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Abstracts by Author

Presenter: Utku Ali Riza Alpaydin

Title: University-industry interactions from proximity lenses: Reflections from Norway

Session: 3.2

Location: 108N

Time: 10:30AM-12:00 PM

Abstract:

The interaction between academic and industrial partners is problematic due to a number of factors (Bruneel et al., 2010). The concept of proximity, through its geographic and non-geographic dimensions, has been regarded as a facilitating attribute of interactions, which can eliminate those barriers and ease the process of coordination in these interactions (Boschma, 2005). However, the linkage between university-industry interactions and proximity dimensions has not been dealt extensively. The existing literature has examined this linkage with a narrow focus on innovation-related outputs such as patent citations (Jaffe et al., 1993) and collaborative R&D projects (D'Este et al., 2013). However, the university-industry interactions do not always directly aim at innovation, and involve many other types of interactions (Ankrah & Al-Tabbaa, 2015). The geographical scope of these numerous university-industry interaction channels and the role of different dimensions of proximity on the process of interaction remain unexplored.

Therefore, this paper aims at providing an understanding on the importance of dimensions of proximity in university-industry interactions. The addressed research questions are twofold:

RQ1: Which kinds of interactions are realized at which geographical scales?

RQ2: Which dimensions of proximity are required for what kinds of interactions?

This paper takes a quantitative methodology approach and relies on survey data of 1,201 Norwegian firms located in university regions. For the survey, university-industry interactions have been categorized under three headings (r*esearch-oriented, education-oriented and other interactions)* covering 18 distinct types of interactions ranging from joint research projects to training of firm staff/employees and to creation of new ventures/firms (Spin-offs, start-ups).

The dimensions of proximity were adapted from the framework proposed by Boschma (2005) consisting of geographical, cognitive, organizational, institutional and social proximity. For geographical proximity, a spatial categorization of four scales (within region, within country, within Europe, outside Europe) has been used. For non-geographical dimensions of proximity, the concepts have been operationalized in a novel manner, which distinguishes between the organizational and the personal level. We expect research-oriented interactions to be realized at higher geographical scales than education-oriented and other interactions.

The initial results show that only 19% of the surveyed firms have interacted with universities in the last three years. The most popular interaction types are joint research projects, student projects and informal consultations, in all of which the most dominant geographical scale is within-region interactions.

The study supports the notion that university-industry interactions are mainly realized at the local/regional level. The results convey that the intensity of UIINs decrease when the distance between the interacting parties increases for almost all UIIN types. However, research-oriented interactions are less bounded by limitations of distance and more inclined to occur in geographical distance compared to other UIIN categories, in line with our expectations.

Presenter: Kwadwo Atta-Owusu

Title: University-industry collaboration and regional innovation: Does university research quality matter?

Session: 3.2

Location: 108N

Time: 10:30AM-12:00 PM

Abstract:

Regional innovation policy is increasingly focused on the role of universities in generating innovation and regional development. The number of universities in the world has been growing rapidly, and universities are also increasingly keen to contribute to their regions. However, the geography of scientific research is highly spiky and there are strong Matthew effects in research funding. Furthermore, university-industry collaboration tends to be mainly regional, even more so than other types of innovation collaboration. Hence, the impact of university research tends also to be fundamentally local. This raises the question of whether a regional innovation policy focused on universities may exacerbate the currently uneven regional development trends in the global economy. In light of this, there is a need to examine how peripheral regions engage with universities.

The paper, therefore, investigates the drivers of university-industry collaboration. We first explore whether collaboration with regional, national and international universities is a function of characteristics of the firm or the university. Specifically, we are interested in how the quality of the local university affects the likelihood that firms will interact with local universities and universities outside the region.

The paper draws on a dataset complied from several sources. Using Norway as the empirical context, we gathered information on firm characteristics from three waves of the Community Innovation Survey (CIS) of Norway, supplemented with the Norwegian Linked Employer-Employee Data (LEED). This yielded a representative sample of over 18,000 firms. In addition, we utilized Scopus data to develop a measure of the research quality at the local university in the field most relevant to the firm's industry.

Intriguingly, the results of the analysis show that local universities' research quality relates negatively to collaboration. This indicates that research intensity or excellence-oriented mission of universities can be unfavourable to collaboration with firms. Distance to a university revealed a curvilinear (U shaped) relationship with collaboration, suggesting proximity to a university matters only to a point after which distance has little influence on collaboration. On the firm side, all the factors tested (R&D intensity, size,

other collaborations, and human capital) exhibited positive association with collaboration across diverse spatial scales. This finding confirms the notion that firm attributes play substantial role in determining collaboration decisions.

Presenter: Daniele Battaglia

Title: Project based determinants of academic entrepreneurship as result of proof-of-concept programs

Session: 4.1

Location: CCF

Time: 1:15AM-2:45PM

Abstract:

In this research, we study the effect that the interplay between internal characteristics of Research-Based Innovations (RBIs) and PoCs program have on the different forms of commercialization of research (e.g. licencing, spin offs).

One of the most relevant issues for university managers and policy makers is represented by the commercialization of RBIs developed by the academic faculty. In fact, according to Swamidass (2013), up to 75% of RBIs developed within universities are never licenced and commercialized. Several obstacles and inefficiencies have been identified by previous literature limiting the successful commercialization of RBIs. Among them, the most relevant are related with the lack of available resources to support Technology Transfer (TT; Munari *et al.*, 2016), information asymmetries (Siegel, Veugelers, and Wright, 2007), lack of management skills (Franklin, Wright, and Lockett, 2001) or communication. At the same time research and practitioners have been starting to seek for instruments alleviating commercialization problems. As the funding gap is perceived by public institutions as the most relevant problem (Rasmussen and Rice, 2012), principal instruments identified have been proof-of-concept programs (PoCs) and university seeds funds (Munari *et al.*, 2016). In this research, our focus is on PoCs. PoCs have been demonstrated by previous literature as a favourable instrument for TT since they enable the development of new university spinoffs (Hayter and Link, 2015) and help researchers to assess the commercial potential, to demonstrate the feasibility and value and to facilitate the definition of the strategic plan related with the technology (Kochenkova, Grimaldi, and Munari, 2016). At the same time past research noticed the high heterogeneity in the structure of PoCs offered among different universities in different countries, identifying critical design factors for their implementation (Munari, Sobrero, and Toschi, 2017).

Despite these advancements, literature has not deepened the specific relationship existing between the internal characteristics of RBIs, the PoCs and the commercialization. Internal characteristics (the characteristics of the team working on the RBI, as well its technological content and its development phase) are crucial factors for technology commercialization since they can limit or magnify the impact of PoC programs in relation with commercialization.

We study this issue on a sample of 31 projects developed at Politecnico di Torino and funded under the same PoC scheme between 2016 and 2017. To analyse the data, we employ a Qualitative Comparative Analysis (Ragin and Rihoux, 2009) and we investigate six attributes which are theoretically relevant for

commercialization: the number, the age and the diversity of background of team members working in the same research group; the kind of technology and the degree of maturity underlying the RBI; the *ex-ante* intention of the team to set up a spin off.

The results stemming from the analyses highlight that for successful commercialization (e.g. the creation of a spin off) three requisites are strictly necessary: a high TRL, a previous intention of the team to set a spin off and an engineering-based RBI (instead of a science-based). If these conditions hold, spin offs may arise under four different configurations combining the age of the group, its dimension and the heterogeneity in their background.

These results provide indication to both practitioners and policy makers about the factors to be considered when policies for RBIs are designed. We also contribute to literature moving the attention from the external determinants of RBIs commercialization (as the design of funding instruments, like the PoC, Munari *et al*., 2017) to the internal determinants of projects, as the team and technological characteristics of RBIs.

Presenter: Catherine Beaudry

Title: The role of research funding in African innovation policy

Session: 1.1

Location: CCF

Time: 11:00AM-12:30PM

Abstract:

It is only natural to wonder what returns can be seen from research grants and how much these grants improve productivity. While we fully expect research grants to result in an improvement in research productivity, we need to know more specifics. For example, quite often the levels of funding for many scientists are low, while at other times they are not funded at all. A review of funded researchers by Barnett et al. (2015) showed that allocation of large-scale funding is quite random for medical researchers, and many deserving scientists may not capture the attention of potential funding agencies.

However, there have only been a few studies conducted on the effect that grants have on the importance and usefulness of funded research. Given the significance of government investment in health-related research, this necessitates exploring the impact of funding with a special focus on government sources. This article examines the relationship between research funding and the productivity of researchers in Africa. The efficacy of research funding on research productivity holds global significance for all government funding.

In this analysis, we utilize survey data collected via a web-based structured questionnaire for the Global State of Young Scientists precursor study in Africa (GLOSYS). We then match the data with the articles that were extracted from Leiden University's Centre for Science and Technology Studies' (CWTS) in-house database for the publications with those that have at least one author with an African affiliation. The questionnaire was developed in English and French and administered between May 2016 and February 2017.

We contribute to a greater understanding of the relationship between research funding and research output in Africa by utilizing the articles published by funded researchers. These articles have been adjusted for the quality of publications by the number of citations that the articles received and by the normalized journal score of the publications. We determined that research funding had a strong positive effect on knowledge production, suggesting that the allocation of funding to health-related research is extremely effective.

Moreover, in this article, we provide a broad overview of collaboration measures and their impact on research publications and other metrics based on citations and the journal impact factor score. Understanding the impact of these collaboration metrics is increasingly critical for policymakers in light of the focus on improved productivity. When evaluating the collaboration measures, some reviews place a higher value on the number of authors, number of institutes, and the number of countries than others do. While these measures trace a logical path between collaborations and productivity, we include additional collaboration measures using social network analysis for co-authorship networks over time in order to provide more accurate measures on research collaboration.

These network metrics capture a wide range of collaboration activities based on co-authorship links within the network and serve as a beneficial method in demonstrating the impact of collaborations on scientists' published works. We employ network centrality measures to uncover the importance of network characteristics on published papers and their citations.

Presenter: Catherine Beaudry

Title: Does governmental support help Canadian firms surmount obstacles to innovation and be more innovative?

Session: 2.1

Location: CCF

Time: 3:15 PM - 4:45PM

Abstract:

Canada's sub-par innovation performance has been a concern for a number of years now. Policymakers are therefore on the lookout for appropriate and effective means by which to foster a better environment in which to innovate and to encourage innovation. There is no consensus however on the extent to which such policies should be used. We first build a theoretical framework to study the impact of innovation policy on firm innovation performance. Then, using two Surveys of innovation and business strategies run by Statistics Canada (SIBS) in 2009 and in 2012, we examine whether firms that have taken measures to overcome obstacles to innovation or that have benefited from various government incentives to overcome innovation obstacles have succeeded in innovating.

Our first analysis examines multiple sample definitions to avoid the innovation obstacle paradox where firms that encounter such hurdles are more likely to innovate. For instance, when we include non-technical innovators (those that generate organisational innovations or marketing innovations) results change drastically (not only does the level of significance of the results change, but so do the sign of the coefficients). The reason is simple; the majority of government incentives are targeted at technical

innovations. It is thus imperative to perfectly circumscribe the sample if one is to draw appropriate conclusions.

Our results show that not taking any measures to mitigate innovation obstacles is the worst strategy. Regardless of the success of the measures taken, it is always a better strategy to do something to try to overcome these obstacles to innovation. Second, firms that have used federal government assistance programs to try to surmount these innovation obstacles have a greater propensity to innovate then those that did not use any government support. These same firms also have a greater rate of success when it comes to overcoming obstacles associated with innovation. Obviously, specific government programs, i.e. programs other than direct grants or tax credits that are used widely and not targeted at specific problems, affect differently the capacity of firms to mitigate some innovation hurdles. Training programs, and to a lesser extent, programs aimed at recruiting recent graduates influence the capacity of firms to overcome skills-related difficulties. In contrast, no government programs seem to be able to help firms to mitigate obstacles related to reaching collaboration agreements with external partners or to surmount intellectual property protection or regulatory problems. Now that the government is taking active measures to ensure that heavy regulation does not put a stop or seriously hamper the propensity to innovate, realising which programs are useful, or none as it turns out, to help firms climb over the various innovation obstacles is highly relevant to innovation policy.

Presenter: Shauna Brail

Title: Socially responsible innovation: Ride-hailing, inclusive mobility and cities

Session: 4.4

Location: Board Room

Time: 1:15AM-2:45PM

Abstract:

Ride-hailing is a relatively new, disruptive and controversial form of mobility. Controversy over ride-hailing stems in part from questions regarding whether or not it has a negative impact on public transit use, ethical concerns related to the use of algorithms to entice driver and passenger travel, and uncertainty about the impact of ride-hailing on congestion, total vehicle miles travelled and induced travel demand. Although provisions for accessible, affordable and safe intra-urban mobility are usually governed at the local level, privately-held ride-hailing firms have little incentive to address public good through their technology or services. Therefore, intentional public policy and leadership are required in order to derive public benefit from a private good like ride-hailing which is delivered using public infrastructure.

This paper explores the opportunity for municipal governments to leverage ride-hailing technology and services to promote socially responsible innovation. The paper traces the connections between innovation, public policy and private benefit, suggesting that ride-hailing presents yet another example of an emergent technology and industry that would not exist absent public investment. This is followed by three cases studies in which ride-hailing technology and/or services are being utilized to promote socially responsible outcomes. In Los Angeles, a US Federal Transit Administration grant is partly funding a ride-hailing pilot to address first and last mile challenges of accessing transit for low income riders. A portion of Columbus,

Ohio's $50M US Smart City Challenge Grant is devoted to a ride-hailing service for 500 pregnant women living in parts of the city where infant mortality rates are high. And, in both the global city of Singapore and the small Canadian city of Belleville, transit users have access to ride-hailing technology to summon a public bus operating on a dynamic, algorithm-based route. Through the above case studies, the paper examines the ways in which private sector ride-hailing initiatives can be designed and prioritized to support socially responsible innovation. The paper concludes with a discussion of how we can learn from these examples to extract public benefit from ride-hailing.

Presenter: Dan Breznitz

Title: Technology – A boost or a bane? Inclusive innovation and social choices

Session: 4.4

Location: Board Room

Time: 1:15AM-2:45PM

Abstract:

New technologies are a source of both optimism and dread. This dualism is apparent in the case of People With Disabilities (PWD). On the one hand, new technologies could take the form of assistive devices that help PWD better integrate into the labor market and enhance their capacity to function in society. On the other, new technologies – especially when their development does not follow the principles of universal design – could create new obstacles for PWD often requiring considerable effort to adjust. In an era that is characterized by technological acceleration it is imperative to ask, from a social policy perspective, whether governments could guide technological innovation and absorption in directions that would mainly benefit PWD specifically, and socially marginal populations more generally?

In this study, we approach this question utilizing a qualitative comparative framework focusing on government programs as they apply to PWD relevant technologies in Canada, Israel, Sweden and the United States. Our research is based on document analysis and semi-structured interviews with primary stakeholders and policymakers in the four countries. Our preliminary findings indicate that across all countries policy thinking on how technological development could be guided in directions beneficial to the PWD is marginal. Nevertheless, over the last decade regulatory frameworks that require universal design (that is design intended to accommodate PWD and the elderly in addition to less limited consumers) are gradually evolving. What is generally missing from policy are government efforts to support customized technological innovation targeted for PWD. We argue that not only is this a major oversight, but that commonly employed government instruments, primarily regulation and market-supporting tax incentives, are ill fitted for promoting customized innovation. Governments that wish to advance innovation for PWD should consider both direct state subsidies and appropriate innovation activities within government-sponsored centers.

Presenter: Shiri M. Breznitz

Title: Entrepreneurship education and firm formation

Session: 3.1

Location: CCF

Time: 10:30AM-12:00 PM

Abstract:

Because they recognize the growing interest among students in entrepreneurship, universities have developed a continuum of support activities, such as entrepreneurship education, incubators, and, more recently, accelerators (Wright et al., 2017). Entrepreneurship education, as Gibb (2002) defines, is offered to prepare not only an entrepreneurial person who may become self-employed and an owner of an enterprise but also a person who is able to pursue entrepreneurship and innovation as an employee and/or a person who exhibits enterprising behavior. The content of entrepreneurship education could vary among institutions but is largely focused on new venture creation, covering topics such as writing business plans, networking with customers, and financing entrepreneurial ventures. Many studies show that entrepreneurship education programs contribute to the development of entrepreneurial intentions among students (Fayolle et al., 2006). The entrepreneurial ecosystem (EE) literature, which has attracted attention from both academics and policy makers in the past few years, offers new insights on how to understand the factors that underlie the success of entrepreneurship (Mason and Brown, 2014; Spigel, 2017; World Economic Forum, 2013). Stam and Spigel (2016, p. 1) define EE as "a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory." Despite the increasing significance of this literature, only a handful of studies focus on student start-ups from an EE perspective. Because of the absence of a framework for understanding the ecosystem required to enable students to launch successful start-ups, Wright et al. (2017) identify the relevant elements that facilitate student entrepreneurship, including the university's internal and external context, support mechanisms for student entrepreneurship, and student entrepreneurs themselves. In their case study on the University of Chicago, Miller and Acs (2017) employ Frederick Jackson Turner's frontier theory to construct a framework for understanding the campus as an entrepreneurship ecosystem. The campus entrepreneurial ecosystem is said to possess the characteristics of Turner's frontier: available assets, liberty, and diversity, while creating opportunity and fostering entrepreneurship (Miller and Acs, 2017; Turner, 1894). Yet research that expands empirical evidence on this topic is absent, a gap that the current study aims to fill. Adopting the EE framework, this paper focuses on the growth of student start-ups, especially those that participate in university accelerators. It employs insights from three research streams: the growth of new ventures, the operation of university accelerators, and the entrepreneurial ecosystem. This paper analyzes the University of Toronto (U of T), one of Canada's top research-intensive universities. Specifically, we examine whether U of T entrepreneurship education and service (incubators, accelerators, etc) foster entrepreneurship (via the establishment of firms) as a result of their participation in any of the university's entrepreneurship programs.

