciplinary Committee on Ethics in Human Research on March 3, 2016. In

accordance with requirements, this approval was extended by the same body annually for the project's duration.

Project Findings

Turning to the findings, as noted above, we received 156 survey responses with respondents naming 393 different entities or nodes (see Table 2). A total of 1021 knowledge-seeking interactions - edges - were listed by respondents, 329 in the Corner Brook responses and the remaining 692 in the St. John's responses. The survey asked respondents the number of times people connected (frequency) and the significance they attached to this knowledge seeking (importance). The average degree is the arithmetic mean for the number of degrees which each node possesses. The degree value is simply the sum of edges (in either direction i.e. both inbound and outbound) for any given node. These values ranged from 1 all the way to 85, with the average being 5.24. The average weighted degree is calculated by multiplying every nodes degree value by their respective weights. Every edge contains two different values for weight, "importance" and "frequency", these are both numbers from 1-7. For weighted degrees by importance the range in the data is 1 to 489, and when weighted by frequency it is 1 to 228.

Table 2 – Ecosystem Statistics Network Descriptives

	CB	SJ	All
Nodes	178	264	393
Edges	345	692	1029
Average Degree	3.876	5.242	5.24
Average Weighted Degree (Importance)	10.433	14.208	14.16
Average Weighted Degree (Frequency)	5.944	7.644	7.73

The nature of the respondents' profession was also captured (See Table 3 for details). Respondents self-identified on this topic and could include more than one category. Most of the respondents were entrepreneurial firms (54.9% Corner Brook and 49.5% in St. John's). The next largest group was government (25.5% in Corner Brook and 19.0% in St. John's).

Table 3 - Self Identification of Profession (More Than One Category Possible)

	Corner Brook		St. John's		Total	
	Number	Percent	Number	Percent	Number	Percent
Entrepreneur	28	54.9	52	49.5	80	51.3
Social Entrepreneur	8	15.7	12	11.4	20	12.8
Aboriginal	8	15.7	1	1.0	9	5.8
Venture Capitalist	0	0	6	5.7	6	3.8
Private Individual	3	5.9	5	4.8	8	5.1
Business angel network	3	5.9	2	1.9	5	3.2
Lawyer	1	2.0	3	2.9	4	2.6
Accountant	3	5.9	5	4.8	8	5.1
Government representative	13	25.5	20	19.0	33	2.1
Consultant	2	3.9	16	15.0	18	11.5
Journalist	2	3.9	1	1.0	3	1.9
Professor	6	11.8	6	5.7	12	7.7
Employee in a mature company	3	5.9	9	8.6	12	7.7
Research laboratory employee	1	2.0	2	1.9	3	1.9
Banker	0	0	0	0	0	0
Other (please specify below)	9	17.6	14	13.3	23	14.8

Respondents reported high education levels with all but two having had some form of post- secondary education (Table 4 outlines the respondent's educational profiles). Combined, nearly a quarter of all respondents had a master's degree, while more than half had a bachelors' degree. Ecosystem participants in both regions are then highly educated.

Table 4 – Respondent Educational Profile

	Corner Brook Percent	St. John's Percent	Total Percent
High School or Equivalent	24	15	18
Some College	12	5	7
Vocational/Technical School (2 years)	14	7	9
Bachelor's Degree	45	56	53
Master's Degree	24	26	24

Note: Percentages will not add to 100% due to more than one response from individual respondents.

Much of the data is usefully presented on network maps (or graphs) (see Appendix 2). These maps show all the nodes named by respondents and the type and direction of their knowledge seeking interactions. In these maps centrality and node size represent frequency and importance. An examination of these maps reveals that university/college/research, government agencies and support organizations are very important in both ecosystems (see Table 5 and Appendix 2). Most have large node size and are located in the central portions of the maps with multiple edges going in both directions. Financial institutions are well represented too. Venture capital/angel firms, law firms, and accounting firms are more prominently seen in St. John's (see Appendix 2 maps). Also noteworthy was the very small number of nodes outside the region and beyond. A striking feature on both regional maps (see Appendix 2 and Table 5) is the often peripheral location of entrepreneurial firms, many are located on the outer portions of the maps and have few edges with their entrepreneurial firm peers.

Table 5 - Node Type and Importance of Inward/Outward/Combined Knowledge Seeking

Node Type	Weighted (importance) In Degree	Weighted (importance) Out Degree	Weighted (importance) Combined
University/College/Research	27.81	45.81	73.63
Government Agency	26.13	16.00	42.13
Support Organization	16.71	19.75	36.47
Financial Institution	27.75	0.63	28.38
Venture Capital/ Angel Network	24.29	2.29	26.59
Entrepreneurial Firm	6.26	13.42	19.68
Accounting / law firm	13.74	3.98	17.72

Given our focus on the knowledge seeking of entrepreneurial firms it was important to investigate this aspect of the data. In particular, the kinds of information being sought by entrepreneurial firms. The survey asked respondents to distinguish between business/market/financial versus product/service/technical or a combination of both, and whether they were seeking knowledge from entrepreneurial firms or others in the ecosystem (see Tables 6.0 and 6.1). Especially noteworthy here was how little knowledge seeking occurred between entrepreneurial firms. They sought knowledge 441 times and of these only 104 (less than 25%) were from other entrepreneurial firms (see Table 6.0). Also interesting was the split between types of knowledge sought, entrepreneurial firms were seeking business/market/financial knowledge about three times more often than product/service/technical knowledge whether the inquiry was directed at other entrepreneurial firms or any other entity (see Table 6.0 & 6.1).

