HARNESSING IDEA MANAGEMENT IN THE PROCESS OF TECHNOLOGY TRANSFER AT CANADIAN SPACE AGENCY

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ABSTRACT

This paper purpose an idea management process to support the technology transfer between Canadian Space Agency (CSA) with industrial partners (particularly small-size or start-up enterprises), and exploring how should the technology transfer be boosted using ICT tools. Particular emphasis was placed on crowdsourcing portals, platforms and informational tools used on technology transfer. This paper presents the first steps of the research protocol, as: a) to propose a model of idea exchange based in a collaborative strategy of transfer, b) prototyping of the collaborative idea exchange as a proof of concept that shows how idea management could be supported, and c) proposing knowledge management methods to support the process. Results show that the process of ideas management during developing collaborative projects was not sufficiently supported by current ICT tools. The data also revealed the important role played by social dynamics in the first stages of product conceptualization to harness idea exchanges during the process of technology transfer in further spatial projects development.

KEYWORDS

Idea Management, Creative Process Management, Idea Platform, Technology Innovation, Idea Process Management, Idea support

1. INTRODUCTION

This paper summarizes the key points of the research about the modelling of an open-collaborative platform based in Information and Communication Technologies (ICTs) of the project: "Measure of the Impacts for the Economy and Society of the Investments in the Expertise in Space in Canada" ($M(IES)^2C$) directed by Patrick Cohendet. In which the ÉTS research team proposes the support of CSA inventors/experts to generate a networking to support open-collaborative projects. This project is granted by the programme Capacity Building in Space Science and Technology (SS&T) – Clusters Pilots Results of CSA.

This paper describes the first stage of the analysis to model a new methodology of Technology Transfer (TT). The proposed platform reduces the time of documentation and also enables exchanges among agents involved in the process of new product design, particularly the transfer of spatial technology to be applied on the earth market and community. This paper is divided in three sections: first a literature review about TT Portals and methodologies, second the realized research and finally the description of each stage of the process of idea management.

There are a lot of challenges in implementing a system to support the ideas in the process of technology transfer. The challenges include the analysis of the idea's sharing and the collaborative strategies to adopt the others' ideas. In this paper, we present the project that addresses particularly the methods implemented to capture the idea generation process, which also concerns the knowledge transfer and the mechanisms to foster collaboration among CSA and enterprises. Additionally, the project covered two less frequent analysed challenges of an innovation process: promoting early judgement of the idea potential according with the opportunity

978-1-4799-6270-9/14/$31.00 ©2014 IEEE

and cost of the idea implementation and the strategies to promoting the idea adoption process. At this moment, this research is focused in the following phases: a) data collection phase that ensures that the proposed solutions by the research could be appropriately adapted to the CSA and enterprise's needs; b) the analysis of a study case of the first prototype of a ICT platform (www.innokiz.com). The prototype was modelled with an approach of a human-centered design, the human components were privileged beside the approach of tool-centered design; and c) the design of a techno-social platform that will be coupled with the content produced during the idea generation process.

2. TECHNOLOGY TRANSFER: METHODS AND TOOLS

Technology Transfer (TT) could be defined as an applied process for the introduction of a technology developed by a team or an organization to another organization. The authors Kingsley, Bozeman and Coker (1996, p. 969) mention that TT is "the use by an external party of technology or technical information developed by a publicly sponsored contract".

This process occurs in two phases: when the technology is transferred *"Spin-out"* and how technology is absorbed and implanted in the organisation *"Spin-in"* (Toregas et al., 2004). According with Coccia (2004, p. 33) TT "may be considered as the flow of information from the source (public and private research institutes, universities, etc.) to the users (firms and companies), over a given period of time, through the appropriate channels (communications, logistics and distribution)". Thus, the TT implies a Knowledge Transfer (KT) represented or already explicit in machines or products as *hard technology* and tacit knowledge or know-how as *soft technology* (Cohen, 2004). Bell and Pavitt (1997) explain that the technological changes are introduced by a process of TT, there are also an alternated evolution into new skills for the receiving companies. During the process of KT, explicit knowledge (goods) is easier and cheaper to transfer than the tacit knowledge: first ideas, management strategies, are hard and expensive to be transmitted (Amin & Cohendet, 2004; Nonaka & Takeuchi, 1995).