Presenter: Anders Broström

Title: Academic engagement and performance-based governance: A re-assessment using experimental data

Session: 4.1

Location: CCF

Time: 1:15AM-2:45PM

Abstract:

University Faculty's outreach activities, also known as academic engagement, are considered an important channel for knowledge transfer between academia and its stakeholders. In deciding how, how much and when to engage in such tasks, individual faculty face inherent trade-offs between time and effort spent on academic engagement and on other tasks. Such decisions are therefore expected to be affected by the presence of performance-based governance – i.e. arrangement whereby the funding made available to individuals, departments and/or universities is being conditioned on performance in one or several dimensions. Schemes rewarding (a subset of) outreach activities may encourage researchers to increase efforts for academic engagement; at least for 'measurable' activities (Rossli & Rossi, 2016), and for junior faculty (Zhao et al., 2019). Correspondingly, increasing the pressure for publication output may shift individuals' priorities away from outreach activities.

However, there is very little research engaging directly with how individual behavior regarding academic engagement is affected by the mode of governance. In one of the very few studies to address this issue, Salter et al. (2017) report that respondents to a UK survey are (somewhat surprisingly) found to consistently prioritize impact over publication, even when impact is not of a type rewarded in the existing system for performance-based governance. This pattern is reported to hold for respondents of differing rank and status.

In this study, we re-assess the impact of performance-based governance on the prioritization of outreach activities by junior-level faculty. Specifically, three modes of governance are compared: 1) a situation where an individual's resources for research are conditioned on past individual performance; 2) a situation where an individual's department's resources for research are conditioned on past department performance; and 3) a situation where resources are not conditioned on past performance. We investigate both self-reported sensitivity to changes in the governance structure on prioritization of academic engagement (stated preference) and, using an experimental approach, estimated sensitivity to such changes (revealed preference). Data collection is at the time of writing on-going.

Presenter: Federico Caviggioli

Title: Counterfeits: An empirical analysis of economic performance and innovative activities of affected companies

Session: 1.4

Location: Board Room

Time: 11:00AM-12:30PM

Abstract:

Counterfeits are illegal products that are produced and commercialized in violation of a proprietary brand, copyright, patent or other Intellectual Property Rights (IPRs) (Qian, 2014). The latest, and most comprehensive estimate indicates that counterfeits amount to about 2.5% of worldwide and 5% in the

European Union (OECD, 2009; OECD-EUIPO, 2015). Recent reports showed that counterfeiting is growing in trend and expanding beyond the traditionally-targeted sectors, like cigarettes, watches, and apparel, and increasingly targeting high-tech products, like memory sticks, solid state drives, sound apparatus, video games (OECD, 2017) and related products (BSA, 2016).

Economic theory has highlighted the potential damages that counterfeits can cause to the welfare (Grossman and Shapiro, 1988a; 1988b) and evidenced that strong IPRs are especially important for companies operating in highly innovative markets (Hu and Png, 2013; Brandstetter et al., 2011: Brandstetter, 2017). At the same time, economic theory has also highlighted that counterfeits and piracy may induce indirect and potentially positive externalities that derive from an increase in the brand circulation or user base of the products of targeted company (Qian, 2008; Qian, 2014), particularly in the presence of network externalities or bandwagon effects (Conner and Rumelt, 1991; Takeyama, 1994). In these cases, a positive externality may partly or totally counterbalance the negative effect of imitation, making the net impact of counterfeiting a question that should be ultimately investigated empirically.

Amid different predictions of economic theory, the empirical evidence concerning the implications of counterfeits at present is scant, limited in scope and breadth and inconclusive (Feinberg and Rousslang, 1990; Staake et al., 2009; Qian, 2008, 2012; Qian et al., 2015). Furthermore, due to the lack of micro-level data on counterfeits, the empirical analyses that exist have attempted to investigate the implications of counterfeits only at the aggregate industry or economy level, and not at the level of single companies. This paper is aims at addressing this gap by investigating the implications of counterfeiting for the economic and innovation performance of companies at the firm level.

We focus on a group of highly innovative companies, i.e. the digital technology companies. We build a new database that integrates and combines information on counterfeiting from the OECD-EUIPO database (OECD, 2017), economic and financial data from Orbis-Bureau van Dijk and EIKON Datastream, and patent data from Clarivate. The data cover firm-year information about 260 digital-technology companies in the period 2009-2015. The database enables unprecedented empirical analyses on the counterfeiting and performance of companies affected by counterfeiting. We find that counterfeited activities were targeting specifically the highly profitable companies and companies that have a high propensity to innovate (larger patent portfolios), prior to the observation of counterfeiting activities.

We assess empirically the correlation between infringement and various indicators of economic and innovation performance by adopting estimation methods based on difference-in-difference and propensity score matching. Results indicate lower growth rates of Operating Profits for digital technology companies targeted by counterfeiting with respect to control samples of digital-technology companies not affected by counterfeiting. In particular the econometric models provide robust evidence of a negative impact of counterfeiting on both EBITDA (Earnings before interest taxes depreciation and amortisation) and EBIT (Earnings before interest taxes). Concerning the innovative performance, the study finds that the companies affected by counterfeiting had larger patent portfolios compared to those not affected by counterfeiting prior to the observation of counterfeiting events and that this difference decreases over time. However, the relative decrease is not statistically significant, when we control for potential confounding factors. Hence the analysis did not find significant impact of counterfeiting on the patenting activities of companies.

Furthermore, there is no observable effect on the investment in intangible assets between companies affected and not affected by counterfeiting.

Presenter: Sen Chai

Title: Pre-competitive consortia: An underutilized technology transfer tool?

Session: 4.2

Location: 108N

Time: 1:15AM-2:45PM

Abstract:

Firms who operate at the frontiers of science and technology are often faced with a dual challenge. Not only do they have to push a product through its development cycle and into the marketplace, they also often have to advance an underlying production process or key building block technology. In semiconductors or advanced materials, the high levels of investment needed to conduct basic R&D can be substantial. In drug development and bioinformatics, the scope of data collection can be inordinately large. In fields like these, scale and scope demands on R&D inputs and capabilities may be beyond the reach or justification of many companies, big or small, effectively limiting entry to all but the best funded firms or those with government sponsors.

To address this challenge, many companies establish external collaborations through alliances and joint ventures, as this is a powerful way to spawn new ideas and improve innovative performance (Gulati, 1998; Khanna, Gulati, & Nohria, 1998; Mowery, Oxley, & Silverman, 1996). A less used form of collaboration is known as a pre-competitive consortia (PCC). Pre-competitive consortia are early stage external research collaborations in which partners from different institutions, public and private, work together on a common technology platform for which they will subsequently independently develop differentiated downstream products. The industrial partners work together with other industrial partners but also academic partners on the platform technology. However, the industrial partners potentially compete with each other in downstream product markets using that shared platform. PCCs are a closed consortium model that bring many of the benefits of open innovation while maintaining options on proprietary access for consortia members to the intellectual property and learning that might result. It is a more controlled approach than open-sourcing part of one's value chain in areas that are important enablers of value delivery.

PCCs are not that commonly used. In this article, we investigate the benefits of PCCs, then discuss some of the perceived impediments to their more widespread use. Finally, we examine some structuring considerations – who to partner with and how they are managed.

We look at several cases in detail, including Biopro, a collaboration in the Danish biotech manufacturing sector, SEMATECH, a research, development and testing consortium in the semiconductor industry, some work in advanced semiconductor chip manufacturing in Upstate New York that had its roots in what was called the Common Platform Alliance, and the TiFN food and nutrition consortium in the Netherlands. We find that while this type of collaboration poses contractual, managerial and legal challenges, we believe that more companies should push past the obstacles and engage in these partnerships. The value brought by

these collaborations in enhancing the effectiveness of R&D processes or the development of foundation technologies while reducing costs and developmental risks outweighs the costs.

Presenter: Haneul Choi

Title: Assessing the role of championing leadership in enhancing academic entrepreneurship: Evidence from U.S. research universities

Session: 3.4

Location: Board Room

Time: 10:30AM-12:00 PM

Abstract:

All research-intensive universities have establishing technology transfer offices TTOs (Bercovitz & Feldman, 2008), as well as numerous programs and initiatives to promote entrepreneurship and the commercialization of university research (Siegel and Wright, 2015), demonstrating that the norm of academic entrepreneurship has been fully diffused. However, there are huge variations in actual university technology transfer activities. Against this backdrop, researchers have asked the following questions: Why are the widespread adoption of TTOs and encouragement of university technology transfer activities not producing the expected outcomes? Why is there variation in technology transfer outcomes among the universities?

This study adopts a "micro-level" perspective on academic entrepreneurship, focusing on psychological and organizational factors that may affect this activity. Given that a successful university technology transfer is ultimately up to the active involvement of individual academic scientists, micro perspective can provide a better insight into academic entrepreneurship (Balven, Fenters, Siegel, & Waldman, 2018). Balven et al., (2018) propose three types of micro factors within academic entrepreneurship: 1) self-contained micro-processes that incorporate cognitive or affective phenomena; 2) relational factor focused on interaction with other individuals (i.e., department chair, colleagues, etc.); and 3) interaction between individuals and organization level factors (i.e., university tech transfer policies, organizational culture).

Among three types of micro processes, we take the second and the third perspective of micro-processes focusing on leadership roles in reducing barriers to academic entrepreneurship. Specifically, this study examines whether the championing leadership mitigates the negative impact of 1) lower organization level receptiveness to academic entrepreneurship; and 2) lack of information - scientist's weak understanding and knowledge of how to initiate technology transfer processes.

We test our hypotheses using longitudinal data from 391 academic scientists and engineers at 25 major U.S. research universities. Our econometric results indicate that championing leadership can have a positive influence of the propensity of scientists to engage in academic entrepreneurship. We find no evidence of an association between lack of receptiveness to academic entrepreneurship and technology transfer intention of university scientists. However, we find that informational barrier (i.e., confusion regarding commercialization process, lack of knowledge whether and how TTO can help them engage in academic

entrepreneurship) is a strong factor that undermines academic scientist's intention to engage in technology transfer activities in the future.

We find no evidence of any direct role of championing leadership. However, we find that championing leadership mitigates the negative relationship between the informational barrier and future technology transfer intention. The finding, in general, suggests that academic entrepreneurship is well received, at least in our study sample, and may no longer be a huge barrier for potential academic entrepreneurs. However, informational barriers such as scientists' confusion regarding the technology transfer process and their lack of awareness of TTO's role, may still be a huge barrier to academic entrepreneurship. There could be many ways to help potential academic entrepreneurship, and this study suggests the role of championing leadership as an alternative to foster academic entrepreneurship.

Presenter: Paige Clayton

Title: Funding emerging ecosystems

Session: 4.2

Location: 108N

Time: 1:15AM-2:45PM

Abstract:

Surprisingly little research examines how financing that supports entrepreneurial businesses promotes regional growth and influences industry emergence. Studies tend to examine one program in isolation. Yet the combined impact on a regional economy—the sum of effects on individual firms—remains unexplored. This paper extends the literatures on entrepreneurial ecosystem building and industry emergence, as well as public-private funding interactions and R&D funding policy. We analyze the development of one industry in one region over a long-time horizon, focusing on the interacting roles of state and federal public funding and private funding of new firms. Specifically, we ask how the interplay of these three sources influenced the emergence of North Carolina's Research Triangle region’s life sciences industry. We use data from the PLACE: Research Triangle database on the universe of 670 entrepreneurial life sciences firms founded in the region between 1983 and 2012.

The Research Triangle’s life sciences cluster is one of the largest in the country, anchored by the three research universities, a long history of pharmaceutical branch plant location and a large number of entrepreneurial startups. Its origins can be traced to Research Triangle Park’s 1958 establishment—the result of a collaborative effort involving politicians, academics, and financiers. Over time, the region slowly nurtured an entrepreneurial ecosystem, thanks to mergers and layoffs from high-profile multinational firms, a more aggressive technology transfer stance from the region's research universities, and the development of a plethora of support institutions.

The paper employs mixed methods to examine industry emergence, beginning with an historical analysis of the cluster’s development. To examine the interplay between public and private funding of startups, we first apply Granger causality tests. We find varying relationships based on the life sciences sub-sector. For human therapeutics, federal and state funding evolve together, while federal funding predicts private

funding. For medical devices, state funding predicts federal funding, while the state-to-private relationship is mutually predictive and federal funding predicts private. We next use discrete event history analysis to investigate how the variety of multi-level public and private funding influences ecosystem emergence through firm survival. We find private and federal funding decreases the probability of firm failure, while state funding likely goes to more high-risk firms. Finally, preliminary threshold regression results indicate three statistically significant structural breaks in regional industry dynamics occurred during the time period of study when the industry can be seen to move from a period of emergence to take-off, then to a period of expansion, and most recently to a period of maturity, based on the number of firms founded annually.

Ultimately, our results demonstrate how the actions of multi-level public and private actors coalesced to support the emergence and development of an entrepreneurial ecosystem. This paper contributes to the literatures on entrepreneurial ecosystems, funding of innovation, and regional development, highlighting the roles of universities, incumbents, policy makers, and other ecosystem stakeholders. Furthermore, findings offer practical insights for policy makers and business strategists.

Presenter: Sarah Crane

Title: Maximizing innovation and technology commercialization of federal research investments through the best practices of innovation and economic prosperity universities

Session: 4.1

Location: CCF

Time: 1:15AM-2:45PM

Abstract:

Research universities and Federal Research Labs (FRL) are the cornerstone of American innovation. The country's national competitiveness depends on these institutions to increasingly perform, translating research into the innovative products the country needs. However, technology commercialization is a nonlinear process and difficult to achieve efficiencies and address gaps. To address this, it is necessary to understand best practices for high-performing universities. This study investigates the best practices of 59 Innovation & Economic Prosperity (IEP) designated universities in technology commercialization. Among a sample of 110 public doctoral universities in the U.S. with detailed technology commercialization output data available between 2012 and 2016, those with the IEP designation produced a significantly higher mean volume of new disclosures, new patents, startups initiated, and exclusive licenses and options**.** This demonstrates the unique qualities of this study group with its intentional focus on economic development and innovation.

The study team performed a mixed method analysis to determine best practices. Qualitative data informed thematic groupings of the best practices, while quantitative survey data helped inform the validity of the finding. The study collected and analyzed primary, original data from 261 participants involved in technology commercialization:

- 51 interviews with IEP university faculty researchers,
- Ten interviews with affiliates of the federal research laboratories, and

- 200 surveys with IEP survey panel members, including Vice Presidents for Research, technology transfer staff and angel investors.

Results indicate four themes of best practices: culture, champions, incentives and collaboration. Universities with a strong cultural emphasis on lab-to-market promote its value both internally to the university, as well as externally to the surrounding community. Strong technology ecosystems are dependent upon champions - experienced professionals assisting in the maturation of a technology through expert guidance and mentorship. Incentives are vital to motivate and reward new ideas, while resources provide the necessary environment for continued growth. Finally, key collaborations are necessary throughout the process to foster ideas and to access resources throughout the ecosystem. These best practices form a foundation that can guide, grow, and evolve as IEP universities experiment and implement lab-to-market ideas.

Presenter: Margaret Dalziel

Title: Creating high-potential alumni entrepreneurs: The imprinting effect of student work terms

Session: 2.4

Location: Board Room

Time: 3:15 PM - 4:45PM

Abstract:

Asymmetrical information on business possibilities is essential to the discovery of opportunities (Shane, 2000; Shane & Venkataraman, 2000), and while mature entrepreneurs benefit from prior experience as an entrepreneur, employee, or user (Agarwal et al., 2004; Westhead et al., 2009; Shah & Tripsas, 2007), for many young entrepreneurs, their only exposure to the world of business, health care, or transportation is as a consumer, patient, or passenger. In cases where an initial idea is wanting, the prospects of a successful venture may remain limited despite pivots and enabling inputs such as coaching and financing. An important question is therefore: How can young entrepreneurs get good ideas?

We begin with a sample of alumni entrepreneurs that have been identified as having raised venture capital financing by Pitchbook, a venture capital (VC) analytics firm, and investigate the sources of their ideas, focusing on the work terms in which they engaged while undergraduate students. Our hypothesis is that student work terms will have an imprinting effect on the ventures of alumni entrepreneurs. Our sample of alumni entrepreneurs are graduates of the University of Waterloo (UW), in Canada. UW has been identified as an exceptional university due to its inventor-owned intellectual property policy (Kenney & Patton, 2011) and its effect on local economic development (Bramwell & Wolfe, 2008). According to Pitchbook, UW ranks 1st in Canada and 20th in the world in terms of its ability to produce VC-funded alumni entrepreneurs (Pitchbook, 2016).

Our sample consists of 157 employer-venture pairs and up to 413 control group firm-venture pairs. We use over 150,000 USTPO patents to test our hypotheses, finding support. Our contributions to the academic literature are three. First, while entrepreneurship scholars investigating opportunity identification acknowledge the importance of available opportunities and asymmetric information relevant to those

opportunities (Shane, 2000; Shane & Venkataraman, 2000), there is little empirical evidence on the relationship between idea sources and subsequent ventures. To this literature we contribute evidence of the technological antecedents of a sample of VC-backed ventures, based on an examination of patents and their references. Second, in so doing, we bring knowledge proximity measures, frequently used in studies of technological diversification and clustering, to the field of entrepreneurship and demonstrate the use of a knowledge proximity measure of proven reliability (Yan & Luo, 2017). Third, we provide evidence of the minimum "stamping" (Ellis et al., 2017) requirement for an imprinting effort. For policy makers interested in enhancing the viability of the ventures of young entrepreneurs, we point to the potential of cooperative education programs in enabling entrepreneurs, while simultaneously preparing students for the workforce and providing employers with fresh talent.