Table 6.0 – Total Knowledge Seeking by Entrepreneurial Firms

	Business/ Market/ Financial	Product/ Service/ Technical	Both	Neither	Total
SJ All KS	210 (55%)	50 (13%)	96 (25%)	25 (7%)	381
CB All KS	31 (52%)	6 (10%)	8 (13%)	15 (25%)	60
Total KS	241 (55%)	56 (13%)	104 (24%)	40 (9%)	441

Note: CB = Corner Brook; KS = Knowledge Seeking; SJ = St. John's

Table 6.1 – Entrepreneurial Firm to Entrepreneurial Firm Knowledge Seeking

	Business/ Market/ Financial	Product/ Service/ Technical	Both	Neither	Total
SJ E To E KS	38 (44%)	10 (12%)	36 (42%)	2 (2%)	86
CB E to E KS	5 (28%)	4 (22%)	3 (17%)	6 (33%)	18
Combined KS	43 (41%)	14 (13%)	39 (38%)	8 (8%)	104

Note: CB = Corner Brook; E = Entrepreneurial Firm; KS = Knowledge Seeking; SJ = St. John's

This data was thought provoking and raised a number of intriguing points which are discussed in the next section.

Discussion

Not unexpectedly the data did not indicate great differences between the two ecosystems and therefore we are combining the discussion for both in this section. However, there are a few notable differences. Corner Brook had a substantially higher self-identification of aboriginal background compared to St. John's. This is not surprising given the number of residents of the region who were members of the Qalipu First Nation. Another difference is that Corner Brook lacks venture capitalists compared to St. John's which is likely a function of the region's smaller size. However, more respondents in Corner Brook identified as part of a business angel network which would likely compensate somewhat for the lack of venture capital funding availability in the ecosystem. There were also more respondents in St. John's who identified as consultants.

More specifically, examining and reflecting on the findings reveals a number of key points. Firstly, encouragingly, both regions have, arguably, many of the actors needed for a thriving entrepreneurial ecosystem (Malecki, 2018; Spigel, 2017; Stam, 2015). Each region has evidence of entrepreneurial firms, support organizations, venture capital/angel

network presence, financial institutions, venture capital/angel investors, higher education facilities, accounting and law firms, and government agencies, all of which appear to be playing, largely, a positive role. Using Cukier et al's (2015) four stage schema, our preliminary sense of the two ecosystems suggests both were in the evolving stage, with St. John's a little further developed as evidenced by the stronger roles of venture capital and support organizations in that region.

Secondly, most troubling is what appeared to be a lack of interaction among entrepreneurial firms in both regions. There were good examples of entrepreneurial firm driven networking organizations in both regions, including Startup NL and Common Ground in St. John's as well as Humber Valley Entrepreneurs in Corner Brook. However, our data did not show entrepreneurial firms seeking knowledge from their peers as much as from government agencies and support organizations, with less than 25% of knowledge seeking by entrepreneurial firms directed to other entrepreneurial firms (see Tables 6.0 & 6.1). This low level of peer to peer knowledge seeking is contrary to the emphasis in the available literature that suggests entrepreneurial firms are crucial in helping other entrepreneurial firms both build their businesses and the ecosystem (Feld, 2012; Napier and Hansen 2011; Isenberg, 2010). This literature asserts that entrepreneurial firms must play a key role in organizing and defining their ecosystem (Feld, 2012; Isenberg, 2010; Napier & Hansen, 2011). This includes frequent local activities (e.g., mentoring sessions, startup activities, coffee clubs, etc.) and communication among entrepreneurial firms and other ecosystem participants. Governments, universities and other organizations play important supporting, funding and/or 'feeder' roles, according to this view. Thus, building and maintaining the ecosystem must be led by entrepreneurs (Feld, 2012; Isenberg, 2010).

Thirdly, and also troubling is that the responses (See Table 6) had significantly higher knowledge seeking behavior related to business/market/financial knowledge (55%) rather than product/service/ technical (13%), though a number of respondents referenced both (25%). This may be indicating that our entrepreneurial firms are not as innovation focused as they could be or do not have the internal knowledge needed to recognize the value of this type of external knowledge. After all innovation, arguably, requires product/service/ technical knowledge (Cohen & Levinthal, 1990; Grimpe & Sofka, 2009; Laursen & Salter, 2006; Wang, 2011).

Both the second and third findings may be partly a consequence of the substantial presence of government agencies and support organizations in each ecosystem. Both actors may want to reflect on their appropriate roles in the ecosystem. Questions they may consider is this process are: what types of knowledge seeking do they want to encourage and with whom; is their prominence in business/market/financial knowledge seeking related to lower risk funding and, if so, does this point to an immaturity in the island's ecosystems when compared to regions in the world that attract large amounts of financing or is this normal for peripheral regions? More research will, likely be necessary to fully address these questions and the wider issue of what constitutes an appropriate role in a developing ecosystem.

Fourthly, the level of entrepreneurial firm-to-mature firm interaction was lower than expected based on information from established ecosystems (Saxenian, 1996). The maps of the two ecosystems show few connections between newer entrepreneurial firms and mature firms. Arguably, each region's mature firms have significant expertise and capacity to help their region's entrepreneurial firms (Alvarez & Barney, 2001). This suggests that more needs to be done to include the expertise of mature firms in ecosystem activities. Similarly, there was also limited connections to venture capital, with venture capitalists outside the centre in both the St. John's or Corner Brook maps. This may change as the ecosystems mature and deal flow increases.

Fifthly, in addition to government, the maps show that entrepreneurial firms were also seeking knowledge from university/colleges and support organizations. Entrepreneurial respondents referenced the College of the North Atlantic, Memorial's St. John's and Grenfell Campuses, as well as support organizations such as NLOWE, Futurpreneur and the Community Business Development Corporations. The degree of centrality for these institutions as well as node size reflect the frequency and importance of these connections for ecosystem participants (see maps Appendix 2). In addition to government, other support organizations are also important sources of capital for entrepreneurial firms which may tend to skew the knowledge seeking to business/market/financial rather than product/service/technical. Overall, these results tend to show these organizations playing a positive ecosystem role.

Finally, also troubling was that both ecosystems lack many external connections beyond their regions. The literature on innovation systems notes the importance of external connections and that a lack of these can limit innovation in an ecosystem (Bathelt, Malmberg & Maskell, 2004; Rodriguez-Pose, 2010). Survey respondents seldom referenced connections across Atlantic Canada and even fewer referenced any beyond Atlantic Canada to the rest of the world. There was some evidence of actors reaching outside the ecosystem to the broader Atlantic region and beyond (e.g. MARS, Build Ventures). However, there was not as much of this as might be expected in a healthy ecosystem. This suggests weak connections between the two ecosystems and Atlantic Canada, North America, and the rest of the world. Within the province, Corner Brook and St John's appeared to be well connected but both ecosystems connections are island centric. There were a few notable exceptions, both of very well connected individuals and to particular places (e.g. evidence of links to the Caribbean in St. John's likely stemming from a project driven by the Newfoundland Environmental Industry Association). Interestingly, this finding of limited connections beyond a region is consistent with the finding from the Halifax ecosystem mapping project (Farrell & Dennison, 2015).