2.1. CURRENT ACTIVITIES OF SPATIAL TECHNOLOGY TRANSFER

In the study about six big spatial agencies presented by Petroni, Venturini, Verbano, and Cantarello (2009), TT is considered as an "implicit strategy" of the strategy orientation for all these agencies: European Space Agency (ESA), the Japanese Space Agency (JAXA), the Russian Space Agency (ROSCOSMOS), the Indian Space Agency (ISRO), the French Space Agency (CNES) and the Brazilian Space Agency (AEB). According with authors, "a clear strategic orientation of this type can be particularly noted in the behavior of CNES, ESA and JAXA. In all three cases there exist well organized structures for research and for the design of missions and space instruments. In addition, shared initiatives have been launched with universities and public and private research centers" (p 58.). The implemented strategies that encourage the TT between agencies and enterprises are mainly supporting Spin-off developments and contracts between others government entities. As the case of ESA "has recently promoted the establishment of a fund to finance programs of early-stage innovations" (idem), or JAXA shares initiatives with METI (Ministry of Economy, Trade and Industry) (ibid). Other agencies, such as ISRO, "possess excellent technical corps, but do not yet have a broad, space-related industrial system" (idem).

2.2. TOWARDS OPEN-COLLABORATIVE TECHNOLOGY TRANSFER IN SPATIAL PROJECTS

Firstly, we would like to introduce the concept of Open-collaborative Innovation Projects (OCIP), For Baldwin and Von Hippel (2010) "*an open collaborative innovation project* involves contributors who *share* the work of generating a design and also reveal the outputs from their individual and collective design efforts openly for anyone to use. The defining properties of this approach are twofold: (1) the participants are not rivals with respect to the innovative design (otherwise they would not collaborate) and (2) they do not individually or collectively plan to sell products or services incorporating the innovation or intellectual property rights related to it" (p. 9). The open collaboration implies certain challenges for all actors involved, particularly enterprises, to open their brief of the design and integrate an external team early in the process For designers is not easy develop confidence in a process, where are a high degree of incertitude about intellectual propriety or role definition in the project (Jimenez-Narvaez, Dalkir, Gélinas, & Gardoni, 2013).

This kind of collaboration has some similarities with crowdsourcing platforms; one well-known case is the use of *InnoCentive* a crowdsourcing platform for NASA. Since 2008 to 2010, "14 external problems or challenges were posted through three different vendors: InnoCentive, yet2.com and TopCoder. The 20 internal challenges were

conducted using the InnoCentive crowdsourcing platform designed for use internal to an organization and customized for NASA use, and promoted as NASA@Work" (idem). NASA@Work also is used to integrate 10 research centers of NASA, there are distributed in the nation. This platform is a good example of the need of integration of large research centers that have their creative/innovation resources delocalised geographically.

The context of Open Innovation (OI) implies some substantial changes on the variables and the factors of TT. Particularly, OI generates a new interaction among actors involved in open projects and society. As mentioned by Jolly (2012, pp. 9-10), OI provides direct benefits and drawbacks to aerospace sectors. Many of the OI drawbacks mentioned by Jolly (2012) are related with the ability to leverage R&D which was developed outside the enterprise, the others are:

- Management and oversight of innovation is more complex;
- Extra costs of managing co-operation with external partners;
- Over dependence on external parties, with potentially opportunistic behaviour of partners (future competitors);
- Loss of (some) technological competencies;
- Increased risk of leakage of proprietary knowledge and involuntary spillovers.

In some cases, the above drawbacks are mitigated for the quick absorption of the technology generated by spatial sector that is useful to resolve the first needs in health and sciences for the life (Brisson & Rootes, 2001). Also there are potential benefits for the small technological enterprises that will be able to share R&D expenses and risk to commercialize new products and services, in a strength innovation ecosystem (Wessner, 2012, 2008). For the reasons already explained, the open-collaborative practices have to be developed in parallel with strategies and methods of idea management supported by ICT tools. ICT enables and outlines the collaboration that is already setting up, as we will explain in the next Section.

3. TECHNOLOGY TRANSFER PORTALS

3.1. WEB PORTALS BASED ON DATABASE INFORMATION

Some programs of Technology Transfer were implemented using ICT as a main strategy of sharing information. These portals are divided in two categories: *Spin-in* when agencies need service from providers, and *Spin-out*, when agencies propose work subjects to external partners and community. In Table 1, we show a review of TT platforms used by the main spatial agencies, these data was provided by the enterprise Turquoise (personal communication with CEO of Turquoise Ozgur Gurtuna, 2012).

We observe at Table 1, a common aspect in the use of these web-based portals, is the use of HyperText Markup Language (HTML) pages and Extensible Markup Language (XML) to encode and to read databases. In the Canadian Portal the use of Active Service Pages ASP a Web Application framework developed by Microsoft. In the European Platform, we find programming languages such as C++ and Practical Extraction and Reporting Language (PERL). In this kind of Web services, external enterprises have the possibility to be informed and knowing about some future projects. In other way, for agencies, these portals had the advantage of obtaining and tracking information about the possible providers or contractors, by producing an active database.

