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Networking to Support Spin-out Decision: the Case of Women in Engineering

Short Paper

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Abstract

This article presents the work of a research and action group that promoted the creation of spin-outs by women researchers in science and engineering. The project involves developing and offering a community of practice to support women university researchers who have the potential to create spin-outs; the community's goal is to develop and maintain networking opportunities and reciprocal relationships, and facilitate the multidirectional flow of academic knowledge and expertise between researchers and their students. From an academic point of view, this paper aims at answering the research question of whether a community of practice mediated by IT tools can provide a useful support and generate a positive impact on the launching of a startup by women in STEM. Finally, to measure the success of the community, two surrogates will be used: satisfaction and effectiveness (in assisting decision)

Keywords: Ccommunity of practice, spin-out, STEM, entrepreneurship, innovation

Introduction

This paper reports on a project implemented to create a community of practice dedicated to women engaged in doctoral studies in sciences and engineering. Women in STEM have been repeatedly victim of STEM biases, namely in university tenure (Jaschik, 2014), but it's time to implement the necessary resources to put an end to it according to Weisshaar (2017). This community intends to complement the work of university-industry technology transfer (UITT) offices, interested in making money out of licensing researchers' inventions. But not all women are interested to turn their invention into a business, especially novices, more attracted by technical problems than commercial concerns. The goal is to help those women decide about launching a spin-out or spin-off enterprise and provide them the insight of the community to assist them in his delicate phase of uncertainty. Not all women will transform into an entrepreneur, for many reasons. This project offers them support thru the capacities of an IT mediated community, aligned with the women's empowerment movement. Along with the information, knowledge, and advice from women participants from the community, specifics resources will be offered such as webinars, calendar of events, links to funding organisms, and open forums, as well as women's entrepreneurship organizations. The project is expected to have a three-fold impact: economic, by creating new businesses that will generate new jobs; cultural and social, by learning about others and their values and by creating and developing mutually supportive and sharing relationships.

From an academic point of view, this paper aims at answering the research question of whether a community of practice mediated by IT tools can provide a useful support and generate a positive impact on the launching of a startup by women in STEM. To answer the research question, a participant observation methodology was chosen because observation is critical to giving sense to phenomenon (Bardon et al., 2020) who state four challenges: defining what to observe, how to observe, how to preserve and how to tell. Galle (2020) mentions that participants observation is useful to study groups since it provides more rich insight than surveys, improving content validity. Finally, to measure the success of the community, two surrogates will be used: satisfaction and effectiveness (in assisting decision).

Topic and theoretical background

Women in STEM

Weisshaar (2017) examined a sample of 475 assistant professors from 95 departments of sociology, 475 in English from 127 English departments and 606 from 108 Computer Science departments, drawn from the NCR data. She observed that the gender gap in tenure cannot be explained only by the professor's productivity or the characteristics of the department and concluded that the evaluation process could be suspected. If women are underrepresented in STEM it explains why fewer launch a startup based on their invention.

This paper asks if it is possible to help women to decide about this important question, namely with the help of a community of practices, built to bring them support. This can have a huge impact according to Smith et al. (2017), who offer an interesting point of view based on an experiment which offered psychological support to women faculty engaged in STEM that resulted in a significant improvement in job satisfaction for both men and women.

The need to create this kind of community is aligned with the women's empowerment movement and the UNESCO's STEM and Gender Advancement (SAGA) project, which aims to reduce the gender gap in STEM (Elliott et al., 2020). This gap is not new in universities as mentioned by Jaschik (2014) but it's time to implement the necessary resources to close it according to Weisshaar (2017).

To reduce the gender gap, the SAGA project determines, measures and assesses sex-disaggregated data, as well as supports the design and implementation of science, technology and innovation (STI) policy instruments that affect gender equality in STEM (science, technology, engineering and mathematics). The need to create this kind of community also aligns with the goals of the governments and with NGO programs, which focuses on women's entrepreneurship.