Knowledge Mobilization

This project was part of a broader Atlantic Canadian partnership that includes St. Mary's University, Memorial University of Newfoundland, Cape Breton University, University of Prince Edward Island and Universite de Moncton. The cooperating universities have held

workshops in Halifax, Charlottetown, and Corner Brook. The Corner Brook workshop took place in April 2017 and included 50 participants from the local ecosystem. An additional session is planned for St. John's in partnership with the Memorial University's Harris Centre. As data becomes available across Atlantic Canada more sessions comparing and sharing research are planned. Findings for Atlantic Canada, including St. John's and Corner Brook, were shared at the Global Consortium of Entrepreneurial Centers in Halifax in the fall of 2017.

Recommendations

The literature on ecosystems and knowledge seeking by firms highlights key elements of successful regions and innovative firms. Based on this literature, there were several expectations formed at the beginning of this study. The first of these was that there would be considerable university/college knowledge search by entrepreneurial firms. This was confirmed through the interviews, with Memorial University's, St. John's and Grenfell Campuses, and College of the North Atlantic, all prominent players in knowledge seeking by entrepreneurs. Second, we expected to find considerable entrepreneurial firm-to-entrepreneurial firm knowledge seeking, however we found much less than anticipated. Third, we expected to find good knowledge seeking beyond the local ecosystems and into Atlantic Canada, North America and beyond. Again, less of this was found than anticipated.

Reflecting on our findings we would make the following recommendations to actors in both ecosystems.

- Entrepreneurial firms, while maintaining their knowledge seeking relationships with others in the ecosystem, should consider doing more among themselves to enhance their ecosystem by taking a greater role in communicating, interacting, and supporting each other.
- Support organizations and government agencies should consider ways to increase knowledge seeking, especially product/service/technical, between entrepreneurial firms or other appropriate sources inside/outside the regions (e.g. directing knowledge seeking entrepreneurial firms to other entrepreneurial firms, hosting/funding entrepreneurial networking events).
- Government agencies, support organizations, and universities/colleges could organize events that bring mature firms and venture capital firms in regular contact with entrepreneurial firms and their ecosystem (e.g. hosting/funding hackathons and networking events, inviting mature firms and venture capital to attend).
- Mature firms could make more effort to interact/mentor entrepreneurial firms in their regions (e.g. include them in R&D efforts, provide office hours, lend resources and/or expertise, hosting/funding networking events, buying products from them, and introducing them to suppliers, customers, and industry partners)

- University/colleges should, with government funding, maintain their long term investment in supporting the knowledge seeking, particularly product/service/technical, in both ecosystems. Their boundary spanning, incubation, networking, research, and teaching activities are critical to ecosystem evolution and growth.
- All ecosystem actors should look to expand extra-local knowledge seeking (e.g. new international linkages could be shared with other ecosystem participants to forge new regional links to extra-local places, combining resources to attend trade missions and trade shows).

Conclusions

This work has led to the first micro-level quantitative understanding of the nature and extent of knowledge seeking in the evolving St. John's and Corner Brook entrepreneurial ecosystems. Key data from over 156 respondents representing a variety of ecosystem actors has been presented. The data was analysed, based on social network analysis, and recommendations were made based on this analysis. Taken together with our Atlantic province colleagues, this project represents an ambitious research program that can give significant insights into the current state of entrepreneurship in Atlantic Canada.

Future work will include comparisons with the data from the work being undertaken across Atlantic Canada in Prince Edward Island, Cape Breton, and New Brunswick (the study of Halifax has been completed). In particular, more study comparing rural results to urban centres across the region needs to be done. The work will also enable further data mining based on gender, age, stage of growth, and industry sector. There is also the possibility to redo the work after a period of years to determine what changes have occurred in the ecosystems.

References

- Acs, Z. Stam, E. Audretsch, D., & O'Connor A. (2017). The linkages of the entrepreneurial ecosystem approach. *Small Business Economics: An Entrepreneurship Journal*, 49(1): 1-10.
- Acs, Z., Autio, E., & Szerb, L. (2012). National Systems of Entrepreneurship: Measurement Issues and Policy Implications. GMU School of Public Policy Research Paper No. 2012-08, SSRN.
- Ahmad, N., & Hoffman, A. (2008). A Framework for addressing and measuring entrepreneurship, OECD Statistics Working Paper No. 2, Organization for Economic Co-operation and Development.
- Aldrich, A., & Zimmer, C. (1986). Entrepreneurship through social networks. *California Management Review*, 33: 3-23
- Alvarez, S., & Barney, J. (2007). Discovery and creation: alternative theories of entrepreneurial action. *Journal of Strategic Entrepreneurship*, 26(November): 11-26.
- Alvarez, S., & Barney, J. (2001). How entrepreneurial firms can benefit from alliances with large partners. *The Academy of Management Executive* (1993-2005), 15(1): 139.
- Audretsch, D., (2015) *Everything in its place: entrepreneurship and the strategic management of cities, regions and states*. Toronto: Oxford University Press.
- Autio, E., Kenney, M., Mustar, P., Siegel, D. & Wright, M. (2014). Entrepreneurial innovation: the importance of context. *Research Policy*, 43(7): 1097-1108.
- Bathelt, H., Malmberg, A. & Maskell, P. (2004). Clusters and knowledge: Local buzz, global pipelines and the process of knowledge creation. *Progress in Human Geography*, 28(1): 31-56.
- Baumol, W., & Strom, R. (2007). Entrepreneurship and economic growth. *Strategic Entrepreneurship Journal*, 1(1-2): 233-237.
- Benjamin, L., Rubin, J., & Zielenbach, S. (2004). Community development financial institutions: Current issues and future prospects. *Journal of Urban Affairs*, 26(2): 177-195.
- Bloom, N., & Dees, G. (2008). Cultivate your ecosystem. *Stanford Social Innovation Review*, 6(1): 47-53.
- Blondel, V., Guillaume, J-L., Lambiotte, R., & Lefebvre, E. (2008). Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment*, 10: 1000.