Table 1 – Web Portals at Space Agencies

Agencies	Spin-in (Contracts)	Spin-out (Sharing projects)
CSA	MERX https://www.merx.com/	Transfer projects with Federal partners http://www.fptt-pftt.gc.ca/eng/about/partners/space.html Intellectual Property Management and Technology Transfer http://www.asc-csa.gc.ca/eng/industry/ipmtt/default.asp iNano http://www.inano.ca/fr/inano-registre-des-defis.php?defi_pat_id=1000004
ESA	EMITS http://emits.esa.int/emits/owa/emits.main EUMITS https://eumits.eumetsat.int/	Technology Transfer http://www.esa.int/SPECIALS/TTP2/
NASA	Multiple RFP Systems http://prod.nais.nasa.gov/cgi-bin/nais/index.cg	Knowledge Management http://km.nasa.gov/whatis/index.html Technology Transfer http://technology.nasa.gov/ Early-stage of innovation Program http://www.nasa.gov/offices/oct/early_stage_innovation/early_stage_programs_chart.html

For the paradigm of "database" approach of the use of these Portals, we observe the following drawbacks:

- Limited information about projects
- Not collaborative spaces

- Not workspaces
- Competition oriented
- Non-contact with sponsor, partners or experts

On the other hand, these platforms are also limited to completing a process of collaboration, because the used technology not allows convenient visualization among participants and either the following of projects.

3.2. CROWDSOURCING PORTALS

Figure 1 provides a comparison and an explanation of main functionalities found in different crowdsourcing portals: InnoCentive.com, OpenIdeo, Challengepost, y2.com, Topcoder, idea.me, and 10000Ideas, and Innokiz (prototype ETS-Montreal). We compared these portals using 10 criteria-functionalities (Jacquot, 2012):

1. Price
2. Visualizing new ideas
3. Innovation Management
4. Communication tools
5. Recruitment of staff
6. Collaboration, Professional networking
7. Tools/Workflow/ Process
8. Challenges proposed
9. Public participation
10. Public Poll

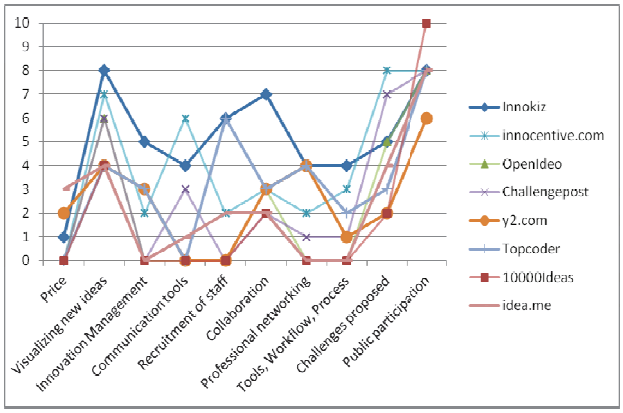

Figure 1 – Comparative of crowdsourcing portals used to knowledge and ideas transfer

These elements are essential to support collaboration for ideas exchanging in a *Spin-out* technology transfer from large enterprises or public administration to SME. Also, *InnoCentive* supports *Spin-in* technology transfer, in a virtual Pavilion dedicated to a NASA internal challenges (Davis, 2011). Into the paradigm of "Crowdsourcing" Portals, the Portals have some advantages comparing to "database" Portals. Crowdsourcing allow the connection among sponsors and contributors to the project. We observe the following drawbacks in the use of crowdsourcing portals to be oriented to technology transfer among SME enterprises and the CSA agency:

- Result oriented and not process oriented
- Not collaborative activities proposed among participants
- Competition oriented
- No contact or access with sponsor, partners, experts, community of practice
- No Networking generation

4. DESCRIPTION OF RESEARCH STAGES

This research follows a "Research-oriented Design" method (Dalsgaard, 2010, p. 200), in which a "design situation", in our case the design of a collaborative platform for TT, "is employed as a means of generating insights that will feed into the design of a product" (Idem). This method is also defined as "Research through Design"(Gliner & Morgan, 2000; Koskinen, Zimmerman, Binder, Redstrom, & Wensveen, 2011), in which the "design artifact became design exemplars, providing an appropriate conduit for research finding" (Zimmerman, Forlizzi, & Evenson, 2007, p. 493). This methodology is particularly useful in the design of systems, methodologies, or Human Computing Interfaces (HCI) that needs interactive research between technical opportunities and theory model gaps (ibid).

In an overview this research is composed by the following studies and stages:

1. The validation of data collected comparing the theoretical studies with the needs of enterprises
2. Comparing the main methodologies of current collaborative portals based in crowdsourcing (section 3)
3. Proposing a methodology of work to land the spatial technology to current market, in a technology transfer approach by satisfying the SME enterprise's needs.