Presenter: Antonio De Marco

Title: Global versus local star inventors: Human capital and firm innovation activities

Session: 2.4

Location: Board Room

Time: 3:15 PM - 4:45PM

Abstract:

This paper aims to improve the understanding on the relation between a firm's innovation activity and the individual contribution of the employed inventors. The study builds on the literature linking the resource-based view of firms and the human capital theory, by focusing on the micro-foundations of strategic capabilities (Tzabbar and Kehoe, 2014). Previous research on firm innovation activities at the micro-level has focused on the role of inventors in shaping firm innovation output (Grigoriou and Rothaermel, 2014). Past works analyzed the role of star inventors and found a general positive impact on productivity, cumulative knowledge generation, and value of inventions (Hohberger, 2016). Moreover, they have been found to have positive network effects improving the productivity of coinventors (Oettl, 2012). Recently, negative effects associated to the presence of star inventors have been advanced: they could limit the emergence of other innovative leaders in an organization and fall in the trap of organizational myopia (Chen and Garg, 2018).

At the firm level, the presence of star inventors has been studied in relation to the company's technological scope and the level of exploitation of current technological assets with respect to the propensity to explore new technological fields. Previous research found mixed results on the correlation between the presence of start inventors and the commitment to exploitation / exploration.

This research aims to analyze and compare the innovation output of firms employing global star inventors (i.e. highly productive with respect to the technological field or the whole industry), firms relying on local star inventors (i.e. suboptimal stars but highly productive within the organization boundaries), and firms with an equally distributed involvement of the inventors' team. Our study will provide a quantitative analysis of the contribution of firm inventors to the innovation output with respect to different team configurations.

The empirical setting focuses on the teams of inventors working for US firms operating in the '*Medical Devices*' sector. The time window of analysis is between 2005 and 2010. The employed data repositories are the following: the last available version of PATSTAT for patents; the inventor names disambiguated by the application of the algorithm of Li et al. (2014); information on deaths from the US Death Master File.

The expected contributions of this research are twofold. First, we introduce a measure of concentration of the contribution of inventors that makes possible to distinguish the presence of global and local star inventors. Second, we follow the approach described in recent literature employing data on inventor deaths as an exogenous shock to evaluate the impact on firm-level innovation performance. The results will contribute to the understanding the role played by different type of inventors in sustaining innovation activities in firms, which constitute one of the resources to gain competitive advantage.

Presenter: Kevin De Moortel

Title: International academic mobility and entrepreneurial knowledge: The moderator-mediator role of interpersonal networks

Session: 4.1

Location: CCF

Time: 1:15AM-2:45PM

Abstract:

Globalization and internationalization drastically change the higher education sector in the 21st century (Knight, 2004; Audretsch, Lehmann, & Paleari, 2015). Academics increasingly move across international borders for educational, scientific, or commercial purposes (Rostan & Höhle, 2014; IOM, 2004). We refer to these movements as *international academic mobility*. At the same time, academics are increasingly challenged to engage in entrepreneurship next to their teaching and research duties (Davey, Rossano, & van der Sijde, 2016). Such engagement requires knowledge on how to start and operate a business including know-how on opportunity recognition or exploitation and on functional aspects of starting and running a business (Honig, 2004; Pretorius, Nieman & van Vuuren, 2005). We refer to this knowledge as *entrepreneurial knowledge*. Studies on how international academic mobility relates to academic entrepreneurship are scarce but add crucial insights to debates on career development, incentive systems, and university or government policies towards entrepreneurship (Wright, 2014). While scholars find support that international academic mobility stimulates academic entrepreneurship (e.g. Krabel, Siegel, & Slavtchev, 2012), we lack understanding on the relation between international academic mobility and the academics' receipt of entrepreneurial knowledge as a result of this mobility. We address this research gap and examine interpersonal networks as moderator and mediator of the relation between international academic mobility and the receipt of entrepreneurial knowledge. From a knowledge-based perspective, we theorize that an academic's international academic mobility and interpersonal networks allow to accumulate entrepreneurial knowledge. Interpersonal networks provide necessary knowledge to pursue certain career paths, like commercialization (Davidsson & Honig, 2003; Light & Gold, 2000; Shane & Cable, 2002) and international mobility serves as a way to augment the academic's interpersonal network which allows for the accumulation of additional multi-faceted knowledge that cannot be obtained otherwise (Edler, Fier, &

Grimpe, 2011). As an empirical setting, China's current knowledge and innovation-driven economy increasingly relies on a high amount of international academic mobility, e.g. through CSC scholarships, the Graduate Students Joint Training program, and returnee professors, to drive academic entrepreneurship (Zhang et al., 2010). While Chinese academia is currently in a state of uncertainty towards embracing entrepreneurship, e.g. on incentives, university missions, and support systems, *guanxi*, i.e. interpersonal relationships, may form a safeguard in such uncertain environment (Fu, 2016; Liu, 2016; Xin & Pearce, 1996). A structural equation model for moderation and mediation is used to analyze the survey responses of a sample of Chinese academics.

Presenter: Pablo D'Este

Title: Aligning scientific impact and societal relevance: The roles of academic engagement and interdisciplinary research

Session: 1.2

Location: 108N

Time: 11:00AM-12:30PM

Abstract:

Scientific findings from publicly-funded research are increasingly expected to demonstrate both scientific impact and societal relevance. Scientific impact is associated with achieving recognition within the community of scientists; while societal relevance is related to the capacity to respond to the needs of non-academic audiences. Despite the advocacy of policy discourses, the pursuit and achievement of this dual mission face important challenges. The logics governing the production of research findings with scientific impact may substantially differ from (and often conflict with) the mechanisms underlying the generation of findings that achieve societal relevance.

This paper investigates factors associated with knowledge production processes that contribute to reconcile these two missions. First, we examine whether academic engagement in productive interactions with non-academic actors contribute to attenuate the potential tensions between scientific and societal goals, by shaping scientists' cognition, skills and attitudes. Second, we investigate whether scientists who exhibit a stronger involvement in interdisciplinary research approaches are particularly capable to achieve greater performance in both scientific impact and societal relevance.

We expect that engagement via joint research is likely to be conducive to benefits associated to both scientific impact and societal relevance, since this type of interactions provide the mechanisms to arbitrate conflicting interests and respond to goals that meet the expectations of academics and practitioners alike. We also argue that interdisciplinary-oriented scientists are likely to benefit from enhanced scientific performance in terms of both scientific originality and potential applicability.

Our primary data derived from a large-scale survey of 57,406 scientists in the Spanish public research system. The population covers all fields of science including engineering and physical sciences (STEM), biology and medicine (BIOMED) and social sciences and humanities (SSH). We received a total of 11,992 valid responses. In addition to the survey data, information was collected from two secondary sources. First,

altmetric data provides information on publication mentions in social media platforms. We have collected mentions to scientific articles from three social media platforms which try to cover non-academic audiences - i.e. blogs, news and policy briefs - as a proxy to capture societal relevance. Second, bibliometric data from WoS, which included the number of publications published by each scientist as well as the number of citations received by each paper in order to capture scientific impact.

Our findings of a regression analysis suggest that the involvement in joint research with non-academic actors and in interdisciplinary research teams contribute positively to the scientific researchers' capacity to jointly reach societal relevance and scientific impact from public science. Our results support the presence of highly heterogeneous profiles among the population of scientists. Whereas some scientists achieve impact within scientific communities, others achieve greater visibility among non-academic audiences, while still others produce research results which reach both the communities of scientists and practitioners. The results of this study have important policy implications, since they inform on modes of research that might be particularly conducive to integrate distinct research logics, and to overcome the challenges of pursing research goals to reach the communities of scientists and practitioners.

Presenter: Hassan P. Ebrahimi

Title: Using convergent innovation to achieve inclusive innovation goals: A modular governance framework for addressing complex social problems

Session: 4.3

Location: B019

Time: 1:15AM-2:45PM

Abstract:

This paper presents a conceptual governance framework to address complex social problems at the base of communities more broadly. Using the Convergent Innovation (CI) approach as a basis and building on theoretical foundations in modularity, network brokerage and interdependence, we propose that modularization in these contexts is a dialectic, emergent process that brings together a convenor-led network formation with consultative problem definition and solution design. We also posit that social systems are imperfectly modular and need purposefully designed interface governance to integrate the modules. Finally, we elaborate on how modularity may be leveraged to simultaneously observe the interests of participating actors and deliver societal value, making the solution sustainable and scalable and addressing the distribution of value appropriation among innovating actors. The propositions together advance a governance framework for a modular, multi-actor adaptive system capable to offer innovative solutions for the dynamic diversified social problems.

Methods:

This paper develops a conceptual framework for governance of an innovation approach as solution for addressing complex social challenges. The governance framework draws out the key insights that would inform the development of the framework and identifying the critical gaps that exist. We build on convergent innovation as an extension of inclusive innovation as a starting point and complement this

literature with two bodies of literature to advance the governance framework. First, we leveraged the literature on modularity. Modularity provides a way to break down complex systems into manageable components. Then, we married this with the literature on network governance. In such an approach, each module is perceived as a collaborative inter-organizational network that may have a range of governance mechanisms based on the characteristics of the network.

Results:

The developed governance framework enables to: first, manage the scale of the problem by involving a variety of actors in the solution, and breaking the problem down into a set of modules that each address a part of the overall problem; second, manage the modular interfaces to stitch components together to create a solution system; and third, in order to make these collaborations sustainable and effective on sufficient scale, it simultaneously creates value to participants and to society at large. CI proposes forming cross-sectoral, collaborative platforms between different actors. In such a scenario modularity can leverage the capability of the actors. We posit a convenor is required for understanding the larger problems, involving and orchestrating a network of actors.

Conclusions:

The governance framework advanced in this paper makes several important contributions. First, it provides a theoretically-grounded actionable framework for addressing complex social problems. Second, it extends modularity into the social sphere. Third, it paves the way for discussing how society can harmonize the engines of wealth creation and societal well-being. We advanced the conversation on addressing pressing complex social problems in three ways. First, while our paper takes CI as the entry point, the modularity-based governance mechanism we advanced can be extended to other solution types. Our framework resolves the dichotomy of whether a top-down or a bottom-up approach is more suitable to address complex social problems by arguing that a convener is needed to catalyze and facilitate solutions by bringing together actors and positioning their respective interests, capabilities and actions in relation to that of others. Third, our framework contributes to research on collective action to address complex systemic challenges. Summarily, the framework provides an actionable and scalable solution to address inclusive innovation goals such as responsibility in innovation.

Presenter: Ruben Fotso

Title: Estimation of indirect effects of technological platforms as technology transfer tool: The impact of French Technological Research Institutes on non-beneficiary SMEs performance

Session: 2.2

Location: 108N

Time: 3:15 PM - 4:45PM

Abstract:

Although knowledge spillovers are at the core of the innovation policy's justification, they have never been properly measured by any impact evaluation. This paper fills this gap by estimating the spillover effects of the Technological Research Institute (TRI) policy in France. The objective of the paper is to analyze and

evaluate the indirect impact of innovation programs based on science-industry transfer to improve innovation policy decisions. More specifically, it analyzes and estimates the effects of technological platforms used ad technology transfer tools, on the performance of non-recipient SMEs. For that, we consider the French TRI called "Nanoélec", one of the TRIs based on technological platforms, located throughout France. To evaluate the indirect effects, we focus on geographical proximity by considering that the non-recipient companies located in treated department are likely to benefit from local knowledge spillovers. To the best of our knowledge, this empirical work is the first impact study that seeks to evaluate the indirect impact of a TRI on the performance of SMEs. Technological platforms are one of the preferred tools in France to accelerate the knowledge transfer from science to industry. Despite their proliferation, their real impact on performance of the companies remains un-evaluated. Therefore, this study contributes to the literature on the indirect impact of technological platforms. This work also contributes to the literature on the evaluation of innovation policies based on science-industry transfer. Indeed, one of the foundations of these innovation policies is to generate the knowledge spillover that can benefit non-direct beneficiaries. Despite the importance of this policy, no empirical study, to the best of our knowledge, has sought to evaluate the indirect effects of these policies. From a sample of 270 SMEs observed over the period 2008-2016, the difference-in-difference method combined with matching methods tend to show that the non-beneficiary companies, located in the treated department significantly improve their socio-economic performance (turnover, financial autonomy and share of managers) compared to control companies located in the control departments. The analysis of the dynamic of the effects indicates that performance does not improve immediately after the treatment but rather with a time delay. Furthermore, it should be noted that the indirect beneficiary companies that effectively benefit from knowledge spillovers are constituted of local control companies, that is to say, the non-beneficiary companies, located in the control departments, with similar characteristics than those of treated companies.

Presenter: Nancy Gallini

Title: How important are patents in the decision to scale up and commercialize Canadian innovations?

Session: 1.4

Location: Board Room

Time: 11:00AM-12:30PM

Abstract:

Several studies, attempting to explain why Canada consistently underperforms in innovative output, have noted that Canadian researchers, while productive in early stages of innovation, are less successful at scaling up their operations. Building upon these studies, we attempt to understand more fundamentally the role played by the patent system in impacting incentives for innovators to advance along the innovation process.

While intellectual property (IP) – or property rights on intangible assets – are fundamental to a well-functioning innovation market, we find little evidence that strengthening patents in a small open economy as Canada would have much impact on scaling up innovation activity in Canada. Of greater importance to Canadian inventors is the ability to acquire patents and operate in global markets. Drawing from the economic literature, we argue that patent ownership is a key factor in inventors' ability to advance along

the innovation process from discovery to commercialization. However, while patent ownership of Canadian small and medium enterprises (SMEs) can mitigate uncertainties of scale up, patents held by large firms can add to the costs of scale up when the patents are complementary inputs essential for product development. Furthermore, when SMEs anticipate competing with large, vertically integrated firms, they may find that selling their IP and other assets can be a more attractive option than scaling up.

We then turn to data on patent ownership by Canadian residents. USPTO patent data reveal that the majority of patents filed in the U.S. by research teams with at least one Canadian inventor are assigned on the date of issue to a foreign firm or subsidiary, and this pattern holds across several technology areas. For the data we examine in Artificial Intelligence, for example, Canada ranked in the top quarter in "inventiveness" among peer countries, but only in the middle of the pack in "ownership". In preliminary findings using a sample of patents invented with Canadian input, patents were more likely to be assigned to a Canadian resident, the greater the proportion of Canadians on the research team, and for those patents originally assigned to Canadian residents, approximately one-quarter were reassigned to foreign firms within the next ten years, and therefore not advanced in Canada for commercial exploitation.

Lastly, we examine current and prospective policies in Canada aimed at promoting better management of Canada's IP assets, such as the new National IP Strategy and its initiatives toward patent collectives and patent trolls. We also examine innovation policies that impact IP indirectly, namely tax credit and direct research funding programs. We observe direct support to be more closely associated with high patenting across peer countries than indirect support through tax credits. We recommend that policies be aimed at reducing cost inefficiencies of accessing global markets – such as high search costs of identifying prior art and overlapping patents – that could incentivize scale up while increasing the return on research investment, in contrast to policies that tax IP sales or inefficiently retain IP in Canada. Toward informing these policies, we conclude with several research questions for further examination.

Presenter: Aldo Geuna

Title: Multinational companies and industrial inventors' interactions with international universities

Session: 1.2

Location: 108N

Time: 11:00AM-12:30PM

Abstract:

While there is an extensive literature exploring the presence ofinteractions between firms and local universities (Fritsch 2001; D'Este and Iammarino, 2010; Laursen et al. 2011; Bouba-Olga et al. 2012), as well as the role of geographical distance as a mediating factor in university-industry interactions (Mansfield and Lee 1996; Hanel and St-Pierre 2006), more limited research exists on the drivers of collaborations between firms and *distant* universities, particularly those localized beyond national borders (Rõigas et al., 2014; Muscio, 2012) This literature has so far emphasized that since collaborations with distant universities entail higher transaction costs than collaborations with local universities, they are likely to be undertaken

only if their benefits are particularly high; in fact, firms usually consider the former as more valuable than the latter (Weterings and Ponds, 2009).

In this paper, we investigate the role of industrial researchers' social networks as facilitators of interactions with universities in different localities, distinguishing between universities in the same region, in other regions in the same country, and abroad. We rely upon an original survey of university-industry relationships involving 915 industry inventors based in the Italian region of Piedmont. We analyze the extent to which interactions with universities in different localities are enabled by different types of individuals' personal and business networks, controlling for selection bias and for numerous other individual and firm-level factors identified by the literature as important determinants of interactions with universities.

Findings suggest that industrial researchers' personal networks play a greater role in the establishment of interactions with closer universities (in the same regions, and in other regions in the same country) whereas business networks are important for the establishment of interactions with universities abroad.

This paper is original in several respects. First, it is one of few papers that explicitly shed light on the determinants of international collaborations. Many studies analyzing the role of geographic proximity in fostering university-industry collaborations have been carried out with national data, neglecting international collaborations. Even when using geographically more extensive datasets, geographic proximity is usually measured on a continuous scale without considering international collaborations as a special category. A second element of originality of the paper is the focus on the perspective of industry researchers. This is quite rare in the literature. A lot of the research focuses on the factors that increase academics' likelihood to interact with industry rather than on industrial researchers' likelihood to interact with universities.

Presenter: Peter T. Gianiodis

Title: The locus of innovation and entrepreneurship on university campuses: (How) Does it matter?

Session: 3.1

Location: CCF

Time: 10:30AM-12:00 PM

Abstract:

Where the locus of innovation resides on university campuses is an important question in linking human capital inputs – scientific discoveries, technological breakthroughs, etc. – to commercial outputs – licensing agreements, venture formation, and regional economic development. Research suggests that universities have multiple "pockets" of innovation, which vary in orientation, practices and goals; centralized administrative units such as Technology Commercialization Offices (TCOs) try to align these disparate entities to enhance overall performance (e.g. Gianiodis et al., 2016). Yet, tension between the periphery (e.g. scientists and their labs) and TCOs may lead to suboptimal performance outcomes (cf. Valdivia 2013). A potential link to connect the university scientists' potential entrepreneurial capital and the

commercializing efforts of the university's TTO may exist through entrepreneurship educational programs (Audretsch & Keilbach, 2004).