Borgatti, S., Everett, M., & Johnson J. (2018). *Analyzing Social Networks (2nd ed.)*. London, UK: Sage.

Bramwell, A., & Wolfe, D., (2008). Universities and regional economic development: The entrepreneurial University of Waterloo. *Research Policy*, 37(8) 1175-1187.

Brown, R., & Mason, C. (2017). Looking inside the spiky bits: A critical review and conceptualisation of entrepreneurial ecosystems. *Small Business Economics*, 49, 11–30.

Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, 43(7): 1164-1176.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35(1), 128–152.

Community Accounts 2018, <http://nl.communityaccounts.ca>, last accessed March 30, 2018.

Cukier, D., Kon, F., & Krueger, N. (2015). *Towards a software startup ecosystems maturity model*. Technical report RTMAC-2015-03. São Paulo: University of São Paulo, Department of Computer Science.

Farrell, E., (2016). *Weak ties and global reach: network theory and the Atlantic entrepreneurial ecosystem*. Working Paper Series No. 2016-01. Halifax: Sobey School of Business.

Farrell, E., (2017). *The role of mature firms in an entrepreneurial ecosystem*. Conference Paper presented at the University Industry Interaction Network in Dublin, June 7-9, 2017.

Farrell, E., & Dennison, N. (2016). *Quantitative analysis of the Atlantic entrepreneurial ecosystem's innovation activities*. Working Paper Series No. 2016-03. Halifax: Sobey School of Business.

Farrell, E., & Dennison, N. (2015). *Measuring and mapping knowledge-seeking behavior in an entrepreneurial ecosystem*, Conference Paper submitted to Financing Knowledge Transfer Conference, Rimini, Italy, April 16, 2015.

Feld, B. (2012). *Startup communities: Building an entrepreneurial ecosystem in your city*. Hoboken NJ: John Wiley & Sons.

Ferreras-méndez, J. L., Newell, S., Fernández-mesa, A., & Alegre, J. (2015). Industrial Marketing Management Depth and breadth of external knowledge search and performance: The mediating role of absorptive capacity. *Industrial Marketing Management*, 47: 86-97.

Freshwater, D., Simms, A., & Ward, J. (2014). *Local Labour Markets as a New Way of Organizing Policies for Stronger Regional Economic Development in Atlantic Canada*. Report prepared for the Harris Centre Memorial University of Newfoundland.

Giuliani, E., & Bell, M. (2005). The micro-determinants of meso-level learning and innovation : evidence from a Chilean wine cluster, *Research Policy* 34: 47–68.

Government of Canada Small Business Statistics 2016, http://www.ic.gc.ca/eic/site/061.nsf/eng/h_03018.html; last accessed March 13, 2018.

Grimpe, C., & Sofka, W. (2009). Search patterns and absorptive capacity: Low- and high-technology sectors in European countries. *Research Policy*, 38(3): 495–506.

Hall, H.M., Walsh, J., Greenwood, R. and Vodden, K. 2016. Advancing innovation in Newfoundland and Labrador: Insights for knowledge mobilization and university-community engagement. *Journal of Community Engagement and Scholarship*, 9(1): 19-30.

Hechavarria, D., Renko, M., & Matthews, C. (2012). The nascent entrepreneurship hub: goals, entrepreneurial self-efficacy and start-up outcomes. *Small Business Economics*, 39(3), 685-701.

Hernández-Espallardo, M., Sánchez-Pérez, M., & Segovia-López, C. (2011). Exploitation- and exploration-based innovations: The role of knowledge in inter-firm relationships with distributors. *Technovation*, 31(5-6): 203–215.

Isenberg, D. (2010). How to start an entrepreneurial revolution. *Harvard Business Review*, 88(6): 40-50.

Isenberg, D. (2011). *The Entrepreneurship Ecosystem Strategy as a New Paradigm for Cultivating Entrepreneurship: Principles for cultivating entrepreneurship*. Boston: Babson Global.

Isserman, A. (2007). State economic development policy and practice in the United States. In Plane, Mann, Button & Nijkamp (Eds.), *Regional Planning: Classics in Planning* (Vol. 4). Cheltenham: Edward Elgar Publishing.

Korsgaard, S., Ferguson, R. & Gaddefors, J. (2015). The best of both worlds: How rural entrepreneurs use placial embeddedness and strategic networks to create opportunities. *Entrepreneurship and Regional Development*, 27 (9-10): 574-598.

Lam, J., Carter, K., McGillis, L., Pike, C., McCahon, M. & Vodden, K. (2013). *Networks for Business Innovation in Corner Brook, NL*, Report prepared for the Harris Centre, Memorial University of Newfoundland.

