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University-industry technology transfer: instruments to enable the commercialization of academic inventions. A case study on the PoC program at Politecnico di Torino

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Chapter 1 - Introduction

1.1 Motivation and Objectives

The present work was born as an experimental thesis, at the Politecnico di Torino. The main project that the writer has dealt with is the "Proof of Concept" (PoC) program, which is expressly funded, to help the research projects in their development and growth. It is born to lead the early stage projects to overcome the "Valley of death", i.e. the distance between a research project (only an idea without a demonstrator), and a desirable project, such as a tested idea in a relevant environment, for the firms. The "Proof of Concept" program started at the Politecnico di Torino in June 2016, now we are at fourth call. This dissertation has the purpose to explain if and how the "Proof of Concept" helps and helped the research projects at the Politecnico during these years. To obtain this information we conducted interviews to the participants of first "Proof of Concept" call.

Given the huge amount of work, this work has been developed by a group of research composed of two students: Orazio Pennisi and me, my thesis advisor: Prof.ssa E. Ughetto and two Co-advisor: Prof. E. Paolucci and Phd Student D. Battaglia.

Another important reference to address our research comes from the paper "Individual and organizational inhibitors to the development of entrepreneurial competencies in universities" wrote by A. A. Gümüsaya, T.M. Bohné, 2018. The objective of this paper is to identify and classify the existing inhibitors for the commercialization and the development of research projects inside the academia setting. In fact, starting from this research, we decided to extend the study, adding another step, considering also other issues, not investigated in the paper. Therefore, before focusing on the reason why the "Proof of Concept" program exist, what is its scope and how it helps the inventors, we studied the real issues for the inventors to develop and implement their research projects. In this way, we can have an overview of the whole research process, together with the issues met by research team and the help provided by "Proof of Concept" activity.

For this reason, the following work has two different purposes: the first, inspired by Gümüsaya paper, explains the issues for the research teams to develop and implement their projects before their entrance in the market's industry. The second is to demonstrate how, with the "Proof of Concept" program is possible to resolve and/or smooth some of the found issues.

The research question can be synthesized as "What are the inhibitors for the commercialization of university research project? How could the Proof of Concept help to reach this purpose?"

We can discuss the aforementioned topics in two different steps:

1. Finding and classify the inhibitors for the commercialization of research project in the university setting;
2. Understanding the role of "Proof of Concept" project to overcome or alleviate all or some of these inhibitors, linking the found inhibitors with the "Proof of Concept" solutions.

The whole data are real, the outcomes of this dissertation result from the triangulation of three different input data:

- Structured Interviews;
- Documents by TTO - Technology Transfer Office of Politecnico di Torino;
- Dataset of research projects funded by Proof of Concept by Politecnico di Torino.

The realized interviews, as well as research projects of this first Proof of Concept call are twelve. The main source of data in this work are the interviews, performed with the purpose of collecting the real opinions of the inventors and members of research/project team.
Although this dissertation is a qualitative work, the research is structured and based on tangible evidence, accordingly to the most methodologies present in literature, such as:

1. The "Case Study Research: Design and Methods", a book by Robert K. Yin, to classify our case study;
2. The "Grounded Theory", theory developed by Glaser and Strauss for the qualitative analysis of case studies, we used to lead our case study during the different phases;
3. The Gioia's methodology, a specific methodology based on the "Grounded Theory" developed by Denny A. Gioia. We used this methodology especially to create a structured interview using a robust and flexible interview protocol.

The Documents by TTO are, principally:

1. The documents regarding the rules of Politecnico's Proof of Concept;
2. The documents about the situation at the Politecnico di Torino before of this program;
3. The information about the people involved in the Proof of Concept program;
4. The reports about the funding projects;
5. The information about the projects' evolution during the years.

Instead, the Dataset consists of all information about projects, for example:

1. The project area;
2. The information about the project team;
3. The starting date and the end date of the Proof of Concept for every single project;
4. The approval funds for every project;
5. The starting TRL and the TRL at the end of the program;

All the information, documents and transcribed interviews are used in a triangulation of data in order to develop a qualitative but relevant case study, using tangible evidence.

1.2 Dissertation structure

This work is structured in six chapters.

The first chapter explains the reasons that have brought at the drafting of this dissertation, the research questions and the sources of the documents.

The second chapter is a literature review, it describes the existing literature concerning our research questions, the existing inhibitors to the commercialization of research projects and the existing solutions.

The third chapter describes the Politecnico di Torino situation before of Proof of Concept program, the Proof of Concept rules and the classification of the project inside different dimensions. Moreover, it provides some interesting considerations about the funding projects and their current state and their Proof of Concept's classification.

The fourth chapter defines the different steps used in collecting and elaborating the interviews in order to draw up a qualitative but consistence work.

In the fifth chapter, the results are processed in order to answer to the research questions.