Although the subject of much research, (e.g. forthcoming special issue in JoTT), research on entrepreneurship education and university-based technology commercialization is still not a priority for many scholars. This has led to: (a) a stagnation in entrepreneurship curriculum in business education, and (b) a lack of widely disseminated and systematic evidence on the most interesting and innovative curricula, especially from programs housed outside of business schools. In this study, we seek to address these shortcomings by investigating the efficacy of one type of entrepreneurship education – Blended Entrepreneurial Programs (BEPs). BEPs merge university-level entrepreneurial education with discipline-focused degrees (Turner & Gianiodis, 2018). Though BEPs are growing rapidly, administrators are often underwhelmed with their students' abilities and intentions toward technology entrepreneurship. However, not all BEP offerings suffer the same way; recent research points to some differentiators such as the entrepreneurial experience of students, the robustness of the curriculum, and embeddedness of the program into the regional economy (cf. Duval-Couetil, 2013).

There is much to learn because research on BEPs is at the nascent stage. To date, there has been no systematic review of BEPs, especially how they compare relative to Traditional Entrepreneurship Programs (TEPs), i.e. solely administered through business schools. Given the enthusiasm for academic entrepreneurship (AE) by most universities and their stakeholders, this is surprising. We believe it is time to close this gap with a comprehensive study examining these programs.

Methods and Results

In this study, we analyze data collected from BEPs and TEPs. We create 25 match-pairs based on common similarities – university size, presence of medical and/or engineering school, geographic location, etc. – and compare the programs using several important learning and entrepreneurial performance outcomes – depth of curriculum, robustness of student opportunities, new ventures formed, technologies licensed, etc. We employ both primary (e.g. via structured interviews) and secondary data.

Preliminary findings show strengths and weaknesses in each type of program. For example, BEPs are better at leveraging specialized knowledge to connect innovation to entrepreneurship; whereas TEPs better train would-be entrepreneurs on adaptability skills (i.e. "pivoting"), which enhances the likelihood of launching a venture and for its subsequent survivability. Findings will provide guidance to policy makers and university administrators; the message – to enhance innovation and entrepreneurial outcomes requires a balance between domain-specific and generalist knowledge.

Presenter: Ana María Gómez-Aguayo

Title: Use me when you need me: Firms' co-creation output with universities and the economic cycle

Session: 1.2

Location: 108N

Time: 11:00AM-12:30PM

Abstract:

In this paper, we explore the impact of the economic cycle on university-industry scientific knowledge co-creation output. According to our university-industry cycle theory, there are reasons to believe that economic growth will either encourage or discourage firms to co-create with universities, but the former is more likely to occur in crises and the latter in expansions. To verify this, we use data on Spanish firms' co-publications with universities from 2000 to 2016, which includes the Great Recession started in 2008. Our results agree with the theory, so that when the economy grows fast, firms co-publish less with universities and when the economy grows slowly or contracts, firms co-publish more with universities. Policies to promote university-industry scientific knowledge co-creation output could adapt to the phase of the economic cycle.

Presenter: Marie Gruber

Title: The impact of knowledge networks on the identification of entrepreneurial opportunities by Early-Stage-Researchers (ESRs)

Session: 3.4

Location: Board Room

Time: 10:30AM-12:00 PM

Abstract:

Research about EO highlights the importance of social networks, as mechanisms to access tangible and intangible resources – such as new knowledge and information. The relationship between knowledge and networks has led to the emergence of the concept of knowledge network: "a set of nodes - individuals […] that serve as heterogeneously distributed repositories of knowledge and agents that search for, transmit, and create knowledge - interconnected by social relationships" (Phelps, Heidl, & Wadhwa, 2012, p.3). However, previous studies have often failed to capture two important aspects. On the one hand, existing research has mainly investigated the knowledge networks of senior academic staff and principal investigators, rather than junior researchers' ones. On the other hand, these studies also often use an ex-post approach that lacks a dynamic perspective and is not well-suited to capture the evolution of the network and the knowledge that is exchanged through the ties. In this research, we aim to address these two challenges by investigating the following research question: *How and when do ESRs' knowledge networks contribute to enhance the identification of entrepreneurial opportunities?*

To answer our research question, we conduct a qualitative, mixed-methods study on 14 early-stage researchers, all within the first 3 years of their doctoral research. The first step comprises an online survey oriented to collect information on ESRs' knowledge networks, and which was distributed already twice in a six-month interval to all ESRs. We ask for important sources of knowledge and spotlight 5 types of knowledge: (1) generic and (2) specific scientific knowledge, (3) business-related knowledge and (4) present and (5) future career knowledge. A ranking shows the value of the provided knowledge. The results further allow us to identify the crucial nodes in each of the knowledge networks. Complementary, we conducted 29 interviews with the ESRs, their supervisors and technology transfer officers (TTOs) to deepen

our understanding on how ESRs access knowledge and when they identify and/or abandon (entrepreneurial) opportunities during their PhD trajectory. Interviews with both TTOs and supervisors help us to capture and understand whether the entrepreneurial/scientific orientation of an institution or a research group influence on the ESRs' opportunity identification. Through the active participation in the project, we have the opportunity to build a longitudinal database, which allows us to further analyse the dynamics of the interconnections between reported contacts by all ESRs and follow up on the development of identified opportunities. Our findings show that some ESRs value mobility as a possibility to access new sources and knowledge which results in new ideas and opportunities. We propose that those ESRs take a more central position in the network and foster their relationships. Also, mainly two out of approximately 120 nodes in the network provide valuable knowledge to the ESRs among the five types of knowledge. In contrast, the majority of nodes stands out in one type of knowledge. Through the interviews, we find evidence that the entrepreneurial/scientific orientation of the research group leaders rather than the overall vision on an institutional level impacts ESRs opportunities identification.

Presenter: Maribel Guerrero

Title: Do universities generate bi-directional effects in emerging economies' innovation ecosystems?

Session: 3.2

Location: 108N

Time: 10:30AM-12:00 PM

Abstract:

Universities are identified as organizations that generate and diffuse knowledge, but also interact with several actors, promoting regional development. In this context, the concept of entrepreneurial university emerges, being demanded of that these organizations engage in several forms of technology transfer. Assuming that universities act as anchors in regional development, this article analyzes their role in the structural dynamics of innovation and entrepreneurship ecosystems

In developed countries, the interactions between universities and ecosystems' actors are bi-directional. It allows identifying the impact of universities in the innovative and entrepreneurial activities of firms, as well as understanding how firms provide relevant resources and capabilities to universities. In emerging countries, universities are seen as capable organizations of leveraging regional capabilities. However, the bi-directional relationships among actors tend to be scarce, informal and influenced by dominant actors. As a result, emerging countries' academic organizations face these challenges that make difficult to fulfill their role as entrepreneurial universities. Thus, the following research questions are proposed: how do universities' activities support knowledge flows in innovation and entrepreneurship ecosystems within an emerging economy context? And how do innovation and entrepreneurship ecosystems' actors support the role of these organizations?

Method

Twenty-four actors of different innovation and entrepreneurship ecosystems were interviewed between September and November of 2018. These interviews included technology transfer offices, leaders of

research groups, research centers and companies of the Program PIPE/FAPESP. These agents located in five representative ecosystems of the state of São Paulo, in which the main research intensive universities are also located: Campinas, Ribeirão Preto, São Carlos, São José dos Campos and São Paulo. The research protocols covered several dimensions of analysis: structure and resources, technology transfer, generation of spin-offs, generation of results/impacts in general, internal barriers, geographical dimension of ecosystems, and institutional context.

Preliminary results and implications

Preliminary results suggest that universities play a pivotal role in the analyzed ecosystems. This goes beyond formal relations, also including informal relations with firms and student entrepreneurs. The supply of qualified human resources is highlighted as a main contribution of academia to these ecosystems. Joint research projects and sharing of infrastructures are also mentioned. Additionally, the role of star scientists stands for a key mechanism of academic entrepreneurship. Moreover, it was possible to identify that universities also depend on the support of the firms with which they interact through: (1) provision of financial resources for research projects and for maintenance and acquisition of research assets; (2) entrepreneurial mentoring; (3) generation of new scientific ideas, which can be explored in dissertations and theses; and (4) exploitation of intellectual property rights. In this sense, industry plays an important role in bringing academia closer to market practices and other commercial partners. Several implications emerge from these results. Concretely, policy makers need to understand the systemic nature of the relationships present in innovation and entrepreneurship ecosystems. In addition, even if the impacts of universities are bounded to the local level, it is the global connections that enable academic organizations to leverage regional innovation capabilities.

Presenter: Maribel Guerrero

Title: Does university entrepreneurship ecosystem engage technology commercialization in emerging economies?

Session: 4.2

Location: 108N

Time: 1:15AM-2:45PM

Abstract:

Since the publication of Clarks' book (1998), research about the entrepreneurial universities has increased significantly. Traditionally, several studies tend to take a narrow view of universities and ignoring the impacts generated by graduate entrepreneurs (Wright et al., 2017; Guerrero et al., 2018), academic entrepreneurs (Hayter et al., 2016), and technology transfer/commercialization (Fini et al. 2018) on regional development (Guerrero et al., 2017). However, the debate about how university entrepreneurship ecosystems are configured still needs an in-depth discussion. Based on this academic debate, this paper explores the configuration and impacts of university entrepreneurship ecosystems in emerging economies. We first address which environmental conditions determine the configuration of university entrepreneurship ecosystem' across countries (Acs et al., 2017; Wright et al., 2017). In a context with

institutional voids, entrepreneurial universities should assume the responsibility for reducing them to enhance the quality/quantity of universities' endeavours. It could explain why entrepreneurship ecosystems have become a popular topic of discussion among scholars and policy makers, specially, in emerging economies (Guerrero and Urbano, 2017). Then, we address which types of impacts are generated by university entrepreneurship ecosystems in emerging economies. Very few studies have explored the outcomes/impacts generated by university entrepreneurship ecosystems (Guerrero et al., 2015; Fini et al. 2018). Focusing in an emerging economy, the most effective pillar in the ecosystem will be the entrepreneurship education instead of technology commercialization infrastructures (Guerrero and Urbano, 2017). In this assumption, it is expected that impacts should be reflected in graduate entrepreneurship instead of academic entrepreneurship (Nabi et al. 2016).

Setting the research in a Chilean entrepreneurial university, we used qualitative grounded theory methodology (Eisenhardt, 1989; Eisenhardt and Graebner, 2007). The data collection process adopts the triangulation suggested by Yin (2014) that consists on combining multiple sources to gather data as interviews and secondary datasets provided by the Marketing Intelligence Department. Covering a longitudinal analysis (from 2015 to 2018), our preliminary findings offer interesting insights about the role of institutional voids on the evolutionary entrepreneurial stages of university ecosystems. At organizational level, we identify the nascent technological evolutionary stage of the university entrepreneurial ecosystem (Guerrero and Urbano, 2012; Start-up Genome, 2017). Even the efforts implemented by the university during the last years, the lack of strong research component also explain the premature stage of this entrepreneurial university ecosystem. Adopting an evolutionary approach at university level, we identify that the main challenge was not only defined the most appropriated elements according with potential entrepreneurs' needs but also was configuring dynamic capabilities for capturing impacts (Alvedalen and Boschma, 2017). The lack of understanding of the evolutionary nature limits strategic decisions and the configuration of policies that are required to sustain it in time (Mack and Mayer, 2016). Moreover, immersed in a highly competitive arena, the dynamic capabilities approach also helps to understand how university managers have been transforming business models and introducing agile innovation strategies for structuring a sustainable university entrepreneurship ecosystem (Teece, 2010; Teece et al., 2016). In emerging economies, entrepreneurial universities should redirect and enhance their resources toward strategic decisions that capture sustainable outcomes (Leih and Teece, 2016). Given the qualitative studies' limitations, this phenomenon requests a better understanding of the resources/capabilities that are behind of the university ecosystem elements that generate exponential/sustainable technology commercialization outcomes in long term.

Presenter: Georges Hage

Title: The adoption patterns of advanced and digital technologies in Canada

Session: 2.3

Location: 208N

Time: 3:15 PM - 4:45PM

Abstract:

Technology adoption has multiple benefits including productivity increase and higher quality of products, which in return can lead to increased economic performance. The industry 4.0 revolution is made possible by the advances in ICT technologies allowing the integration of technologies such as cloud-computing and IoT which leads to smart-manufacturing (SM). This paper aims at understanding the adoption patterns of advanced technologies by Canadian firms. In total, we explore four main families of technologies (manual handling, business intelligence, processing, and design) across different sectors.

Our paper uses the apriori algorithm, which looks for patterns in technology adoption. We focus on a market basket analysis approach to understand what bundles of technologies are being adopted by Canadian firms. We look for popular set of technologies but also for sets that are less known and perhaps more used by early adopters. Our data comes from the 2014 edition of the Survey of Advanced Technology (SAT) provided by Statistics Canada. In total, we have 7912 firms who responded to the survey with their technology adoption strategies. These firms come from different industries including the manufacturing sector. In the processing and design families, the most popular set of technologies adopted are (a) Extranet and EDI and (b) Wireless communications for production. This bundle of technologies has been adopted by 22% of firms. Furthermore, when a firm has adopted (b) there is a 61% probability that it will also have adopted (a). A less popular bundle integrated (c) CAE, CAM, Virtual Product development, (d) Virtual manufacturing, and (e) Enterprise Resource Planning (ERP). In fact, only 5.3% of firms adopted it. However, this set seemed to be very complementary for firms because they are almost always adopted together. In fact, if (d) and (e) are adopted, there is a 90% probability that (c) would be adopted as well. This makes a lot of sense because it is a set of technologies that is complementary. ERP will complement virtual product development and production. When we look at additive manufacturing, only 5 % of firms adopted 3D printing. If 3D printing for metals was adopted, there is a 75% 3D printing for plastics was also adopted. This particular set of technologies is isolated from the rest, suggesting that only early adopters have been experimenting with additive manufacturing.

The study confirmed the low uptake of key advanced manufacturing and business intelligence technologies, specifically the additive manufacturing and big-data technologies which are a key application of smart-manufacturing. The study also showed that adopting advanced technologies might be a complex process as firms usually, must adopt not only one technology, but a bundle of technologies. In the era of ERPs, adopting a new technology was a pass or fail. In today's 4.0 world, the process of adopting advanced technologies is more complex because but it becomes even more crucial to implement them in the correct order. Some potential policy implications combining these two results include external and internal talent management as well as a capital investment strategy to ensure the right technologies are adopted at the right time.

Presenter: Christopher S. Hayter

Title: The emergence of the software outsourcing industry in Ukraine: Past developments and future outlook

Session: 2.2

Location: 108N

Time: 3:15 PM - 4:45PM

Abstract:

Ukraine has emerged as an increasingly popular global software outsourcing destination for U.S. and European companies. While a robust strand of outsourcing policy research in the early 2000s focused on the emergence of the "3 I's"—India, Ireland, and Israel—as rapidly-growing outsourcing destinations (Arora and Gambardella, 2005), Ukraine was viewed as a "third tier" nation (Carmel, 2003). However, by 2018, Ukraine exported $4.5 billion in IT services, with 18 of the International Association of Outsourcing Professionals (IAOP) top 100 outsourcing companies with offices in Ukraine employing thousands of software engineers and personnel. After reviewing the empirical literature on global outsourcing and policy, this study will empirically explore factors responsible for the emergence of a Ukrainian software industry, including the role of human capital and legacy education systems, connectivity to the Ukrainian diaspora, and tax and self-employment policies that accelerated its rapid emergence. These factors will then be compared to the development experiences of other outsourcing countries discussed in the literature. Finally, the paper will examine the outlook for the Ukrainian outsourcing industry within the context of that country's challenging economic and political context, including its prospects for moving up the global value chain and contributing to domestic productivity growth. Implications for policy and management will be discussed.

Presenter: Donna Heslin

Title: Entrepreneurship education in Canadian HE: Progression of an academic movement

Session: 3.1

Location: CCF

Time: 10:30AM-12:00 PM

Abstract:

In recent decades it has been recognized that Canada is facing an "innovation gap" relative to our international peers. This gap is largely attributed to economic, political, and cultural factors. As a result of this diagnosis, federal and provincial governments in Canada have provided support for the development of entrepreneurship in higher education as a means to promote innovation and generate employment.

As provincial governments have reacted differently to these efforts, this paper provides a quantitative review of the universities across Canada to assess the embeddedness of curricular and co-curricular entrepreneurship programs within institutions and provides comparisons between provinces. This study further assesses the trends in entrepreneurship education that have developed in relation to institutional type (medical/doctoral, comprehensive, primarily undergraduate). As medical/doctoral and comprehensive institutions are generally better resourced, larger in size, and tend to have a stronger research focus, we look at how these factors have impacted the delivery and pervasiveness of entrepreneurship education within institutions.

This study has important implications for the design of policy tied post-secondary entrepreneurship as it highlights where funding has effectively supported the growth and embeddedness of entrepreneurship within universities and where there are opportunities for modification.

Presenter: Nina Hjertvikrem

Title: Do collaboration lead to more innovative ideas?

Session: 3.3

Location: B019

Time: 10:30AM-12:00 PM

Abstract:

Public funding for research aims to promote the generation of new knowledge and new ideas which are useful for society. Research is increasingly done in large collaborative projects, often integrating firms or government agencies as well as research organisations. This is particularly the case for projects relying on public funding. However, little research has explored how collaboration affect the novelty of the projects. Collaboration may bring new ideas and perspectives to a research project, enhancing the generation of new knowledge. However, collaboration also involves compromises. Consequently, projects that include a wide range of different partners may be more conventional than individual projects, where the creativity of the researcher is allowed to blossom more freely and unchecked. The characteristics of collaboration partners may also matter. Collaboration within the similar types of partners, in terms of organization format, geographic locations and discipline, may result in more conventional projects than collaborations among heterogeneous partners.