- Lambiotte, R., Delvenne, J-C., Barahona, M. (2015). Laplacian dynamics and multiscale modular structures in networks. *IEEE Transactions on Network Science and Engineering*, 1(2): 76-90.
- Laursen, K., & Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among U.K. manufacturing firms. *Strategic Management Journal*, 27(2): 131-150.
- Malecki, E. (2018). Entrepreneurship and entrepreneurial ecosystems. *Geography Compass*, 12(3): 1-12.
- Mason, C., & Brown, R. (2013a). *Entrepreneurial ecosystems and growth oriented entrepreneurship*. The Hague: OECD.
- Mason, C., & Brown, R. (2013b). Creating good public policy to support high-growth firms. *Small Business Economics*, 40(2): 211-225.
- Mayoux, L. (2001). Tackling the down side: Social capital, women's empowerment and micro-finance in Cameroon. *Development and Change*, 32(3): 435–464.
- Motoyama, Y., & Knowlton, K. (2014). *Examining the Connections within the Startup Ecosystem: A Case Study of St. Louis*. Kansas City: Kauffman Foundation.
- Napier, G., & Hansen, C. (2011). *Ecosystems for scaleable firms*. Copenhagen: FORA Group.
- Obadic, A. (2013). Specificities of EU cluster policies. *Journal of Enterprising Communities: People and Places in the Global Economy*, 7(1): 23-35.
- Ribeiro-Soriano, D. (2017). Small business and entrepreneurship: Their role in economic and social development. *Entrepreneurship and Regional Development*, 29 (1-2): 1-3.
- Saxenian, A. (1996). Inside-out : Regional networks and industrial adaptation in Silicon Valley and Route 128. *Cityscape: A Journal of Policy Development and Research*, 2(2), 41–60.
- Schumpeter, J.A. (1934). *The Theory of Economic Development*, Trans. R. OPIE. Cambridge, MA: Harvard University Press.
- Stuart T.E., Sorenson O. (2005). Social Networks and Entrepreneurship. In: Alvarez S.A., Agarwal R., Sorenson O. (eds) *Handbook of Entrepreneurship Research*. International Handbook Series on Entrepreneurship, vol 2. Springer: Boston, MA.
- Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, 41(1): 49-72.

Stam, E. (2015) *Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique*. Utrecht University: Tjalling C. Koopmans Research Institute.

Stam, E., Bosma, N., Van Witteloostuijn, A., de Jong, J., Bogaert, S., Edwards, N. & Jaspers, F. (2012). *Ambitious entrepreneurship. A review of the academic literature and new directions for public policy*. Den Haag: Adviesraad voor Wetenschap en Technologie-beleid (AWT).

Stangler, D., & Bell-Masterson, J. (2015). *Measuring an Entrepreneurial Ecosystem*. Kauffman Foundation. March.

Tappeiner, G., Hauser, C., & Walde, J. (2008). Regional knowledge spillovers : Fact or artifact ? *Research Policy*, 37(5): 861–874.

Vodden, K., Tucker, A, Gibson, R. & Holley, J. (2011). *Network weaving for regional development on the tip of the Great Northern Peninsula*, Report prepared for the Rural Secretariat, Government of Newfoundland and Labrador.

Wang, C. C. (2015). Geography of knowledge sourcing, search breadth and depth patterns, and innovative performance : a firm heterogeneity perspective. *Environment and Planning A: Economy and Space*, 47: 744–761.

Wang, C. H. (2011). The moderating role of power asymmetry on the relationships between alliance and innovative performance in the high-tech industry. *Technological Forecasting and Social Change*, 78(7): 1268–1279.

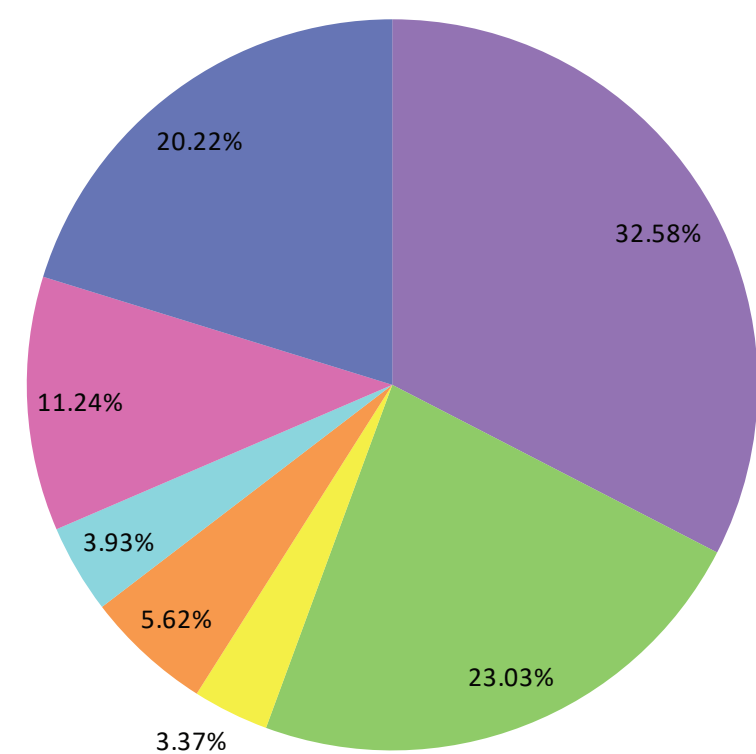
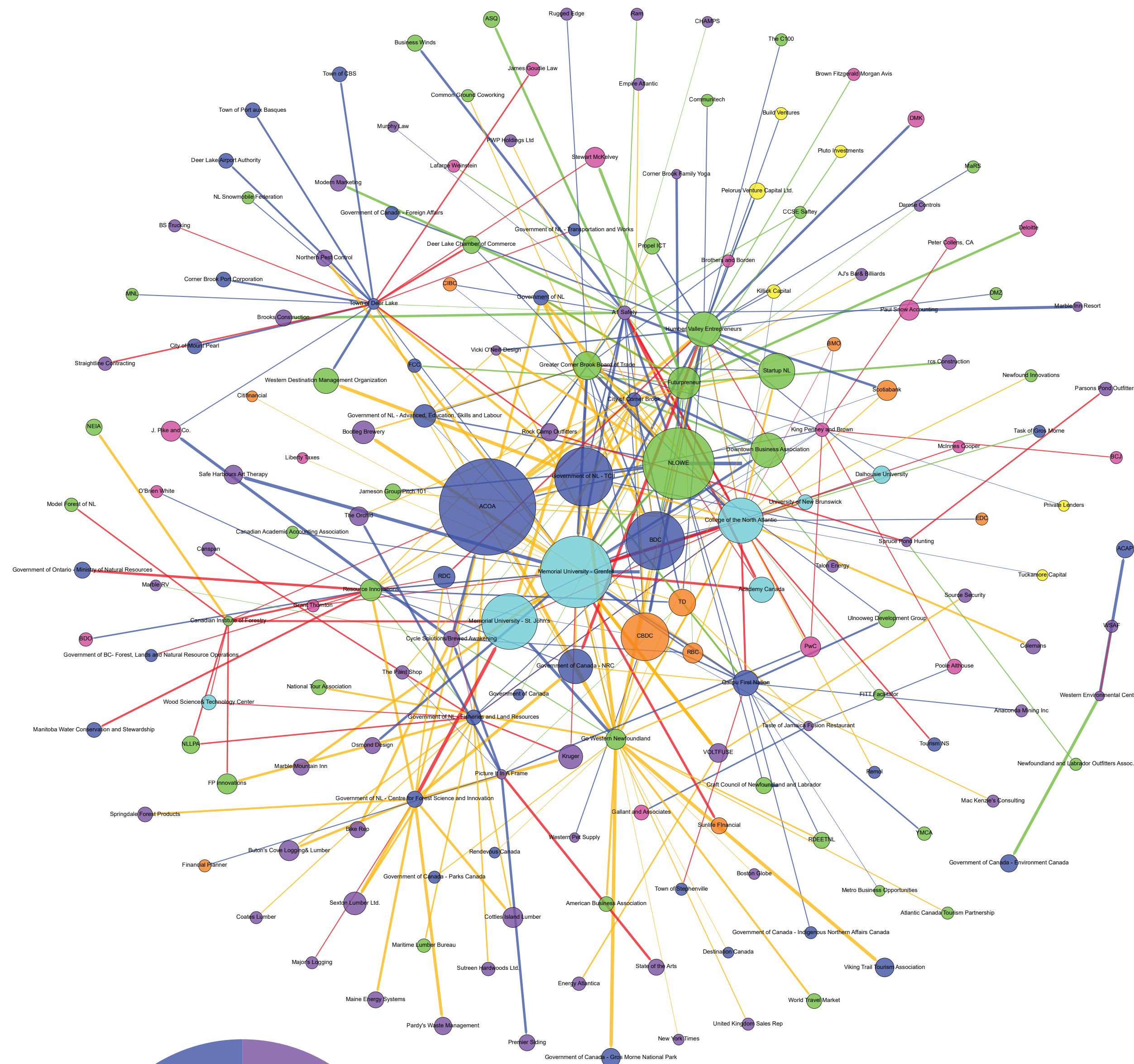
World Economic Forum (2013). Entrepreneurship ecosystems around the globe and company dynamics. Report summary from the annual meeting of the new champions, World Economic Forum, Stanford University, Ernst and Young, & Endeavor. Davos, Switzerland.