The First Stage: designing a model of idea generation process requires social events or meetings among strategy stakeholders or project leaders, researchers, and members of their communities. The idea generation process is produced around a subject matter, challenge or problem situation. This process is tracked to observe the dynamics of ideas' sharing. In this phase the research techniques as: Task-analysis and Formative User Evaluation are useful to define: roles, functions, and needs of the participants. Also, it is observed the role of the external partners. These techniques allow the comprehension of the impacts of each role and function in the idea process. The

findings of the first phase will be compared to bibliographic research on the field.

The Second Stage of the project consisted in conceiving, documenting, and testing a prototype that support the idea management process. This ICT prototype has to support also, open-collaborative practices. ICT enables and outlines the collaboration that is already setting up. As shown at Figure 2, we propose three strategic phases that have to be developed in parallel with CSA TT activities:

1. Definition of the strategy of Open Innovation for the project to target the strategic knowledge for Open Collaborative development, this stage is developed by Internal Staff of R&D of CSA and concerned departments

2. Definition of the network that have to be propelled or to be supported: as the definition of Community of Practice (or desired network) and searching of external shared expertise in the project definition.

3. Planning and implementing the co-design events (meetings, congress, summits, etc) in co-localized or delocalized settings supported by ICT Platform of technology transfer.

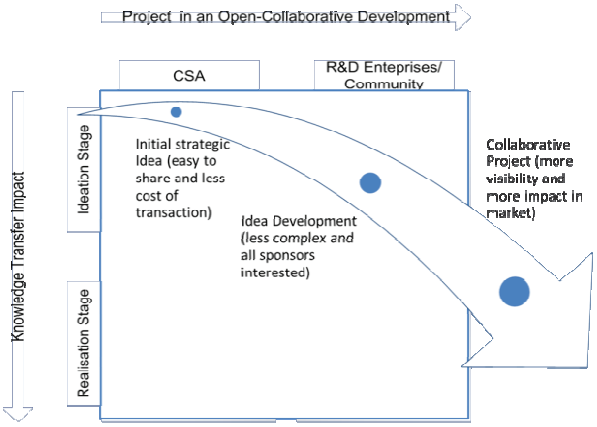

Figure 2 –Knowledge Transfer Proposal for CSA in an Open-Collaborative Project Development

The Third Stage consisted in testing and modelling the platform. The test of the platform is centered in defining how the stakeholders and researchers could be able to follow up the resulting ideas of the process of interaction with SMEs and open communities.

The platform has to be available to support all the activities involved in the technology transfer and the process of idea sharing. At the same time, the platform has to provide the needed information for different levels of complexity and for each participant's need. To illustrate: 1) once the SME show an interest in some project or CSA technology, 2) when there is a community problem that could be resolved with spatial technology, 3) when a proven spatial technology could be reused to the market purposes and how an enterprise can exploit it, and 4) when the new enterprises in spatial sector seek the help or the coaching of government and subvention associations or foundations.

4. CONCLUSIONS

The economic models and policies of innovation, and especially those related to technology transfer, are designed to support scientific and technological developments in high-tech or science sectors under policies that encourage the classic technology transfer process. However, our research demonstrates that the innovation could be encouraging in an open innovation process. In this case, the idea generation process requires a strategy that enhances diverse types of knowledge sharing and opportunities related with technology transfer.

The technology sometimes emerges at different times and from different actors; the design of these products requires the management of social factors that are complementary to the knowledge transfer and open-collaborative practices. Moreover, the socio-technological conditions, there is an important ICT research to bring forward the open-collaborative project development. In our research, we observed that the development of ICT platforms in in spatial sector for support Technology Transfer is not yet adapted for interaction with public or SME. Sections 2 and 3 provided a summary of ICT portals designed for Knowledge Transfer and open project development. The actual portals are compared with new proposition of crowdsourcing portals as Innocentive, NASA@work, OpenIdeo, Challengepost, y2.com, Topcoder, idea.me, and 10000Ideas. Crowdsourcing ICT platforms show new functionalities coherent with Open Innovation and enabling the network creation and the easily dispersion of Technology Transfer. In this regard, Technology Transfer for spatial sector, and particularly for CSA, needs to be modeling in function of communication needs and aspects like access to the information, the intellectual property definition, and the process of idea management in large-scale projects.

5. ACKNOWLEDGMENTS

Authors would thank CSA Grant and Staff, also Patrick Cohendet supervisor of M(IES)2C Project, Catherine Beaudry of Ecole Polytechnique, Ozgur Gurtuna CEO of Turquoise, and the teammates of M(IES)2C for the comments and support to this research.

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