In this paper, we examine these relationships using data from project abstracts and collaboration networks in projects financed by the Research Council of Norway. We text-analyze half a million words in 3,600 abstracts in six subject areas to assess the novelty and conventionality of each abstract. Then, we investigate how the novelty and the conventionality of the abstract are related to the characteristics of the collaboration networks, in terms of the partner types (university, research institutions, industry, government agencies, etc.), geographic locations (local, regional and international), and interdisciplinarity. As our initial step, we measure the novelty and the conventionality of the abstract by looking at how rare or common for a word to appear in abstracts in a subject area, represented by the inverse document frequency (*idf*). Then, we construct a novelty measure as the mean of the entire word distribution of the abstract (minus stop words) and corresponding *idf*. A high novelty measure implies that the abstract has a high occurrence of atypical words. Similarly, we construct the conventionality measure as the proportion of words within the abstract that has zero *idf*, so the higher conventionality measure implies that the abstract consists of words that are extremely common across all abstracts in the subject area.

Our preliminary analyses show that abstracts mainly comprise of conventional words, with varied occurrence of novel words. We also find that collaboration in general, and collaboration with actors in other geographic locations even more, leads to *more conventional* abstracts, implying the presence of *compromise*

in collaboration processes. We will continue our investigation of abstract texts using word co-occurrence to identify the novel and conventional ideas and their relations to collaboration networks. Such approach allows us to look at the distribution of word pairs, rather than single words within an abstract, to bring in additional insights.

Presenter: Alix Jansen

Title: Responding to technological disruption: Active labour market policies and the problem of access bias

Session: 4.3

Location: B019

Time: 1:15AM-2:45PM

Abstract:

In the face of labour market frictions and the "new" social risks of the 21st century, many countries have adopted a human-capital focused approach to welfare in which upskilling a country's population is seen as a path to inclusive economic growth (Gingrich & Ansell, 2015; Hemerijck, 2015). Active labour market policies and programs are a central tenet of the social investment approach worldwide, and a core pillar of the Canadian Government's Inclusive Innovation strategy. By providing work experience and skills training to unemployed people, activation policies present a plausible policy mechanism for responding to technological disruption of the labour market. While much can be said about the *effectiveness* of active labour market policies, my work analyzes active labour market policies from a different angle. I ask, if ALMPs are to support displaced workers, do all unemployed people have equal access to this form of retraining?

My work is centrally concerned with the possibility of access bias in activation policies. Access bias occurs when some social group is better able to access a given social policy tool. Access bias is representative of the accusation that social investment policies have Matthew Effects (Bonoli & Liechti, 2018; Cantillon, 2011): benefits accrue to the already-advantaged. In this paper, I identify how Canada compares with OECD countries when it comes to access to training for people who are unemployed. I analyse data from the OECD's Survey of Adult Skills (PIAAC) to identify variations in who receives access to training out of the unemployed populations of each country. I analyse four main axes of potential access bias: education level, migrant status, length of unemployment spell, and gender. I then discuss how differences in access bias between countries reflects variations in the design and delivery of active labour market policies. In doing so, I provide an assessment of one aspect of inclusivity in response to technological disruption of work.

Presenter: Ki-Seok Kwon

Title: Technological catch-up by procurement for big science facilities: The case of Korean firms in nuclear fusion research

Session: 2.3

Location: 208N

Time: 3:15 PM - 4:45PM

Abstract:

A number of recent studies have recognised the economic contribution that public research can make through its demand on firm innovations (Castelnovo et al. 2018; Bianchini et al. 2018; Goldschlag et al., 2019). These studies find that public procurement enhances the performance of the supplier and observe continuing relationships of suppliers with their university buyer. Procurement more widely is considered ab important source of firm learning and public procurement in particular has been linked to innovations as public research can stimulate firms in their innovation efforts (Edquist et al. 2015). These mechanisms could be particular important to enhance the innovation capabilities of firms in a catch-up country.

In this study we aim to investigate the mechanisms behind positive innovation outcomes from big science procurement in the case of South Korea. We look at the case of the construction of KSTAR (a magnetic fusion device completed in 2007) and ITER (an international nuclear fusion device being built in France and of which South Korea is a partner) and the 162 different firms that participated in either one or both of the constructions. We make use of quantitative and qualitative methods. To date we have surveyed 53 suppliers and undertook follow-up interviews with 24 of the firms. In addition, we are currently in the process of collecting detailed information on the firms that did not respond to the survey, as these are more likely to present firms that did not benefit in terms of innovations. We will also collect information on all other firms active in the field of nuclear fusion that did not win a contract.

Preliminary results from the survey and interviews suggest different patterns in the enhancement of innovation capabilities. From the interviews we identified three groups of firms: the general labour intensive, the specialized technology intensive, and the intimate collaboration based. With regard to innovation capabilities, the general intensive firms tend to harvest more benefits, when the contract size is bigger, while the specialized technology intensive benefit from the R&D novelty of the order. The results also hint at a number of additional factors, such as the status of the supplier as insider or outsider. The results are further expected to show a leading role of public procurement in firms' innovation as well as importance of the characteristics of firms themselves in upgrading national cutting-edge technology areas through the construction of big science facilities.

We suggest that in order to maximize the industrial benefits by public procurement, the government needs to consider not only the detailed selection criteria but also long term survival of the firms. Furthermore, governmental investment in big science can be considered a good measure to enhance frontier technology in catch-up countries as shown in the South Korean case (e.g. transferring shipbuilding expertise into setting up nuclear fusion vessels).

Presenter: Albert N. Link

Title: Public support of technology development in small firms: North Carolina's Matching SBIR/STTR Grant Program

Session: 1.1

Location: CCF

Time: 11:00AM-12:30PM

Abstract:

The One North Carolina Small Business Program helps fund North Carolina businesses in capital-intensive, high-risk industries in science, technology, engineering and mathematics (STEM) fields of research and technology development. This program, which is one of approximately 20 similar state programs, matches Phase I federal Small Business Innovation Research or Small Business Technology Transfer (SBIR/STTR) grant awards in an effort to encourage innovation and to promote and support scientific, engineering, and industrial research in the State's small businesses.[1]

In late 2017 and early 2018, the Board of Science, Technology and Innovation conducted a comprehensive survey of the 255 small business that received a matching grant over North Carolina fiscal years 2006 through 2017 (July 1, 2005 – June 30, 2017). The purpose of the survey was to measure the program's impacts, evaluate its efficiency and effectiveness in meeting the program's objectives, and collect grantee testimonials regarding the program. Our proposed paper will describe the One North Carolina Small Business Program, discuss broadly the findings from the survey, and present empirical results about the impact of having received a matching Phase I award on the probability that the business received a follow-on Phase II award.[2]

Presenter: Albert N. Link

Title: The fountain of knowledge: An epistemological perspective on the growth of U.S. SBIR-funded firms

Session: 3.3

Location: B019

Time: 10:30AM-12:00 PM

Abstract:

The premise of this paper is that a basis for firms receiving Small Business Innovation Research (SBIR) research awards to develop commercializable technologies is not only their proposed creative ideas but also their endowment of attendant knowledge necessary to develop the technology being proposed. Based on this premise, we propose that those firms that have higher growth rates attributable to their SBIR awards

[1] Generally, Phase I awards are for proof of concept; those projects are currently funded at not more than $150,000 for a 6-month period. Successful Phase I awarded firms may apply for Phase II funding.

[2] Those firms that receive funding for a 2-year Phase II project are expected to develop and commercialize an innovative technology. Currently, funding for Phase II awards is generally not more than $1,000,000.

are also those firms that are more creative and have more knowledge endowments. Empirically, we quantify a firms creativity and its sources of research knowledge in terms of its past experiences, and we find that firms with more technical experience and sector experience are those that have realized higher growth rates from their SBIR-funded research.

Presenter: Nichola Lowe

Title: Genesis at work: Advancing inclusive innovation through manufacturing extension

Session: 4.3

Location: B019

Time: 1:15AM-2:45PM

Abstract:

Inclusive innovation is a generative concept that offers a hopeful portrait of our economic future—not one in which technological advances displace up to half the current workforce, with little mercy for those already struggling to make ends meet—but one that instead repositions potentially vulnerable segments of the working population as critical actors in an on-going drive to support new product development and process improvements. This concept of inclusive innovation is particularly inspiring for U.S. manufacturing, helping challenge a dystopian narrative in which frontline production workers will be displaced by advances in automation and robotics and thus at risk of further economic marginalization.

But this inclusive turn within innovation studies also has its limits, most notably the tendency to narrowly focus at the individual worker level, pushing investments in higher education as a panacea for extending economic opportunity. What this educational-fix obscures are a deeper set of organizational challenges that keep many businesses from fully engaging their frontline workforce and with it, tapping their creativity and ingenuity, regardless of formal educational attainment. While workforce training can play a critical role in that effort, such investments—in isolation—do little to transform established business practice in order to ensure there is organizational capacity and wherewithal to "pull in" and inspire a skilled workforce.

This paper draws on a three-year, mixed-method evaluation of a novel business-facing initiative called the Genesis Movement, to understand its role in reshaping the workforce experience within SME manufacturing businesses in Chicago, Illinois. Genesis was launched in 2014 by the Illinois Manufacturing Excellence Center (IMEC), with seed funding from local and national foundations. Housed at Bradley University in northern Illinois, IMEC is part of the Manufacturing Extension Partnership—a nation-wide network that was established by the U.S. Department of Commerce in the early 1990s to improve the competitiveness of small- and medium-sized manufacturing enterprises.

Genesis represents a major departure to more conventional approaches to manufacturing extension, which often focus on short-term projects to promote efficiency and productivity improvement through "lean" manufacturing principles. By contrast, Genesis-enrolled firms commit to a 24 month strategic planning process with the ultimate goal of integrating concurrent improvements to job quality with advances in business performance. While non-profit workforce service providers have long attempted to secure a similar job quality commitment from smaller firms, the Genesis experiment is the first to involve a federally-funded

manufacturing extension program—one with a successful history of promoting innovative business strategies and technological modernization. We find that Genesis firms adopt an inclusive organizational culture, using frontline worker engagement, skills training and job quality improvements to drive firm performance. As such, Genesis offers a scalable model with the potential to expand across a national MEP network already serving thousands of manufacturing businesses that collectively employ hundreds of thousands of workers.

This paper supports Genesis diffusion by offering insights for how other North American regions can leverage government and university commitments to manufacturing extension to inform technological progress and in ways that are inclusive of the frontline workforce. It also suggests opportunities for manufacturing extension providers to partner with workforce-service and advocacy organizations in order to magnify their combined impact on inclusion and innovation.

Presenter: Chiara Marzocchi

Title: Graduate start-ups in the regional contexts: Territorial dynamics for anchoring talent

Session: 3.1

Location: CCF

Time: 10:30AM-12:00 PM

Abstract:

The role higher education institutions (HEIs) play in developing regional and national entrepreneurial environments has long captured the attention of both policy makers and scholars. However, graduate start-ups still are an understudied vehicle of HEIs' impact and entrepreneurial transformation, in particular, compared to the depth of attention devoted to other entrepreneurial outputs such as patents or academic spin-offs.

By looking at regions and HEIs in England in the UK, this paper aims to fill this gap by focusing on the relationship between graduates' entrepreneurial outcomes and policy impacts in diverse geographical contexts. Graduate start-ups can be seen as HEIs' vehicle to anchor talent to regions by retaining entrepreneurial graduates. As such, graduate entrepreneurship is relevant not just for its role in promoting new business ventures, but also as a mechanism to channel place-based needs via the interaction between the HEIs' teaching, research and 'third-mission' agendas, and the surrounding policy environments.

This diversity of institutional and local contexts are illustrated by concepts such as 'university-based entrepreneurial ecosystems' and 'campus entrepreneurial ecosystems', that portray graduates belonging to an ecosystem with the university exerting their own influence on the chances of graduate's venture creation. At the same time, universities' entrepreneurial activities are shaped by their surrounding local conditions and national and sub-national policy environments. Existing analyses of the university-based entrepreneurial ecosystems framework are often based on single cases of good practices embedded in a particular historical and social environment, whilst diverse territorial and policy contexts and their interactions tend to be understudied.

Demands for entrepreneurship education have expanded globally over the last two decades partly driven by policy expectations, promoting the 'state-sponsored' student entrepreneurs. Particularly, in 'less favoured' regions, graduate start-ups are promoted as an alternative to graduate jobs. Drawing on literature on university academic spin-offs creation, we know 'entrepreneurial signaling effects' of universities in less-favoured regions. Differences are noted between different types of universities. A possible Matthew Effect in academic spin-offs creation is noted across the research universities gaining further advantage against other less research oriented HEIs. For graduate start-ups, not only research but also teaching attributes affect HEIs' entrepreneurial capacities and outcomes.

In the light of these, and drawing from data including the Higher Education Business Community Interaction Survey (HEBCI) and the Destinations of Leavers from Higher Education (DLHE) survey, we investigate place-based factors that affect retention of graduate entrepreneurs in a region, in relation to the university's organisational attributes (i.e. teaching or research). We focus on graduate start-ups as the businesses created by students who studied at a university in the region, analysing universities' attributes and their diverse local/regional environments. Our findings point to a large heterogeneity in graduate entrepreneurship in terms of both regional and organisational factors. The paper concludes by identifying territorial dynamics and possible intended and unintended policy consequences that affect graduate entrepreneurship activities across diverse regional and organisational contexts.

Presenter: Anita M. McGahan

Title: Negotiated settlements among stakeholders: Creating capacity to confront disruption

Session: 3.3

Location: B019

Time: 10:30AM-12:00 PM

Abstract:

In the face of disruption, adaptation and innovation by organizations that perform critical functions in the economy, such as the provision of electricity, public transportation, and health care, are essential for sustainability. Large, complex organizations face significant barriers when innovation has implications for the organization's architecture. In this paper, we address how such organizations succeed in overcoming these barriers, even when innovation raises the risk of organizational failure. We draw on insights about organizational routines and from stakeholder theory to outline a process by which absorptive capacity can be actively managed within large, complex core infrastructure organizations. We propose the concept of a *negotiated settlement* among stakeholders as critical to the innovation and adaption process. In a negotiated settlement, stakeholders develop understandings of the consequences of innovation for claimancy rights, and trade formally and informally to accomplish a mandate for change in the face of core threats to the organization's survival. By generating demand for innovation, this mandate constitutes an active component of absorptive capacity. We outline the implications of such a process for management theory on absorptive capacity and architectural change, as well as practical implications for organizations and the inter-institutional systems in which they are embedded.

Presenter: Scott McKnight

Title: Deep offshore exploration & production with state-owned oil companies: Comparing Petrobras and Pemex

Session: 1.1

Location: CCF

Time: 11:00AM-12:30PM

Abstract:

Research question

How did Brazil's national oil company (NOC) Petrobras become an award-winning industry leader in deep- and ultra-deep water oil exploration and production (E&P) while Mexico's NOC, Pemex, is a sclerotic laggard?

Common explanations

Traditional explanations fail to explain this stark difference in NOC capacity. After 1945, both Brazil and Mexico experienced state-led industrial 'miracles', which successfully diversified their economies and export bases. Both countries transitioned democracy from the mid-1980s on, and now experience regular elections and changes in control of the presidency. Each country is home to several world-class universities, which each year churn out high-quality engineers, scientists and administrators. Each country boasts a domestic oil industry that date back many decades (Mexico the early 1900s; Brazil to the early 1930s) and feature an abundance of oil reserves (Mexico onshore and offshore; Brazil largely offshore). Likewise, each NOC has decades of experience in every phase of the oil business, after being founded (Pemex in 1938; Petrobras in 1953) with practically no experience and having to learn on-the-spot.[3] Despite all of the similarities, their NOCs are vastly different in capacity, especially in offshore E&P.

Argument

[3] George W. Grayson, *The politics of Mexican oil* (Pittsburgh, Pa: University of Pittsburgh Press, 1980); *Á*ngel de la Vega Navarro, *La evolución del componente petrolero en el desarrollo y la transición de México*, (Programa Universitario de Energ*í*a, Coordinación de Vinculación, Universidad Nacional Autónoma de México, 1999); Isabelle Rousseau, *Tribulaciones de dos empresas petroleras estatales, 1900-2014: trayectorias comparadas de Pemex y PdVSA* (Mexico City: Colégio de México, 2016); On Petrobras, George Philip. 1982. *Oil and Politics in Latin America: Nationalist Movements and State Companies*. New York: Cambridge University Press, pp. 227-42. On the formation of Petrobras, see G. Cohn, *Petroleo e nacionalismo* (Sao Paulo, 1968); Adilson de Oliveira, 'Brazil's Petrobras: strategy and performance', in D. G. Victor et al. (eds.), *Oil and Governance: State-Owned Enterprises and World Energy Supply,* Cambridge University Press, pp. 515-56.

As both Brazil and Mexico approached a crisis in oil self-sufficiency in the late 1960s and early 1970s, each state (a military regime in Brazil; one-party corporatist authoritarianism in Mexico) pushed its vertically integrated NOC to explore for oil in harder-to-reach places. For Mexico, this led Pemex into the jungles of Tabasco-Chiapas and the shallow offshore of the Campeche Sound; for Brazil, into the increasingly deep waters of the Campos Basin. In each then, this particular geological endowment forced the NOC into new areas of E&P expertise. In the case of Petrobras, the state adopted a flexible approach to Petrobras, mixing tax incentives, decision-making autonomy for the NOC, and intense collaborations with universities (especially through its specialized program known as CENPES).[4] Petrobras emerged an award-winning oil company in deep-water operations, eventually making the historic 'pre-salt' (*p*ré-*sal*) discoveries in the early 2000s in the Santos Basin.[5]

By contrast, Pemex rapidly experienced a bonanza with its finds in the Campeche Sound, deposits that were technologically undemanding and at time of historic high oil prices (late 1970s-early 1980s).[6] After the debt crisis hit Mexico in 1982, the state converted Pemex into a cash-generating machine, systematically decapitalizing the NOC over several decades and allowing its technological arm (the IMP) to atrophy.[7] By the time deep-water oil deposits in the Gulf of Mexico were confirmed through the 2010s, Pemex lacked all capital and expertise to undertake their development, and the state was forced to open the oil monopoly in 2013-14.[8]

Innovation policy in the Brazilian case is one of deep, multi-decade collaboration between Petrobras (especially its E&P division), several Brazilian universities and certain specialized engineering firms. By contrast, in Mexico, Pemex is starved of resources, operational and budgetary autonomy, and the NOC struggles to attract high-quality talent and complex tasks all 'farmed out' to private (invariably foreign) firms.