Wu, A., & Wang, C. C. (2017). Knowledge search pattern and product innovation of firms in low and high-technology industrial clusters : A knowledge relatedness perspective. *Tijdschrift voor economische en sociale geografie*, 108(4): 488–502.

Zahra, S. & George, G. (2002). Absorptive Capacity : A Review, reconceptualization, and extension. *Academy of Management Review*, 27(2): 185–203.

Appendix 1: Ecosystem Maps

Frequency

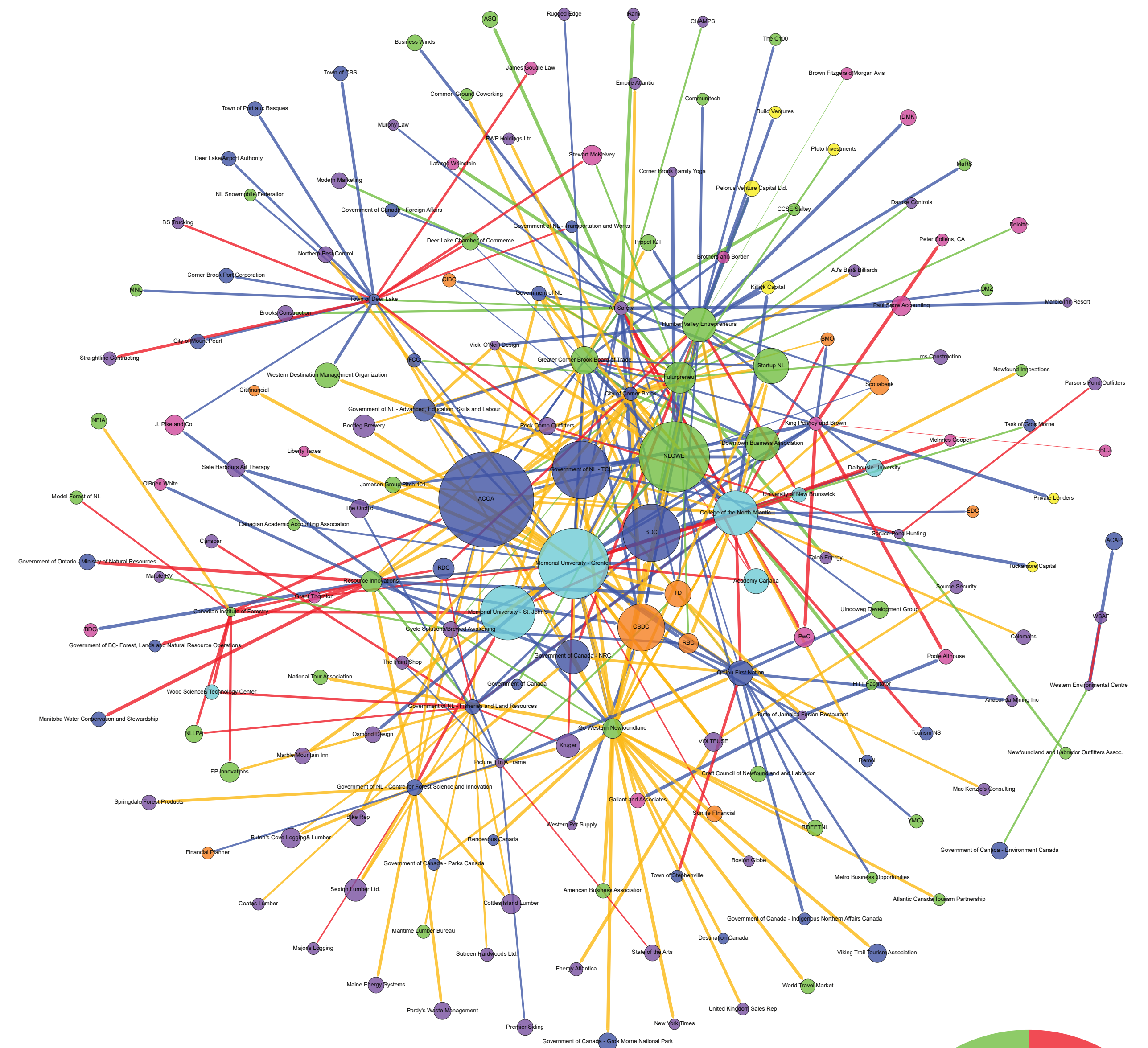


Nodes: 178

- Entrepreneurial Firm
- Support Organization
- Venture Capital/Angel Network
- Financial Institution
- University/College/Research
- Accounting/Law Firm
- Government Agency