To determine if there is gender bias in favor of men in sciences, Handley et al (2015) organized three experiments double-blind and randomized. In each the participants would assess the quality of an abstract on gender bias but with a man or woman as first author. In the first experiment, conducted with 205 adults recruited from Amazon crowdsourcing marketplace, men participants evaluated significantly less favorably the abstract than women did. The second sample was taken from a research-oriented university and composed of STEM (n=116) and non-STEM professors (n=89). Male faculty assessed more severely the abstract than women. From experiment 1 and 2, the authors conclude that men are less receptive to the idea of an existing bias in STEM. A third sample (n=303) was also recruited online from Amazon online job website. They received either an original abstract or a modified abstract without bias, with author name being either a woman or man name. As expected by authors, men showed bias in appreciating the abstract while women were reacting more strongly to the abstract showing no bias in STEM. Handley et al (2015) concluded that there is a need to reduce this lack of objectivity to favor discovery and achievement.

Surprisingly, and in contradiction of the main perception about bias, a study by Hengel & Moon (2018) observes that in top economic journals, articles written by women are cited more frequently than those signed by men and that the presence on a woman co-author increase the probability of being cited.

University innovation through startups and the role of transfer offices

Companies are relying more and more on scientific partnerships to complement their R&D efforts and ensure their continued commercial success (Hohberger et al., 2015). The university's third mission is to transfer technological knowledge to the productive sectors of society (Miranda et al., 2018), thereby enabling the university to be involved with the wider economic world (De Wit-de Vries et al., 2019; Orozco 2019) but, by the same token, putting researchers under increasing pressure (Perini et al., 2018). Most universities have created these kinds of offices (TTO) to encourage the commercialization of university research (Rasmussen and Wright, 2015).

Based on their academic research, De Cleyn and Braet (2009) distinguish between two kinds of entities: spin-offs and spinouts. They define the former as “a new legal entity (company), founded by one or more individuals from a parent organization to exploit knowledge gained in the parent organization and transferred to the new company” and the latter as “an existing entity, being separated from a parent organization as a new legal entity (company) to exploit knowledge gained in the parent organization and transferred to the new company”. They state that, in their view, “a spin-off is the creation of a completely new entity outside an existing organization, whereas a spin-out concerns the separation of an existing entity (division, business unit, etc.) from the mother organization.”

TTOs tend to support the creation of spin-offs rather than spinouts, because the university retains partial ownership of the intellectual property (Fauzan and Gooneratne, 2019), and the goal of these offices is to maximize revenue (Meysman et al., 2019). They focus on patenting, drafting revenue-sharing agreements and sorting out other legal matters and, by and large, do not increase the number of patents received or spin-offs created annually (Baglieri et al., 2018). TTOs and other involved parties work in isolation, using only their own data, and their work is confined to a single university. This project addresses the ivory tower-silo shortcoming (Mowery et al., 2015) by proposing to establish a cross-university community.

To do so, the project relies on a range of IT tools favoring knowledge dissemination and exchanges of knowledge among researchers, businesspeople, and industry by:

- a) Transmitting the practical and theoretical knowledge of experienced researchers whose industrial commercialization projects have either succeeded or failed and foster relationships between novice researchers and industry.
- b) Creating a group to increase industry's ability to find research partners who can contribute to their R&D efforts.

- c) Making information more accessible to researchers who want to commercialize their invention by providing them with the knowledge, experience, advice, know-how and support of a community.

Membership in the community of practice is restricted initially to university researchers and to people working in startup incubators and government programs that support business innovation, venture capitalists, industrial clusters, potential industry partners seeking innovation opportunities, as well as interested journalists.

Risks and challenges of technology transfer

Each year, hundreds of patents are filed, but converting these patents into products slips into the so-called “valley of death”, i.e., the period between the technology's academic research phase and its commercial application in the marketplace – at the riskiest stage during which the new company develops its product and customer base and attempts to secure funding to commercialize and develop its technology. Risks include:

- Ambiguity and misinterpretation of objectives and opportunities.
- Lack of effective project management.
- High turnover: as employees of these companies are often interns who leave the company as soon as they find a better position, leading to high staff turnover and a loss of knowledge.
- Losing control of the technology, after the researcher signs a licensing agreement.
- Sales misjudgment: potential market size, revenue projections, cost structure.
- A technical defect serious enough to end the project or increase cost.