This research was done as part of my doctoral dissertation in political science on the political economy of national oil companies. As such, I conducted extensive interviews, over 50 in all, with Petrobras and Pemex

[4] Interviews with various Petrobras engineers, Rio de Janeiro, March 2018; with ex-Petrobras president, Sao Paulo, March 2018. CENPES stands for 'Centro de Pesquisa e Desenvolvimento' or Centre for Research and Development. It proved vital in many of Petrobras's technological breakthroughs. When the Petroleum Law was passed in 1997, a key clause required Petrobras to continue to invest 1% of its budget in R&D, half of which went to CENPES (which roughly covered its budget) while the other half went to academic research for Petrobras projects, which turned into a major stimulus for petroleum-related studies in Brazil. Interview with Brazilian institute research director, Rio de Janeiro, April 2018. On CENPES, see Carlos Eduardo Sarmento and Sergio Lamarao, *Engenharia da Petrobras: 1972-2005,* Petrobras, 2006.

[5] This enormous wealth also made it the focus of a systematic predation scheme, uncovered as the 'Car Wash' (Lava Jato) investigations from late 2014 and continue today. Roberta Paduan, *Petrobras: Uma Historia de Orgulho e Vergonha,* Objetiva, 2016; On the investigations, see Vladimir Netto, *Lava Jato: O Juiz Sergio Moro e Os Bastidores da Operacao que abalou o Brasil* (Primeira Pessoa, 2016); Flavia Pacheco, *Operation Car Wash* (no publisher, 2017).

[6] This rush of wealth also set off a wave of predation of '*telenovela*-levels of corruption'. Interview with Pemex executive, Mexico City, October 2017. Also Michael Gavin, 'The Mexican Oil Boom: 1977-85.' *Working Paper Series* (Inter-American Development Bank, 1996).

[7] Interviews with several IMP (Mexican Petroleum Institute) directors, Mexico City, October 2017.

[8] Juan Carlos Moreno-Brid and Alicia Puyana, 'Mexico's new wave of market reforms,' in P.A. Haslam and P. Heidrich (eds.), *The Political Economy of Natural Resources and Development: From neoliberalism to resource nationalism* (Routledge, 2016).

technical staff, executives, managers, technical staff as well as academics (Brazil, March-April 2018; Mexico, September-October 2017).

Presenter: Cameron McRae

Title: Digital platforms for more inclusive agri-food innovation and value chains: A quasi-experimental study of Ekutir's microentrepreneur-led digital ecosystem and its societal outcomes in Odisha, India

Session: 4.4

Location: Board Room

Time: 1:15AM-2:45PM

Abstract:

Inclusive innovation efforts hold great promise to contribute to society on many levels. However, the impact of such can often be difficult to assess due to the complexity of real-world implementations. In the present case, we present the results of a quasi-experimental study designed to assess the impact of a digital ecosystem led by the social enterprise eKutir on household fruit and vegetable consumption. eKutir aims at providing self-sustaining solutions to poverty and undernutrition in vulnerable communities by leveraging digital technologies through an ecosystem anchored by micro-entrepreneurs distributed across the agri-food value chain. Farming micro-entrepreneurs (FME) provide agricultural knowledge, inputs, and market linkages at household and community levels, followed by progressive integration of other micro-entrepreneurs along the value chain. The present case examines FMEs along with retail micro-entrepreneurs (RMEs) deployed in vulnerable rural and urban communities in Odisha, India. A quasi-experimental approach was used to investigate the effects of the digital ecosystem and the actors within, focusing on the farm (FME) and retail (RME) support. A three-group design was used for the rural sample to compare (1) farmers with access to RMEs only, (2) farmers with access to both FMEs and RMEs, and (3) farmers unexposed to the digital ecosystem. In urban communities, households were grouped as either having access to RMEs within their neighborhood, or those who did not. Structured questionnaires were administered to all participating households at pre- and post-intervention with questions about demographics, fruit and vegetable consumption, dietary beliefs and attitudes, and agricultural production (for rural farmers only). Structural equation modeling and the product method were used to assess changes in fruit and vegetable consumption, as well as whether homegrown consumption played a mediating role for rural farmers. Multivariable linear regression and ANOVA were used to test group differences in the urban sample. Farmers in rural communities exposed to eKutir's digital ecosystem consumed more overall fruit and vegetables ($\beta = 0.30$, $p<0.001$) and fruits alone ($\beta = 0.53$, $p<0.05$) than those farmers in comparison villages unexposed to the eKutir ecosystem. Mediated by homegrown consumption, the consumption effect was concentrated in households exposed to both FMEs + RMEs ($\beta = 0.60$, $p<0.0001$), with non-significant directional effect in comparing fruit and vegetable consumption in rural households exposed to RMEs only

over comparison communities. Urban consumers, exposed to the digital platform ecosystem through access to RMEs operating in their neighborhood community, did not increase their fruit or vegetable consumption compared to non-intervention communities. The results reveal the potential of reaching fruit and vegetable consumption impacts in vulnerable communities through homegrown consumption, with farm-level support enabled by a digital ecosystem outside of governmental/philanthropic intervention. The results also underscore, however, the challenges of both changing eating behavior and intervening across the agri-food value chain. Implications for more effective digital ecosystem design and intersectoral policies will also be discussed.

Presenter: Stéphane Mercure

Title: Bolstering the capacity to innovate at Canadian post-secondary institutions through research infrastructure funding

Session: 3.3

Location: B019

Time: 10:30AM-12:00 PM

Abstract:

The Canada Foundation for Innovation (CFI) awards funding to strengthen the research infrastructure in universities, colleges, research hospitals and non-profit research organizations across Canada. Through its funding, the CFI is expected to provide Canadian researchers in all disciplines the facilities and equipment to undertake world-class research and technology development that supports private sector innovation and commercialization.

The Performance, Analytics and Evaluation unit of the CFI has recently undertaken a study to assess the organization's contribution to the innovation ecosystem. The CFI uses project progress reports submitted annually to gather information on the outputs and outcomes of projects it funds. Data collected from 4,246 projects through 11,161 PPR's submitted between 2012 and 2017 was analyzed to assess the contribution of research supported by CFI-funded infrastructure to the protection and transfer of intellectual property (IP), and the establishment of spin-off companies.

Our analysis has shown that nearly one out of five CFI-funded infrastructure projects (739) contributed to the innovation ecosystem through the creation, transfer and exploitation of intellectual property. Of the 576 projects that indicated IP rights, a total of 1,956 contributions in the form of provisional patents, patents, trademarks, copyrights as well as other forms of protection were disclosed. Licensing agreements and spin -off companies were reported by 219 and 215 projects respectively. In total, 324 unique spin-off companies were reported between 2012 and 2017.

CFI-infrastructure was shown to yield contributions to innovation in all three major fields of science. Approximately 19% of projects in the health sciences and in natural sciences and engineering (NSE) reported at least one IP right, licensing agreement or spin-off company. Projects in the social sciences and humanities were less likely to report contributions to innovation (7% of projects) particularly in the form of IP rights.

Contributions to innovation were also shown to grow steadily with award value; 46% of projects that received a CFI award valued at $1 million or more reported contributions to innovation compared to 13% for projects with a value under $200,000.

We are currently conducting interviews with a select group of researchers and institutional representatives to learn more about the contribution of research infrastructure to innovation as well as the process and outcomes associated with the creation, transfer and exploitation of intellectual property reported to the CFI. The findings from these interviews as well as the broader implications of the results of the full study will be discussed.

Presenter: Dolores Modic

Title: Suppliers' ability to influence innovation of multinational automobile producers

Session: 2.4

Location: Board Room

Time: 3:15 PM - 4:45PM

Abstract:

Studies on suppliers of the automobile producers (original equipment manufacturers, OEMs) have a long tradition. From studies that refer to particular country's suppliers to researching different aspects of suppliers' performance, e.g. their intellectual capital (Zerenler et al., 2008), B2B cooperation, (Iskandar et al., 2001), quality management (Curkovic et al., 1999), lean production paradigm (Holweg, 2006), etc. The global automotive industry is facing a period of disruption caused by four trends (Lazard and Ronald Berger, 2017): digitalization, autonomous driving, shared driving (mobility) and electrification. We can add another megatrend – circular economy (Ellen MacArthur Foundation, 2015). Trends are emphasizing increased innovative activity and closed loops.

Previous works suggest divergent reasoning, both supporting ideas that OEMs are susceptible to adapting suppliers' inventions, and contradicting this notion. Studies from 90's were frequently describing long-term relationships (Helper and Levine, 1992; Turnbull at al., 1992), however, there was a refocus on the chain configuration (Galankashi et al., 2016; Hingley et al., 2015). Different configurations might open or close door for innovation (Kamath and Liker, 1990; Wilhelm and Dolfsma, 2018). Challenges in supply chain, standardization (Prajogo and Sohaland, 2004) and the not invented here (NIH) syndrome (Katz and Allen, 1982) speak against OEMs' susceptibility to suppliers' inventions. The uncertainty on markets can also play a role (e.g. Borgstedt et al., 2017).

This article explores the influence of suppliers' inventions on OEMs, by investigating: i. Is there a discrepancy between the type of inventions (proposed) by suppliers and the type of inventions implemented by OEMs?; ii. What are the characteristics of suppliers' innovations that have been adopted by OEMs?; iii. Are the suppliers' innovations that have been adopted by OEM characterized by a push or pull mechanism and what is the nature of their origin (original intent or a by-product)?

We conduct a mixed method research analyzing Slovenian automotive industry, predominantly comprised of automotive suppliers of first and second tier, supplying global industry leaders – thus focusing a specific global loop segment. We analyzed all granted patents connected to automotive industry between 2003 and 2018, to investigate direct and indirect adoptions and the potential supply-demand mismatch. We also conducted in-depth interviews with representatives of supplier companies to understand the characteristic and the nature of successfully adopted suppliers' inventions.

Our research partly confirms findings of Trautrims et al. (2017) that innovation in car body technologies is dominated by OEMs, whereas innovation in car seats is supplier-led. However, our analysis reveals that suppliers invent in many car components seeking a global market niche - yet they are not equally successful in each field. The field of electric engines is strongly present, similar to findings of Borgstedt et al. (2017) who revealed that innovative pressure, based on uncertainty regarding electric vehicles, is passed on from OEMs to suppliers. Successful inventions refer to finding solutions for smaller, lighter, more durable and safer components: i.e. OEMs in the past 15 years seek for incremental inventions. However - due to disruption - there are signs OEMs may become more susceptible to breakthrough inventions.

Presenter: Dolores Modic

Title: On universities' ability for technology transfer: Do technology transfer office cohorts matter?

Session: 3.4

Location: Board Room

Time: 10:30AM-12:00 PM

Abstract:

University technology transfer is a big and controversial business, administered by a growing occupational group, Intellectual property (IP) coordinators. This paper explores the cohort effect, answering the question whether IP coordinators in same cohort exhibit similar patterns in patenting and licensing, thus contributing to the university technology transfer literature, especially the debate on the individual level factors (Wu et al, 2015).

Technology transfer literature using the concept of cohorts has focused on researchers and not on technology transfer staff. Cohort effect has also been recorded for a similar group of experts, patent examiners (Frakes and Wasserman, 2016). Similar works encompassing TTOs remain absent, although early moments of employment are important in shaping attitudes, skills and practices of new staff (Van Maanen and Shein, 1979; Joshi et al, 2010; Zheng et al, 2013). Cohorts and their potential effects are suboptimally conceptualized and researched in terms of different groups inside the technology transfer processes. We present a model allowing for assessment of cohorts' effects in technology transfer offices on individual level data. Within this study we test two hypotheses:

H1: Coordinators in the same cohort exhibit similar patenting patterns.

H2: Coordinators in the same cohort have similar level of success and experience in licensing.

For the analysis we build a database using the university's patent applications data from year 1984 to 2014, merged with licensing data. In order to gain an accurate picture of the cases assigned to individual IP Coordinators, we added their employment and cases' (re-)assignment data. Final dataset is (dynamic) time series data, eliminating the problem of relying on static data. Our database includes 18393 cases of IP Coordinators handling patent cases, and a sub-set of 845 licensed cases.

Our descriptive and discriminant analysis demonstrate that the year in which an IP coordinator is hired, has an effect on their patenting and licensing proclivities. Variations between cohorts suggest that IP coordinators may follow distinct and enduring practices throughout their career. Yet, the biggest distinctions between cohorts do not seem to be connected with IP coordinators' immediate licensing and patenting output, but rather with underlying mechanisms and practices, e.g. cognitive proximity attitudes.

Our analysis holds a number of important implications for public policy and organizational competitive advantage of individual universities, as IP coordinators can be catalysts for commercialization success.

Presenter: Simon Mosey

Title: Research opportunities considering student entrepreneurship in university eco-systems

Session: 3.1

Location: CCF

Time: 10:30AM-12:00 PM

Abstract:

Universities globally are increasing their support for student entrepreneurship through curricular and extra-curricular programmes. Within the curriculum there is a shift towards experiential education as students work on contemporary industrial and societal challenges in the classroom. This is complemented by extra-curricular activities where students and alumni are encouraged to address such challenges through venture creation. University support for student entrepreneurship is diverse and far reaching and includes hackathons, germinators, incubators, seed and angel funding, entrepreneurs in residence and growth programmes.

Research considering the impact of such interventions offers great promise. For the first time, researchers have relatively straightforward access to the antecedents of venture creation in real time. There is potential to consider the earliest stages of venture creation across a vast natural experiment where the factors associated with venture performance can be captured and controlled for. Such an empirical bonanza encourages novel theoretical approaches. We highlight the possibilities for deploying theories from disparate disciplines across and between different levels of analysis.

For instance, we advocate taking an entrepreneurial ecosystem approach to help explain the creation, development and growth of new systems of entrepreneurship within University regions (Wright et al, 2017). We also revitalise the, more traditional, individual level of analysis by utilising diverse theoretical and methodological approaches, such as sense making (Gioia & Chittipeddi, 1991) and visual mapping

(Kearney & Hyle, 2004), and show how this could yield new insights into the antecedents of student entrepreneurship.

We conclude that student entrepreneurship as a domain can yield exciting new contributions to the study of entrepreneurship and technology transfer through the use of novel methodological, theoretical and multi-level investigations.

Presenter: Koichiro Okamura

Title: Knowledge production and spillovers of academic R&D contests

Session: 2.4

Location: Board Room

Time: 3:15 PM - 4:45PM

Abstract:

The innovation inducement contest is widely recognized as one of policy tools to accelerate the commercialization or development of technologies to solve societal and technological challenges in recent years. Witnessing its novelty as well as popularity, academic researchers have also initiated the R&D contests, which are organized in a manner similar to innovation inducement contests, but held in the basic and applied research domains, usually without monetary awards. They organize contests in the hope of educational effects on students who get involved in them as well as gaining momentum in their research field.

This study focuses on the academic R&D contests. Particularly, it analyzes the RoboCup Soccer Competition, an R&D contest in robotics. It is a soccer competition played by robots which are real robots in the physical world or computer programs in simulation, which was initiated in 1997 and has been annually held to date. RoboCup challenges participants to develop a team of robot soccer players that can beat a human World Cup champion team by 2050 (Kitano et al., 1998). In the RoboCup, participating teams who build and/or programmed original robots or simulation programs compete with one another in several areas, each of which focuses on specific research challenges.

The study examines the research performance of participants and the knowledge spillovers from them to robotics researchers in general. Particularly, it uses the number of papers published and the number of citations received from subsequent papers which are widely used as proxy indicators to capture the research productivity of researchers and the amount of knowledge transferred to the research community in bibliometric studies (Kostoff, 2002; Moed, 2005; Narin & Hamilton, 1996). It uses Elsevier's Scopus to collect the bibliometric information for major journals in robotics to compare RoboCup participants and other robotics researchers who do not take part in the contests. The data are a panel data, with researcher in one dimension and year in the other. The fixed-effect panel-data regression model is used for regression since there may exist individual-specific effects that are not fully controlled by control variables.

The study finds that the researchers who participate in the contests are more productive overall than those not. The knowledge spillover from the participants to the research community is likewise greater than

others, but is not equally clear as research productivity. The effect of the contest participation is positive and significant with both research performance and knowledge spillover in early years; it decreases over time however. Secondly, there is a performance variation among the areas. The contests have more positive effects on the researchers participating in the areas where real robot teams play games against one another than those participating in simulation games overall. The findings have the implications about the optimal design and arrangement of the contests for researchers as well as policymakers.

Presenter: Andrew Park, Elicia Maine

Title: To patent or not to patent: Open innovation mechanisms within an emerging personalized medicine innovation ecosystem

Session: 1.3

Location: 208N

Time: 11:00AM-12:30PM

Abstract:

Personalized medicine is a rapidly growing subsector spanning medicine, biotechnology, and information technology, which is forecast to transform medicine, bringing benefits to patients and medical professionals and reducing overall system costs. The emergence and growth of such science-based innovation ecosystems rely heavily on open innovation: the science ventures seeding these ecosystems frequently need to access complementary assets, finance, and may need to contribute to the formation of new regulations and policies. Little is known about the mechanisms employed by science-based ventures in order to attract the alliance partners and investors they require, nor the innovation policy which would enable such mechanisms. In following an open innovation model, it is uncertain how leading and following science-based ventures differ in managing knowledge spillovers during collaboration (Arora et al., 2016). If firms are successful in contributing to a growing innovation ecosystem using open innovation strategies (Chesbrough, 2006), there can be broader societal and public policy implications in encouraging further open innovation (Chesbrough & Bogers, 2014).