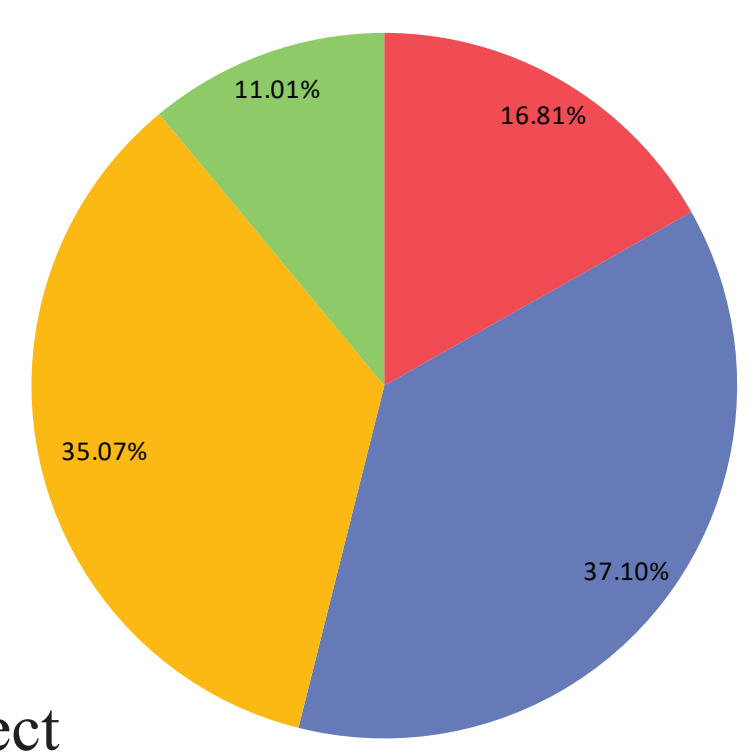
On these charts, the knowledge-seeking actions amongst **Corner Brook respondents** to the Memorial University Atlantic Entrepreneurial Ecosystem surveys are shown based on both frequency and importance.