The sixth chapter reports the conclusions, illustrating the results and the open points for future research.

Chapter 2 - Literature

2.1 Introduction

In recent years, we are trying to face the problems that the globalization and the economic growth have created: the gap between basic researches developed by universities and what the market, industries and firms seek to create, such as innovation for their products and/or services. In developed countries, globalization has shifted the competition from manufacturing activities towards knowledge-based and services industries (Friedman, 2005). Research and new discoveries are a crucial source for the economic growth because they are the basis of innovation. For this reason, the university research plays an important role for the country's innovation. The university are a critical component for the economic development of the territory where they are located (Braunerhjelm et al. 2010). In fact, there has been a growing support of the public sector to transfer and commercialize the university-based research.

Most of the university research projects have the problem, that developed technologies do not become attractive and so are not marketable for the industries. To study this problem, we analysed the literature related to the two research questions that this dissertation tries to answer: the literature related to the "funding gap" and to the "Proof of Concept".

According to the literature, we found that this problem is caused by several reasons:

- The lack of external funding for research-based technology project;
- The nature too "embryonic" of the technologies;
- The high level of risk and uncertainty of research-based technology project;
- The long time lag required to transform technologies in marketable products;
- The lack of incentive for the investor;
- The technologies could be too disruptive;
- The presence of information asymmetric and transaction costs between inventor and investor;
- The lack of communication bridge between inventor and investor;
- Different interests and background between inventor and investors;
- The presence of a conflict of interest between commercial and academic work;
- The few incentives for the researcher to post-invention research and for the commercialisation of the new technology;
- Academics lack of business skills and managerial experiences;
- Academics tend to ignore financial and market considerations in their development projects.

In the next chapter these issues will be described in detail.

2.2 Issues and the "valley of death"

The main reason that hinder the commercialisation of the new technologies, could be the lack of financing, the funding gap, that does not allow the development of projects at an early stage. This gap occurs mainly because the development of technologies is too risky for investors and because the investors do not have incentives to invest in a project with a high level of uncertainty.

The development of a new technology has the problem to obtain the necessary funding when it is still at an early stage (Lindstrom and Olofsson, 2001; Murray 1999). These funds are essential because they allow the research group to increase the degree of maturation of the technology with the goal to transform it in a product or a marketable service (Jensen and Thursby, 2001). In most cases, the investments required are very high, so there are few investors willing to invest in the projects.

The "funding gap" is caused by the nature of the new inventions, that are still too "embryonic", and this involves a high level of risk and uncertainty associated to the project. This increases the difficulty of validation, industrialisation and commercialisation of the technology (Munari et al., 2018) and also the time lag required to transform the new discoveries in marketable products will become longer (Munari et al., 2018). Therefore, these reasons limit the opportunity to attract external funding.

The projects are characterised by a high degree of uncertainty also because the investors could not know perfectly the features of the new technology, so they do not know if the technology could be useful to them. Moreover, the investors could perceive the new discovery differently from the researchers and this involves that the investors could not understand its real potential. This occurs, mainly because the two actors, the researchers and the investors, have different background and knowledge (Maia and Claro, 2013) and so they have a different perception related to the expectations of the new technology.

Under these conditions, the investor could take non-rational decisions and therefore could decide not to invest. There are few incentives for investors to invest in early-stage projects, characterized by high risk and uncertainty and a long payback. Therefore, to have a safer investment, the investor decides to invest when the development of technology is at its last stage where the risk and the uncertainty associated to the investment decrease, that is the investors, and/or the companies would like to wait until the technology is already developed (Shane, 2004b).

Another reason that causes difficulty to obtain funding is the issue that the new technology developed could be too much disruptive for the industries (Maia and Claro, 2013). The firms, in order to use the new inventions, might modify the entire production process and this, in the most cases, is not advantageous for them, so they do not have incentives to insert in the new technology in their process.

Another reason that could amplify the problem of the lack of funds is the information asymmetries between researchers and external investors (Mazzucato, 2013; Manure and Toschi, 2011; Murray, 2007; Murray et al., 1998). To explain the presence of asymmetric information, it could be used the Agency theory. We utilized this theory to explain the relationship between the investor and the researcher when the investor makes an investment in the projects conducted by the research group.

Agency theory was born from the studies conducted on the ownership and the control of large companies. The studies found out that these are often separated (Berle and Means, 1932). After the investment, the researcher maintains decision-making, the control, on the development of the new technology, even if with the investment part of control is sold to the investors (Jensen and Meckling, 1976). The relationship is based on the fact that the research group should act in the interests of the investor, although the goals of the two actors are in conflict.

The two actors will always have different information regarding the project. This information asymmetry could have a big effect on their relationship: the researcher knows some information that the investor does not know, so he could exploit this asymmetric information to make decisions which are advantageous only for themselves. Instead, the investors should make their decision with less information in relation to research group (Shane and Cable, 2002) and this could create two distinct aspects of the problem of agency: adverse selection and moral hazard.