This paper builds on the notion of selective revealing of knowledge in order to enhance value creation and capture (Dahlender & Gann, 2010). Specifically, we address the research question "How does selective revealing affect innovation performance and value capture by science-based ventures?" To address this research question, we investigate the emergence of a personalized medicine innovation ecosystem in BC, analysing the open innovation mechanisms employed by science-based ventures and the value outputs of these firms.

We contribute to the open innovation literature by addressing the seemingly contradictory positions of Henkel et al. (2014), who argue early selective revealing positively effects firms' competitiveness and West (2003) who states firms prefer proprietary strategies "whenever possible". Our results show that both selective revealing and strategic timing in personalized medicine firms tends to lead to higher value outputs, moderated by uncertainty of the environment. This suggests an open innovation framework can be helpful to a firm's commercialization, but a firm must also consider the breadth and timing of its intellectual

property protection (Maine & Thomas, 2017). Moreover, Dahlander & Gann (2010) note that most open innovation work focuses on observations from American software technology companies such as Microsoft, Intel, and the Linux Foundation, and they encourage future work to explore other contexts to improve external validity. Our study focuses on the emerging personalized medicine industry, which encompasses greater technological uncertainty.

We contribute to practice by providing initial guidelines and insights to both individual firms and public policy makers to encourage the growth of the personalized medicine ecosystem in their jurisdictions. Given the long timelines to commercialization, particularly for personalized medicine therapeutics companies (Pisano, 2010; Maine & Seegopaul, 2016), and the risks and benefits involved in openness and selective revealing (Gans and Stern, 2003), firms must strategically navigate not only their own technological capability development but also their relationships with surrounding firms, universities and other public entities.

Presenter: Vanessa Peña

Title: Metrics framework for evaluating technology transfer of federally-funded research

Session: 1.1

Location: CCF

Time: 11:00AM-12:30PM

Abstract:

This paper describes (1) the results of a systematic literature review on technology transfer evaluation methods and (2) a framework for measuring and evaluating technology transfer from federally-funded research and development (R&D) based on those findings. Federal technology transfer is broadly defined as the transfer of knowledge and results, such as products, techniques, and tools, from intramural, federally sponsored R&D out of laboratories and into practical application. About two-thirds of the $150 billion in federal funding for R&D supports researchers in non-Federal settings, including universities and the private sector. Thus, Federal technology transfer measures must account for both intramural and extramural transfer activities.

The systematic literature review spans published peer-reviewed articles from the last 10 years—2009 to 2019. We employed a semi-automated method to identify relevant articles through keyword searches and developed relevancy criteria to manually categorize those that empirically analyzed or evaluated technology transfer activities in federal and non-federal contexts. Relevant articles in a federal context included those that analyzed various outcomes, such as patents, licenses and royalties, start-ups, and other economic and workforce benefits, of federally-funded R&D, such as portfolios, programs, or projects. Relevant articles in a non-federal context included those that analyzed similar outcomes, including invention and entrepreneurial ventures; however, with no mention of federally-supported portfolios, programs, or projects.

After reviewing the articles, we categorized measures, metrics, and methods used to analyze technology transfer activities, compared differences between federal and non-federal context studies, and developed a

framework that federal policy-makers and managers could reference when considering evaluating the broad impacts of their technology transfer activities. The framework describes common measures that could be employed across varied federal agency mission contexts. We conclude by comparing the framework with existing federal-wide measures and metrics collected and identify options for enhancing federal-wide data collection.

Presenter: Véronique Schaeffer

Title: The role of patents under different institutional frameworks: A historical perspective

Session: 1.4

Location: Board Room

Time: 11:00AM-12:30PM

Abstract:

The rise of the entrepreneurial university in the 2000s and the evolution of the legislative frameworks for intellectual property, aimed to encourage universities to patent their inventions and to promote the exploitation of scientific discoveries in economic activities (Dasgupta, David, 1994, Henderson et al, 1998, Fabrizio, 2007, Geuna, Rossi, 2011, Grimaldi et al, 2011). This evolution provoked much debates in the academic community about the threats that the entrepreneurial university model poses to the norms and value of open science. The detrimental effect of the use of patents on the dynamic of knowledge creation has been under interest (Dasgupta, David, 1994, Slaughter, Leslie, 1997, Heller, Eisenberg, 1998, Lundvall, 2002, Nelson, 2004). Historical perspectives show that strong links between academic and economic activities are not new phenomenon but are rooted in the activities of universities since their medieval origins (Geuna, 1998, Martin, 2012). Adopting an institutional approach, Sauermann and Stephan (2013) show through a sectorial comparison that the academic and commercial logic of university and industrial science are pure ideal types that does not reflect the reality of behaviors. We consider the question of the hybridity of logics and behaviors of academic researchers, and the influence of the institutional context through an historical approach of innovation and academic patenting.

We focus on the case of the University of Strasbourg which constitute a relevant case to study the involvement of researchers in innovation, and the influence of institutional change. This university which has medieval roots, has been French until 1872 and German from 1872 to 1918 It has adopted the Humboldtian model of university and inventions and patens were constituent of its identity. It becames French again, and after the WWII has evolved under a Colbertist approach. We consider the cases of leading scientists (Ferdinand Braun, Nobel Price, Gustave Ribaud member of the Academy of Science, Charles Sadron), highly involved in academic research and innovative activities, from the end of 19th century to the early 21st century, We show the influence of the model of university and institutional frameworks on the role of patents.

Presenter: Sandra Schillo

Title: Novel data uses for innovation research: Analyzing websites of small and medium-sized manufacturers in Cana46

Session: 2.1

Location: CCF

Time: 3:15 PM - 4:45PM

Abstract:

Research on innovation in companies is limited by the data available for analysis. Traditionally, economists have been able to discern the impact of innovation in the context of aggregate, e.g. national-level studies. Micro-level empirical studies typically involve surveys, with the associated biases, respondent limitations, and response burden. Administrative data such as data based on tax returns, can address some of the issues relating to response biases, completeness and accuracy of responses, but does not typically contain information on innovation behaviour. In this context, the use of publicly available data, and in particular company web sites, has been considered by some researchers – in the academic, public, and private sectors – as a potential solution to many of the data issues. Indeed, researchers (including Youtie et al. 2012, Shapira et al. 2014, Gök et a; 2015, Beaudry et al. 2016) have used web-based data to complement existing data sources. The key issues arising throughout this research, however, is that of validation of data and indicators.

This paper presents results of a joint university – public sector research collaboration to address validation issues with the guiding principles of enhancing national statistical holdings, developing new techniques and approaches to data development and exploring new research themes. The paper presents findings from a case study covering 13000 Canadian manufacturing companies. The university researchers first collected information to identify the companies and Statistics Canada experts matched them to existing Statistics Canada records. Statistics Canada records contain information on all Canadian companies from administrative data files, but given that corporate websites typically do not display Business Number information, matching information from web sites to existing records is not always possible. In our data set, 60% of the web-based records were matched with Statistics Canada data, for a total of approximately 7800 identified records.

The focus of this paper is to discuss the data sources and methods and process challenges and opportunities associated with each source, as well as results from our case study. Furthermore, one purpose of this project was to explore whether inclusive innovation dimensions can be captured using web-based data, and we comment on the related challenges and opportunities. We also discuss next steps for the project, including additional linkages to the new federal government-wide Business Innovation and Growth Support (BIGS) programs microdata series that is being developed in partnership between Treasury Board of Canada Secretariat and Statistics Canada.

This paper provides guidance for other researchers attempting to use websites to complement innovation data. It provides insights into the kind of analyses currently possible, their validity, and provides a discussion of further indicator development.

Presenter: Sandra Schillo

Title: Inclusive innovation and indigenous culture

Session: 4.4

Location: Board Room

Time: 1:15AM-2:45PM

Abstract:

The inclusiveness of innovation and economic growth has become a central theme in innovation, industry and economic policies around the world in recent years. In this context, inclusive innovation is one approach to mitigate the increasing uncoupling of economic growth and social and economic development (Chataway et al., 2014), as compared to 'mainstream innovation', which is considered a source of inequality by virtue of improving the welfare of higher-income consumers, but not that of more marginalized peoples, the consideration of formal, but not informal, producers, and the prioritization of economic over social development (Heeks et al., 2014).

According to Heeks et al. (2014), the first issue is that of identity, i.e. the consideration of which groups of people have historically been excluded, and the second issue is that of the level of involvement of these groups in innovation activities, ranging from notional intentions through being considered consumers, all the way to structural and post-structural inclusion. Schillo and Robinson (2017) point out that identity should not only consider past, but also future exclusion, e.g. related to the broadening use of digital technologies. Further, they highlight that consequent inclusiveness will likely lead to a broader definition of innovative activities, broader consideration of economic, social and environmental impacts of innovation, and ultimately profound changes to the governance of innovation.

In Canada, indigenous peoples have historically been marginalized and excluded from the mainstream innovation narrative, even though settlers have been quick to adopt indigenous technologies as innovations, and indigenous knowledge is contributing to scientific understanding, not only with regards to the natural environment but also governance systems. This paper reviews the literature on innovation and indigenous peoples, with a particular focus on indigenous culture.

Although the consideration that innovation and cultural change are deeply linked predates most of the innovation literature (cf references to Barnett, 1953, in Foley, 2000), and although recent work on innovation has gone far beyond the original focus on technological innovation to, for example, include organizational and marketing innovation (OECD, Oslo Manuals), social innovation (Mulgan, 2012), institutional innovation (Hargrave & Van de Ven, 2006) and especially convergent innovation (Dubé et al, 2014), has explored many dimensions of embeddedness in the institutional, economic and societal context (e.g. Systems of Innovation literature), and is beginning to consider indigenous innovation (Walters and Takamura, 2015), there is little work considering culture as the base for innovation, and conversely the impact of innovation on culture from an indigenous perspective. We summarize the existing work and point to promising areas of future research.

Presenter: Philip Shapira

Title: Innovation and societal strategies of SMEs in emerging technologies: Insights from business websites

Session: 2.1

Location: CCF

Time: 3:15 PM - 4:45PM

Abstract:

The formation of small and mid-sized enterprises (SMEs) represents one of the fundamental components of dynamic regional and national economies, with enterprise start-up and early growth being a particularly significant element in pioneering and developing emerging technologies and disruptive innovations. However, multiple challenges need to be addressed as SMEs in emerging technologies seek to commercialize their inventions and research. These challenges include ones of manufacturing scale-up, access to finance, business strategy, market uncertainty and user absorptive capacity, and competition from incumbent technologies and businesses. Additionally, SMEs in emerging technologies increasingly need to anticipate and engage with issues of societal and public concern. Building on literature on responsible research and innovation, corporate social responsibility and business innovation, this study examines the business and societal models of SMEs in the emerging technological domain of synthetic biology. We use a combination of structured data (from open-source business databases) and unstructured data (from enterprise websites and social media) to identify enterprise characteristics and gather information on development, innovation and commercialization activities and on approaches towards societal responsibility. Within our global set of synthetic biology SMEs, we focus on a group of 138 companies in the UK and US. These two countries provide relevant locations for study as each has an emerging and fast-developing synthetic biology sector, but with distinguishing governance strategies and contexts (including the presence of explicit frameworks for responsible research and innovation). We operationalize responsibility (as expressed by business statements and business responsible governance actions) and test how responsibility is associated with innovation strategy, customer orientation and application targets, product or process focus, regulation, finance, and other business characteristics. The analysis is exploratory: it further examines the opportunities to use publicly-available online enterprise data not only to probe business and innovation aspects but also to investigate societal claims and strategies. We also consider the limitations and caveats of using such online sources. The findings of the study enhance our understanding of distinctive ways that SMEs combine new business models and societal models for addressing the challenges in commercializing emerging technologies. We anticipate findings that will shed light on similarities and differences in strategies for responsible commercialization of synthetic biology for UK and US SMEs. The research also informs management and policy strategies related to how societal challenges of emerging technologies are framed and operationalized by SMEs.

Presenter: Jonathan Silberman

Title: Knowledge flows between universities and industry: The impact of distance, technology compatibility and ability to diffuse knowledge

Session: 3.2

Location: 108N

Time: 10:30AM-12:00 PM

Abstract:

This paper investigates university knowledge transfer by the citations to university patents in the patent applications filed by firms. These citations to previously issued patents capture the transfer of knowledge from past research efforts to innovate new products and processes. Data is compiled for the 91 largest research universities in the using the NBER patent citation data. We estimate a spatial interaction model of the origin (university) to destination (industry) citation flow aggregating industry citations to 142 metropolitan areas (MSAs). Separation factors are distance, technology compatibility, location in the same city as the university, and state border. The fixed-effects coefficients measure the ability of universities to diffuse knowledge (providing a ranking of universities) and the ability of MSAs to absorb university knowledge. The distance and spatial origin and destination variables provide measures of knowledge spillovers from university patents. Public v private universities are analyzed separately. We find citations to university patents are significantly higher for universities in the same city as the citing business. The same city effect is greater for public than private universities. The distance indicator variables show that citations at most distance categories are not statistically different than citations beyond 2000 miles. Technology compatibility of university with industry patents has a significant impact on university patent citations, and exhibits considerable variation across university-MSA pairs. MIT has the largest fixed effect (diffusion) estimate more than twice Stanford the next university. Technology centers such as San Francisco, San Jose, Boston, and Research Triangle have high ability to absorb university knowledge from patents. Fixed effects (diffusion and absorption) have a greater impact on knowledge flow than the separation factors for most university-MSA pairs.

Presenter: Courtney Silverthorn

Title: The Return on Investment initiative of the National Institute of Standards and Technology (NIST)

Session: 2.2

Location: 108N

Time: 3:15 PM - 4:45PM

Abstract:

In 2018, the National Institute of Standards and Technology (NIST) established the Return on Investment (ROI) initiative to improve the transfer and impact of U.S. federal R&D investments. The goals of the ROI initiative are to: remove barriers to innovation, modernize R&D partnering models and tools, expand entrepreneurial ecosystems, and create increased opportunities to realize economic and social returns stemming from federal R&D investments. The initiative is informed by responses to a Request for Information (RFI) published in the Federal Register, four public meetings, a summit hosted by NIST, and multiple meetings with stakeholder groups. Findings from the ROI initiative will inform actions

implemented through the Lab-to-Market Cross Agency Priority (CAP) goal, part of the President's Management Agenda.

This paper focuses on findings stemming from the second strategy under the Lab-to-Market CAP goal: Increasing Private Sector Engagement. The ROI initiative evaluated challenges related to a) partnerships between federal laboratories and the private sector and b) attracting private sector investment in federally-funded technologies. Following these challenges, the paper presents specific recommendations for how to encourage and support partnerships, including the use of non-profit foundations, Partnership Intermediary Agreements (PIAs), Other Transaction Authority (OTA), and facilities sharing agreements. In response to the need to develop further federally-funded technologies, the report also recommends the limited use of R&D funds for intellectual property protection and examine ways to improve the impact of the commercialization-related outcomes of the SBIR program. Adoption of ROI findings and best practices is likely to result in increased economic and social returns.

Presenter: Nasrin Sultana

Title: Foreign direct investment, technological advancement, and absorptive capacity: A network analysis

Session: 2.3

Location: 208N

Time: 3:15 PM - 4:45PM

Abstract:

Technological innovation is considered to be an important instrument of economic and technological development (Hofmann, 2013; Findlay, 1978; Xu, 2000; Lall and Narulla, 2004; Volberda et al.,2010). Most countries get the benefit of innovation and new technologies through technology transfer and technology absorption (Keller, 2004 and 2010). Foreign Direct Investment (FDI), among other channels, is frequently used to transfer technologies (Blomstrom and Kokko, 1999; Borensztein et al., 1998; Baranson, 1970; Gorg and Greenaway, 2004; Lall and Narula, 2004). Scholars typically consider direct linkages to understand technological advancement without giving much attention to the indirect linkages or interconnectivity among countries. To extend knowledge on how technology transfers through FDI, we use a network analysis approach and modeled bilateral FDI among countries as interdependent networks for the period 2009-2016.

The purpose of our research is to apply network perspective and to elaborate our understanding of the relationship between a country's position in the global FDI network and the technological advancement of that country. Thus far, no study has been done to understand the transfer of technology through the global FDI network by using a network analysis approach. Our study contributes to theory by complementing international business literature on network analysis, technology transfer, and FDI with quantitative evidence. The study also offers empirical contribution by applying the network analysis to modeling global FDI flows and conducting a longitudinal ordered logistic regression analysis to understand the relationship between the network position and the technological advancement of a country.

We separate the analyses into two parts – network analysis and regression analysis. First, FDI networks, from 2009 to 2016, are prepared to determine the structure of the global FDI network and a country's position in the network. Later, this network position indicator is used in a regression analysis to examine the relationship between a country's position in the global FDI network and the country's technology status. We also analyze whether the absorptive capacity of a country – measured in terms of R&D, human capital, and knowledge intensity – moderates this relationship. Networked Readiness Ranking (NRR, 1=best) is used as a proxy to technology status of a country and the dependable variable in our study.

We have found empirical evidence that the global FDI network has a core-periphery structure and core countries are more technologically developed than peripheral countries. Our research also finds empirical evidence that a country's position in the FDI network is positively associated with that country's technology status. However, the research finds partial support that a country's level of absorptive capacity positively moderates the relationship between a country's network position and technology status. The most remarkable finding in our paper is the significance of knowledge intensity in the technology status of a country. The findings of our study provide us with a nuanced understanding of absorptive capacity that a country can focus on to attract FDIs and to benefit from attendant technologies.