TTOs play a key role in this regard, and in helping researchers cross the “valley of death”. However, bridging this gap requires more than simply making some technical adjustments so the laboratory's offer aligns with the company's needs. It also involves a financial risk for the company embarking on the project. It is therefore only natural for researchers and manufacturers to ask TTOs to help them minimize the risks, thereby facilitating the technology transfer. The researchers' network thus becomes a resource for technology transfer organizations seeking business opportunities and ways to reduce the risk to industry.

The role of a community of practice

Relevance and means of implementing a community of practice

IUTT offices do not usually assist undecided researchers. Rather, they get involved when the person is ready to act. However, even researchers who are interested in creating a startup can be discouraged by obstacles caused by cultural difference between academia and industry. A survey of 22,000 UK academics showed that only 21% of initial contacts were made by transfer offices, compared to 75% by external organizations. (Abreu and Grinevich, 2017).

A community is more effective than a publicity campaign at helping researchers evaluate their entrepreneurial project and less intimidating than a direct approach by businesspeople. It's the right place to ask candid questions, to test innovative, unfinished ideas, and it enables researchers to learn about the factors that facilitate university-industry technology transfer.

Hughes (2017) develops a Canadian report on women's entrepreneurship. His results show that women score consistently lower than men in all aspects. These Canadian results are consistent with a study of 22,000 UK academics in 2008-2009 which found that only 10.4% of women had commercialized their research, compared to 21.4% of men, and that 22.9% of women had targeted the for-profit sector, compared to 37.9% of men (Abreu and Grinevich, 2017).

Some investors might not fund a startup launched by a woman for precisely these reasons. They might also refuse to fund women startups because they are concerned about how the new business will perform

if the woman entrepreneur becomes pregnant (Kuschel and Lepeley, 2016). However, recent studies conducted after the global financial crisis show that women are more diligent than men in repaying their loans, meaning that dealings with women entrepreneurs are safer for financial institutions (Cowling et al., 2019). A study of crowd funding by Gorbatai and Nelson (2017) also found that, compared to men, women entrepreneurs communicate much better and are more successful in business. A study of 30 groups participating in an entrepreneurship course showed that the higher the proportion of women, the better the teams' performance (Neumeyer and Santos, 2020). This suggests that women are well qualified to succeed as entrepreneurs because they have the necessary entrepreneurial skills: boldness, self-discipline, and good communication and money management skills. The conclusions of Armuña et al. (2020) confirm that there is no difference between men and women in terms of their entrepreneurial intentions, but that their insecurity and fear of making mistakes keep women from studying science (Petruzzelli, 2020). Therefore, women's participation in entrepreneurship has become an increasingly important policy objective in many countries, including Canada which, as reported in the Global Entrepreneurship Monitor 2019/2020, has implemented several policies supporting women entrepreneurs (Bosma, 2020).

The life of a community of practice

Communities of practice are formed by people who engage in a process of collective learning in a shared domain of human endeavor: a tribe learning to survive, a band of artists seeking new forms of expression, a group of engineers working on similar problems, a clique of pupils defining their identity in the school, a network of surgeons exploring novel techniques, a gathering of first-time managers helping each other cope. In a nutshell: Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly." (Wenger et al., 2019).

CEFRIO (2020) wrote that the main advantages of communities of practice are that they boost productivity using dispersed resources; they promote individual and organizational learning through knowledge circulation; they stimulate innovation: speed up the transformation of best practices, problem-solving, stimulating creativity; they facilitate integration, retention and a sense of belonging; and they play a unifying role because of their cross-disciplinary approach.

This first step is to create a select group of champions who will form the core of the community. With the help of this core group, the project team will analyze the needs, recruit, and set up the community. Tools to evaluate the community's progress will be developed with the champions in the first few months of the community's existence. As members are recruited, they will gradually take over leadership positions.