Importance



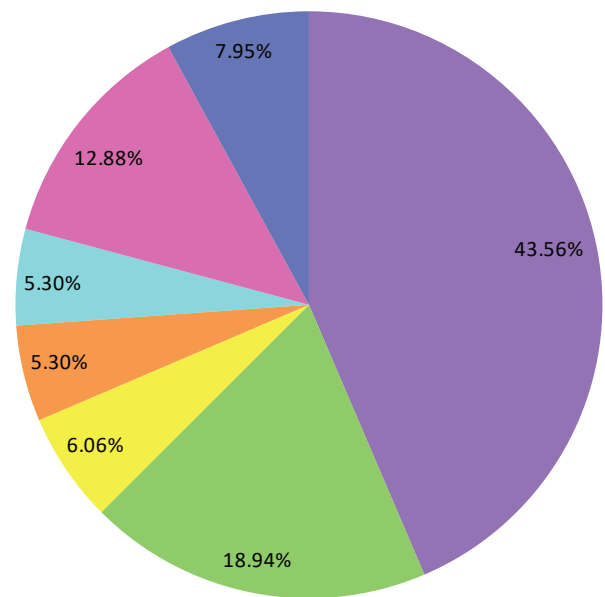
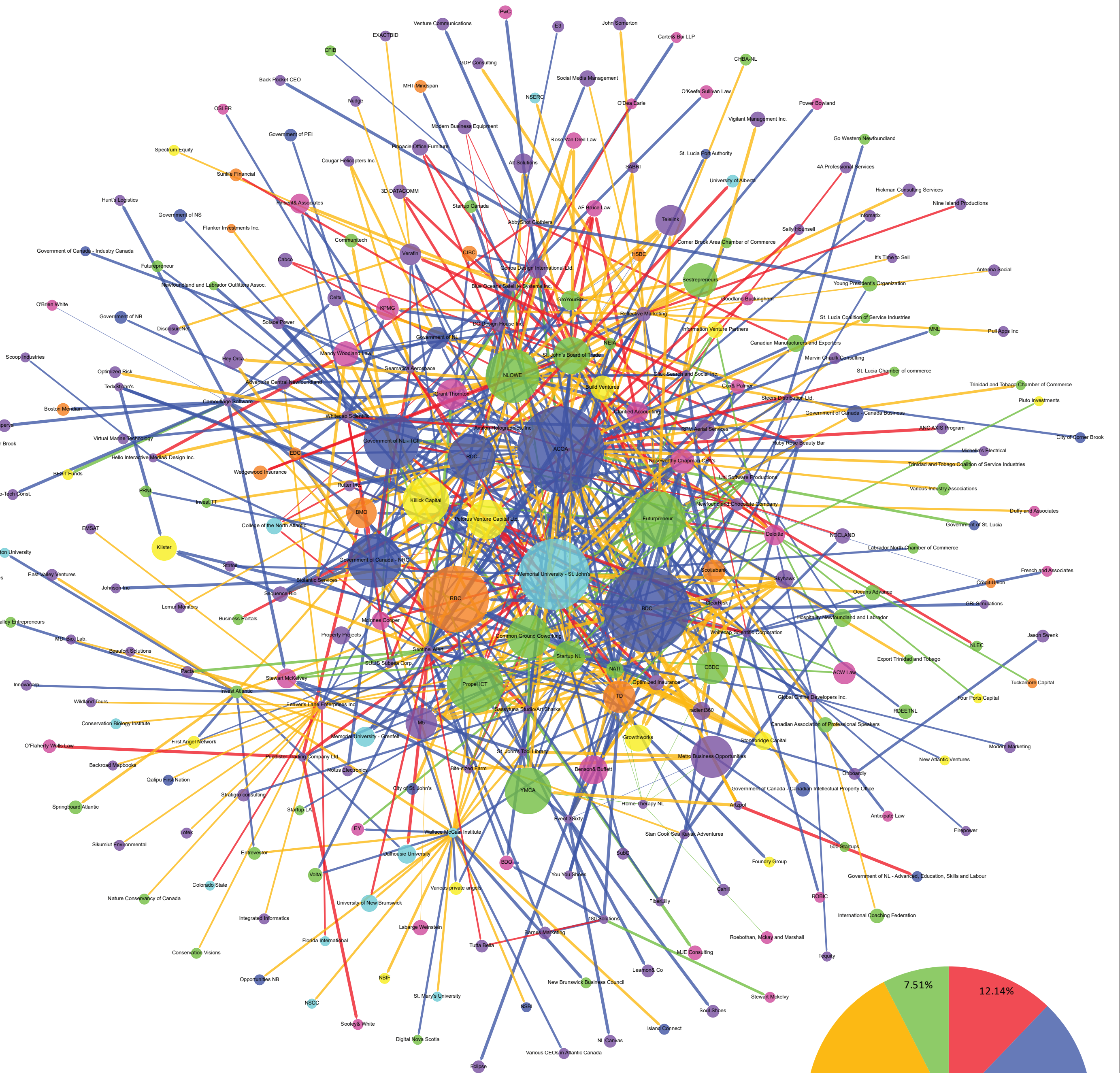
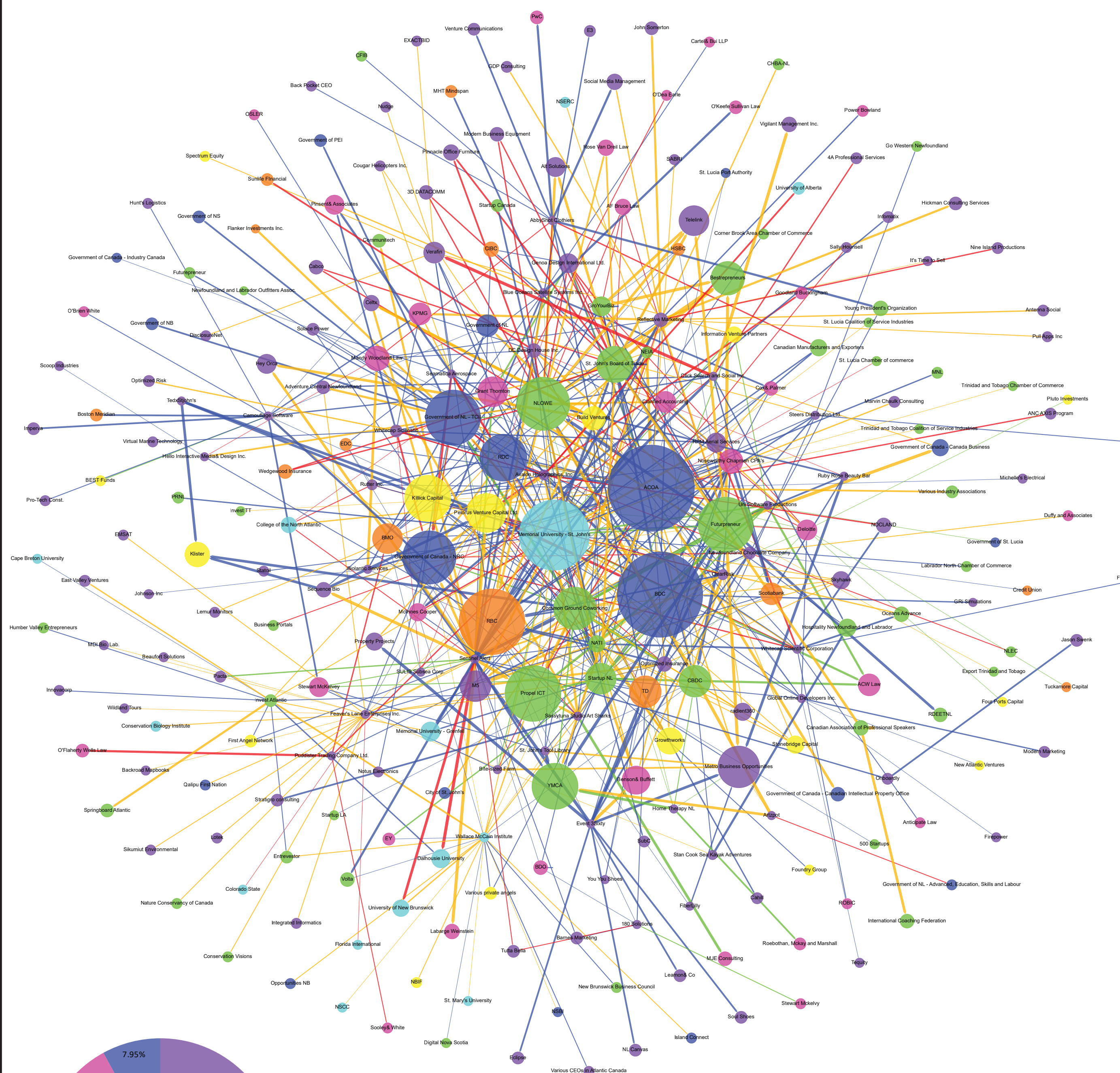
Edges: 345

- Product/Service/Technical
- Business/Market/Financial
- Both
- Neither



Frequency

Importance



Nodes: 264

- Entrepreneurial Firm
- Support Organization
- Venture Capital/Angel Network
- Financial Institution
- University/College/Research
- Accounting/Law Firm
- Government Agency

Edges: 692

- Product/Service/Technical
- Business/Market/Financial
- Both
- Neither