Presenter: Jon Thomas

Title: Endowing university spin-offs pre-formation: Entrepreneurial capabilities for scientist-entrepreneurs

Session: 3.4

Location: Board Room

Time: 10:30AM-12:00 PM

Abstract:

Universities spin-offs are an important mechanism for the commercialization of public science. Spin-offs emerging from universities contribute to regional development and economic growth. However, the majority of science-based university spin-offs fail to survive. To better understand how science-based university spin-offs can be endowed for success, we analyze the *pre-formation* stage of 30 ventures co-founded by a focal scientist-entrepreneur over a 40 year period. Using a unique, longitudinal, multi-level dataset consisting of 1476 publications and 363 granted US patents matched to these 30 co-founded ventures, we inductively develop a model depicting four pre-formation entrepreneurial capabilities with which these science-based university spin-offs are endowed for success. We show how these entrepreneurial capabilities can be developed in the research lab and suggest that innovation policies aimed at innovative start-ups focus on supporting scientist-entrepreneurs in the pre-formation stage of university spin-off emergence.

Presenter: Andrew A. Toole

Title: Limiting innovation? Patenting impacts following the U.S. Supreme Court decision in Alice Corp. versus CLS Bank

Session: 1.3

Location: 208N

Time: 11:00AM-12:30PM

Abstract:

Legal uncertainty in intellectual property rights (IPRs) can severely limit innovation. Prior research shows that uncertainty over IPRs reduces the value of patents, the ex-ante incentive to invest in innovation, licensing transactions in markets for technology and challenges to monopoly markets by entrants. This paper uses a natural experiment to investigate whether courts can change the uncertainty innovators face when seeking patents on their inventions. Specifically, we analyze the impact of the 2014 U.S. Supreme Court decision in the *Alice vs. CLS Bank* case (hereafter *Alice* case) on examiners' decisions to grant patent protection by the U.S. Patent and Trademark Office (USPTO).

Among other requirements for a patent, an invention must qualify as patentable "subject matter." United States Code 35, Section 101 (35 USC § 101) states: "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." Over time, however, the U.S. court system has determined three major judicial exceptions to the "process, machine, manufacture, or composition of matter" definition of patentable subject matter. These are abstract ideas, laws of nature, and natural phenomena. In the 2014 *Alice* case, the U.S. Supreme Court extended prior judicial decisions by increasing the requirements for any invention that involves abstract processes. Following the *Alice* case, the USPTO must apply a two-part test to evaluate whether inventions involving abstract processes are patentable subject matter. This decision dramatically changed how software and business method patents are evaluated for patent protection and introduced the possibility that existing patents for software and business methods are no longer valid and enforceable in the court system.

Using the Supreme Court decision as a natural experiment, our analysis uses a difference-in-difference methodology to test whether the court decision increased uncertainty about patentability and increased the threshold required for patents on technologies involving abstract processes. The richness of recently released USPTO office action data allows us to identify specific reasons for increased uncertainty and rejections at the application level. Further, we exploit internal USPTO data to control for fixed characteristics of examiners that affect patent granting decisions. Additionally, we exploit patent application classifications and abstract language use in patent claims to identify *Alice* at-risk patent applications. The unique characteristics of our data and identification strategy allow for the first causal identification of the impact of ambiguous judicial decisions on increased uncertainty in intellectual property rights.

Presenter: David A. Wolfe

Title: The Alacrity Accelerator Network: An innovative Canadian accelerator model

Session: 2.2

Location: 108N

Time: 3:15 PM - 4:45PM

Abstract:

Accelerators are economic development tools that help regions spur the creation of new, innovative ventures as well as profitable commercial endeavours sponsored by large companies to create high-growth firms that they have an equity stake in. Though accelerators are a new phenomenon, the literature has already developed well-defined models and frameworks for accelerators, ranging from publicly supported ones with specific economic development goals to private, corporate accelerators designed to produce a profit for the accelerator managers or the companies that sponsor them. In both cases, accelerators exhibit a regular structure in which existing firms apply to enter the accelerator to receive investment along with intensive training and mentorship for a set period in exchange for equity in the firm.

Judged against existing structures, the Alacrity Accelerator Network (AAN) offers a unique acceleration model that combines elements of both public and corporate accelerators as well as employs a different strategy based on building successful entrepreneurial teams rather than accelerating existing firms. AAN, founded by Canadian high-tech serial entrepreneur, Terry Mathews, through the auspices of his investment firm Wesley Clover, has grown from a single corporate accelerator based in Ottawa to a network of nine accelerators with locations ranging from Victoria, British Columbia, Cardiff, Wales, to Pune, India and Singapore. Its operations are funded by a combination of investment from Wesley Clover as well as funding from local governments or philanthropic foundations looking for the accelerator to act as a training site for new entrepreneurs, a catalyst for local entrepreneurship, and a hub to build the local entrepreneurial ecosystem.

Rather than accepting existing firms into their accelerator program, AAN managers instead endeavour to create teams of high-quality graduates. AAN draws on partnerships with local universities and dealmakers to identify young, highly-skilled potential founders and brings them together to create diverse founding teams. Beyond this, AAN also seeds them with an opportunity sourced from one of Wesley Clover's partner organizations. AAN works with entrepreneurs to identify an opportunity and source their first customer. The specific structure has changed over time in response to both local contextual needs, the strategic goals of Wesley Clover and its public partners, and the availability of talented accelerator managers.

AAN represents a novel model for accelerators in two ways. First, rather than acting as a judge and curating access to the accelerator from existing start-ups, AAN acts more as a music producer, bringing together talented individuals and providing them with resources and opportunities. This shifts the goals of acceleration from training and resource provision to network brokerage and talent identification. Second, it combines features of public and corporate accelerators, drawing on the resources of an international investment firm while at the same time attracting public investment to achieve economic development and ecosystem goals. This raises new questions about the relationship between individual profit and broader regional economic development goals.

Drawing on interviews with AAN managers and entrepreneurs along with contemporaneous media reports and government documents, we profile AAN's activities, evolution, and impact. This case study advances our understanding of new forms of accelerator networks and how they adjust their activities to correspond to local contexts and needs.

Presenter: Tohru Yoshioka-Kobayashi, Makiko Takahashi

Title: Examining public perception of the university-industry collaboration research by a split-run test: Pitfalls in academic technology transfer policy

Session: 1.2

Location: 108N

Time: 11:00AM-12:30PM

Abstract:

Many government bodies and higher academic institutions have put greater emphasis on university-industry collaboration to stimulate innovations and to obtain research funds. However, because limited universities can survive without any public funding, it is crucial to balance academic commercialization engagement and integrity as non-profit organizations. Our investigations on financial conflict of interest management practices indicate that public perception management is essential to maintain integrity. Despite its essentiality, determinants of public perception of the university-industry collaboration research are not revealed in the literature. This paper examined these key determinants using a public survey conducted in Japan. Considering response biases come from an acquiescence and a lack of interest in academic research, we adopted split-run testing (commonly known as A/B test) to identify differences in responses between cases in which given several conditions are randomly changed. We provided respondents three research project cases from nine imaginary cases. Each case has 14 variations in their conditions; a reputation of the university, and a collaboration partner (including the industry). We also showed a background of the research, estimated term of the project, expected social impact, and total research expenditures. Respondents answered their overall evaluations to individual cases and both positive and negative factors which affected the evaluation. At the same time, we also asked them the perception about the university-industry collaboration itself. Our online survey had conducted for 14,360 survey monitors and received responses from 3,443 respondents (response rate: 24.0%). Genders and generations of respondents are balanced to those of Japanese demographics. The result revealed that university-industry collaboration research has a higher probability to be regarded as a private profit-making opportunity and does not improve the recognition as the way to solve the social issues. These mediating factors dramatically worsen or improve (respectably) overall evaluations of the research project. That means citizens have a negative perception toward a university-industry collaboration implicitly. Interestingly, when we asked respondents the perception about the collaboration directly, they tend to answer very positively. Our research identified a hidden risk of university-industry collaboration promotions. Emphasis on financial returns on both the university and industry potentially induces negative perceptions of a scientific research project. At the same time, an emphasis on its social values will diminish the negative impact. These findings give a managerial implication for the university not to lose public support for conducting academic research activities and to balance academic commercialization and traditional academic activities.

Presenter: Jan Youtie

Title: The impact of I-Corps on academic entrepreneurship

Session: 2.1

Location: CCF

Time: 3:15 PM - 4:45PM

Abstract:

University commercialization support initiatives have evolved since the Bayh-Dole Act (Wright and Siegel, 2015). Approaches after the Bayh-Dole Act emphasized technology transfer offices and tended to be more centralized, intellectual property-oriented, and revenue seeking (Breznitz, 2011). Studies of these traditional technology transfer support programs have not been found to be significantly associated with positive commercialization outcomes such as new venture capital, companies, or jobs (Grimaldi et al., 2011). Methodological factors are an issue in these studies. There are few quantitative studies that are able to find comparison groups that can account for the effects of confounding variables such as the quality of the service, characteristics of the university and location, or attributes of the scientist. Individual-level characteristics also are not well captured. Another issue with these studies is that the commercialization support landscape has evolved toward accelerators and entrepreneurship training programs that tend to be more decentralized, emphasizing entrepreneurship capacity development (Clarysse et al., 2015).

This research will address these gaps by comparing the outcome of individual projects that received support through the US I-Corps program. I-Corps is a program that originated in the National Science Foundation (NSF) in 2011 to provide training in evidence-based entrepreneurship methodologies to accelerate commercialization research of its principal investigators. I Corps training is provided through a network of nodes. Georgia Tech's I-Corps South Node was established in 2012 through the university's VentureLab unit as one of the first three sources for the evidence-based entrepreneurship curriculum. VentureLab is a Georgia Tech program established in 2001 to assist faculty members through the commercialization process.

This paper compares two entrepreneurship support efforts to accelerate academic entrepreneurship of Georgia Tech faculty projects: I-Corps services delivered through VentureLab (VentureLab+I-Corps); and similar services through VentureLab but outside of I-Corps (VentureLab-only). The comparison assesses the likelihood of commercialization outcomes such as attraction of substantial financial capital, new company formation, or jobs. The independent variable of interest is whether or not the project involves VentureLab+ I-Corps or VentureLab-only, which represents whether there is something particular about the approach that I-Corps uses over and above the basic evidence-based methodology which has been widely disseminated. A significant consideration is the ability to identify factors that encourage investigators to select into the VentureLab+I-Corps versus the VentureLab-only service. A selection equation first presents significant variables that distinguish the two service groups. A second stage analysis presents outcome variables—financial capital, new company formation, jobs—as a function of the main independent variable of interest, and control variables for year of service, discipline, and characteristics of the investigator.

Presenter: Christian Zavarella, Brenton Nader

Title: Manufacturing space for inclusive innovation? A study of maker spaces in southern Ontario, Canada

Session: 4.3

Location: B019

Time: 1:15AM-2:45PM

Abstract:

Is the maker economy a potential avenue for inclusive innovation and equitable economic development? Buoyed by growing public interest in do-it-yourself culture, localism, and sustainability, cities around the world – and, especially in North America – have witnessed growing interest in the maker economy. Policy think tanks and urban advocates, including the Brookings Institute and the National League of Cities, have observed the growth of maker spaces that provide access to affordable manufacturing technologies, like 3D printers, laser cutters, and CNC machines. Optimistic accounts suggest that these maker spaces provide foundational and inclusive spaces for learning, skill development and knowledge transfer, as well as business incubation and prototyping infrastructure for artisanal manufacturers, micro-manufacturers, and entrepreneurs. Moreover, such spaces offer potential institutional supports for would-be entrepreneurs, especially those from historically marginalized communities and low-income groups. These trends, coupled with the rise of digital platforms that connect designers with manufacturers or customers with artisanal and craft manufacturers, suggest that maker spaces may be a potential tool for pursuing more inclusive and equitable forms of urban innovation and economic development.

Yet, little is known about the practices of maker spaces, including how they support entrepreneurship and innovation or promote social and environmental sustainability. In an effort to address this gap, this paper asks if (and how) maker spaces promote inclusive forms of innovation and economic development. To explore these questions, this paper draws on a study of maker spaces in southern Ontario. The paper presents an analysis of a unique database of maker spaces across the Greater Golden Horseshoe (GGH) region, as well as findings from in-depth case studies exploring the economic, social and environmental goals and practices at leading maker spaces located in large and mid-sized cities in the GGH region.

The study finds that while there is some evidence that maker spaces actively and explicitly seek to be socially inclusive in their membership and activities, there is limited evidence that this translates into the entrepreneurial, business and economic outcomes touted by urban policy advocates. In other words, while the academic and policy literature on urban manufacturing and maker spaces suggests that these new local institutions hold promise as spaces for new economic potential, social inclusion and progressive environmental practices, it is unclear that this promise is fully realized. Thus, the paper raises questions about the current potential of maker spaces for creating higher quality jobs and inclusive innovation and economic development in North American cities.

Presenter: Majlinda Zhegu

Title: Collaboration in times of connectivity

Session: 1.1

Location: CCF

Time: 11:00AM-12:30PM

Abstract:

Due to a handful technological innovation whose convergence generates endless technology proposals, we are experiencing the greatest connectivity era. But is connectivity a powerful source of problems or solutions? Connectivity is a technological prowess that despite its great potential of tackling innovative solutions is instead generating huge problems. When not managed carefully, global connectivity is prone of creating more risk rather than enabling the international community to achieve more effectively growth and prosperity goals.

Why greater connectivity does not "spontaneously" help organizational collaborations? Some of the most important obstacles are:

- ***Organizational structure***. The organizational routines tend to hinge most collaboration approaches to the status quo. They naturally slow down or even break any disruption of traditional models of engagement in security-threatening situations. Structural obstacles, as rigid hierarchies, proprietary information or working in silos, prevent the development of "trusted networks of practice" (Brown and Duguit, 2001).

- ***Actors' proximities***. Innovation diffusion theory stipulates proximity as a crucial factor for the adoption of novelty. The concept of proximity has many ramifications based on professional, institutional, geographic, temporal, ethnic, tribal and religious elements. As Tsing (2004) warns, "Global connections are an ever-present reminder that universal claims do not actually make everything everywhere the same". The usual "one-size-fits-all" approach of the international actors creates more friction (and tension) instead of resolving the security threatening situations. Furthermore, if each international actor tries individually to achieve its goal, the overall process risks being a zero-sum game.

- ***Facing wicked problems***. Even in the era of flooding information and great connectivity, many decisions are still made in a context of imperfect information and a good deal of improvisation. Therefore, replacing the work in silos with trusted networks of practice is essential to the decision-making process and improvement of its outcomes.

- ***Technological obstacles.*** Differences (gaps) in the technological tools and IT infrastructure restrain the ability of users to take full advantages form connectivity. In the context of collaboration, technological discrepancies frequently cause interoperability problems.

- ***Legal loopholes***. The accessibility, sharing and diffusion of information in a digital context defy the traditional law doctrines and public regulations. These loopholes seem to prevent the emergence of trusted networks, while questionable (abusive) practices of information access and use are flourishing.

Almost every human activity is facing the challenges of connectivity, which is a keystone of the ongoing digital transformations (Olleros and Zhegu, 2016). Important technological, managerial and social issues are emerging from these transformations. How do the new approaches of co-creation compare to the traditional ways of value creation and value capturing? How do these new forms of collaboration affect traditional balances of organizational power, influence, and authority? How innovation policies are being adapted to the actual high-speed transformations?

This exploratory study combines two complementary perspectives. First, a bird's eye view on the ecology of routines of collaboration: the case of cyber security ecosystems. Second, a worm's eye view on the ecology of routines: the case of Danish Open City Sensor Network. The aim is to corroborate a conceptual framework followed by a large-scale study of the collaboration among the public and private stakeholders involved in the context of digital platforms.

Presenter: Kejia Zhu

Title: Patent technological diversity and pendency time

Session: 1.3

Location: 208N

Time: 11:00AM-12:30PM

Abstract:

The last few decades have witnessed a fast growth of patent filings. With the upsurge in patent applications, patent offices are increasingly challenged to optimize the limited examination capacity to decide valuable inventions that will benefit the society, while reducing backlogs so that applicants can receive examination results as fast as possible (Harhoff & Wagner, 2009; Régibeau & Rockett, 2010). Hence, it is important to understand what affects the pendency time of patent applications (i.e., duration of patent examination).

In this study, we focus on the effect of patent technological diversity on application pendency time. This is intrigued by the increasingly prominent view that there seems to be a decoupling between patents and breakthrough innovation: despite the increasing amount of patents, breakthrough innovation is still limited. This makes one wonder how inventions with different levels of innovativeness go through the patent examination process, as this can significantly affect technological landscape. Innovation is often seen to arise from knowledge recombination; and we adopt this recombination view and examine how patents technological diversity affects pendency time.

We attempt to answer this question based on a sample of 283,884 pharmaceutical applications filed between 1985 and 2017 at China's State Intellectual Property Office (SIPO). Using Cox proportional hazard rate model for competing evens, we find a U-shaped relationship between patents' level of technological diversity and pendency time. That means, when the level of patent's technological diversity is moderate, the pendency times for both grant and rejection are the shortest. We theorize that this is because as patents' technological diversity increases from low to moderate, their novelty and inventiveness (i.e., non-obviousness) become increasingly evident to the examiners without much time or effort. However, as technological diversity continues to increase, the information that examiners need to process will increase exponentially for them to evaluate applications' practical applicability despite their novelty and inventiveness, thereby increasing the time necessary for decision-making.

Moreover, we also find that this U-shaped relationship can be moderated. In particular, we find that as the inventor team becomes larger, the extra time that examiners need will be reduced to make the grant decision for applications with high level of technological diversity. We suggest this is because larger inventor teams have a higher absorptive capacity (Cohen & Levinthal, 1990) and therefore can better integrate diverse

technological elements in one invention without much confusion, thereby facilitating the patent examination process and reducing the grant decision time. In addition, our findings also show that those applicants who use patent agents to file their applications will also see a reduced granting time despite the level of technological diversity of their patent applications.

Our findings have important implications for the design of an efficient patent system. They can also provide insights for organizations who seek to better understand the patent examination process in order to manage their innovation strategies. Finally, the findings seem to suggest that breakthrough innovation might experience serious delays going through the patent system successfully.