Specific project challenges: overcoming the initial inertia

The project team addressed the first two challenges by suggesting that, if they prefer, members can initially adopt a passive role while they become familiar with the concept of commercialization and discover how much their situation resembles that of other members, even though their technology is unique. We foresee having to address the following challenges:

- a) Overcoming some researchers' negative feelings and behaviors: lack of interest in commercialization, lack of confidence, inability to assess their invention's economic potential, fear of having their ideas stolen, apathy, modesty, ignorance, etc.
- b) Reducing competitiveness between researchers and the associated industries. The goal of a community is to share knowledge.
- c) Finding the champions. We are counting on the transfer office directors to point out some potential champions among the researchers they have already contacted.

Achievements

The resources provided by this project complement those available through university transfer offices and women's entrepreneurship support organizations that provide expertise in management, finance, and human resources management once the decision to create a company has been made. This project offers the following tools mediated by IT:

- A forum, initially moderated by the authors: The forum enables members to discuss and brainstorm together and avoid feeling isolated. Its purpose is to engage community members by facilitating quality discussions on a variety of interesting topics: the benefits of spinouts, ways to make them happen, risks involved, ways to mitigate them, etc. The forum will archive the discussions to generate knowledge that can be passed on.
- A members' directory and a LinkedIn group, with information that can be viewed according to the privacy settings defined by the members when they register and that can be changed at any time. The LinkedIn group will enable business people, investors and companies, as well as women's entrepreneurship support organizations to recruit researchers and ask for/propose services.
- Webinars: The community will offer to its members webinars on a variety of interesting topics, such as: the decision to start a business, spin-out or spin-off, possible resources, success factors, etc. Representatives of women from several organizations dedicated to women entrepreneurship and empowerment have already agreed to deliver a speech.
- A blog: The blog will initially feature stories of successful transfers and the reasons for the failure of certain projects. The answers to these questions will be complemented by more theoretical content from recently published academic articles. Sample questions include: At what point did you start thinking about turning it into a business? Was it the university that gave you the idea? What ties do you still have to the university? Did you patent your invention? If so, what were the most significant difficulties you encountered? How did you overcome them? What challenges did you face in the business development process? Do you have any advice for future women researchers?

Remaining Work

Since the first version of this paper, the first of a series of 6 webinars has been broadcast by a respected Engineer who co-founded the International Network of Women Engineers and Scientists (INWES) and attracted many participants. The next ones will be more effectively advertised in Facebook and Instagram, more attractive than LinkedIn for the targeted audience.

The project IT tools are in place and the website launched. A first announcement has been widespread to universities to recruit members. The speakers of webinars have agreed to help by recruiting champions from their own networks. The blog will subsequently present different spin-out creators who will respond to questions in an interview grid. A final questionnaire will be sent through the universities' deans and program directors. The results of this survey will be included in a presentation in pre-ICIS 2021. Participation to the community will be compiled to be included in the portrait of the growth and relative success.

Success will be not be measured by "using the social network measures of density, connectedness, centrality, breadth, and reciprocity", so adequately used by Ma et al. (2019, p 773), for a similar style of participants, which is more related to use (models type 1 and 2). Instead, this project will use success surrogate variables (models 3 and 4): satisfaction and effectiveness in the decision making process of launching a startup.

Conclusion

The goal of this project is to support women university researchers who have the potential to create spinouts. It complements the role of TTOs, which support the creation of spin-offs rather than spinouts. The purpose of this project is to provide a cross-university community of practice capable of establishing

productive links between universities and industry. It also provides resources that complement those provided by university TTOs and women's entrepreneurship support organizations. The project team is aware of the risks posed by technology transfer and proposes solutions to address them. It helps new entrepreneurs recognize, assess, and manage the potential pitfalls of technology transfer such as the financial, technical, and technological risks. The community of practice also extends its support to undecided researchers. It provides assistance, guidance, and training during the decision-making process. To develop the tools needed by the community, the project has created a forum, a members' directory on the project website, a LinkedIn group, webinars, and a blog. One of the next steps is to refine our list of topics of interests and measure the impact of the community. During the conference, the authors will present the relative success of their project as measured by the number of participants, the frequency and importance of their participation to the webinars, the blogs, and other activities and particularly the degree of attainment of the self-determination of the community by its members and more important their satisfaction with the community support as well as its effectiveness to help them decide about launching or not their enterprise.

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