1. Adverse selection: is an incorrect representation of the skills of the researcher. During the funding research phase, it could claim to have certain skills or that its project has a greater potential and value rather than real. This problem occurs because the investor can not completely know and verify the information given by the researchers, both before and after the funding (Shane and Cable, 2002). In this way, the research group could obtain the funds. While, from the point of view of the investor, with the information that he knows, he could decide to invest, but if he had all the information regarding the project, the choice to invest could be different. Therefore, the investor has the problem to distinguish the researcher's capability and the technology worth (Sahlman, 1990).
2. Moral hazard: it occurs when the researchers do not put the commitment accorded (Eisenhardt, 1989). The research group could use the information which the investor does not know to limit investor's ability to monitor the commitment of the researchers. Therefore, due to the lack of monitoring, the level of risk of the investment could be higher rather to what the investor imagined (Shane, 2004).

The problem, born by this relationship, creates the need for the investor to monitor the behaviour of the researchers (Eisenhardt, 1989), and to ensure that the goals of the two actors are aligned. The costs related to the monitoring of the behaviour, are known as agency costs which could occur both before and after the investment (Jensen and Meckling, 1976).

As previously mentioned, in most cases, the commercialisation of the technologies developed by the research group within the university, fails because there are conflicts of interests between commercial and academic work (McAdam et al., 2009). The commercialisation of university technology is becoming a key part of the universities, in addition to traditional activities of teaching and of the research (Etzkowitz, 1998). Some universities see the shift of focus towards the commercialisation as a potential

risk to the reputation of the university (Blair and Hitchens, 1998), so they discourage their academics from entrepreneurial activities.

Many academics are interested mainly in advancing in their university career, so they have few incentives for the post-invention research and for the commercialisation of the new technology (Maia and Claro, 2013), indeed they put lot of effort in their academic activities. Therefore, a shift towards the commercial activities and entrepreneurial opportunities could decrease the result of its work and as consequent could reduce its academic value. For this reason, academics have the opportunity cost that are very high, because if they are committed to this type of activities, they will have less time to dedicate themselves to the advancement of their career. This cost is not justified by a possible return coming from the activities of commercialisation.

Another important reason is that academics lack in business skills, managerial experiences and adequate capital human that could help them to understand the commercial potential of the invention and to have the possibility to fully exploit the potential of the new technology (Sapienza et al., 1996; Wright et al., 2004). For this, to have more probability to attract external funding, the researchers should have people who have managerial skills and entrepreneurial experiences within their research group (Campbell, 2005). Academics without this type of skills tend to ignore financial and market considerations in their development projects (McAdam, 2009), and this could involve that the new technologies developed by the research groups, may not have firms interested in them and the commercialisation could fail.

The causes mentioned below create a gap that hinders the development of the basic research in commercial applications where the firms seek to create innovation. In literature, this gap is known as "valley of death" (Auerswal and Branscomb, 2003).

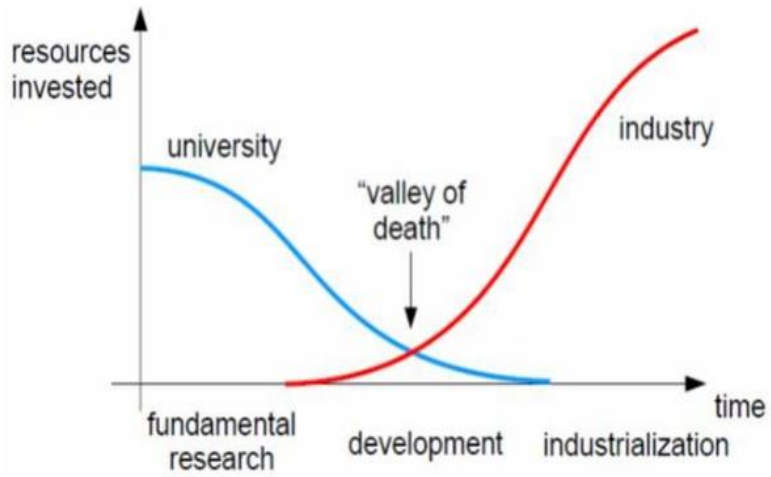


Figure 1: Valley of Death.

The Figure 1 shows where the "valley of death" occurs, between the basic research and the industrialisation phase. Moreover, the graphic shows the amount of resources invested and by who are invested. The horizontal axis shows the phases of development of the technology, from the fundamental

research to the industrialisation. Instead, the vertical axis shows the level of resources invested by the two actors involved: the university and the industry.

In the early stages of development, the research group will finance the research. The industry decides to invest when the new technology is ready to be industrialised because they do not want to invest in a project that has to be developed due to the presence of those problems previously described.

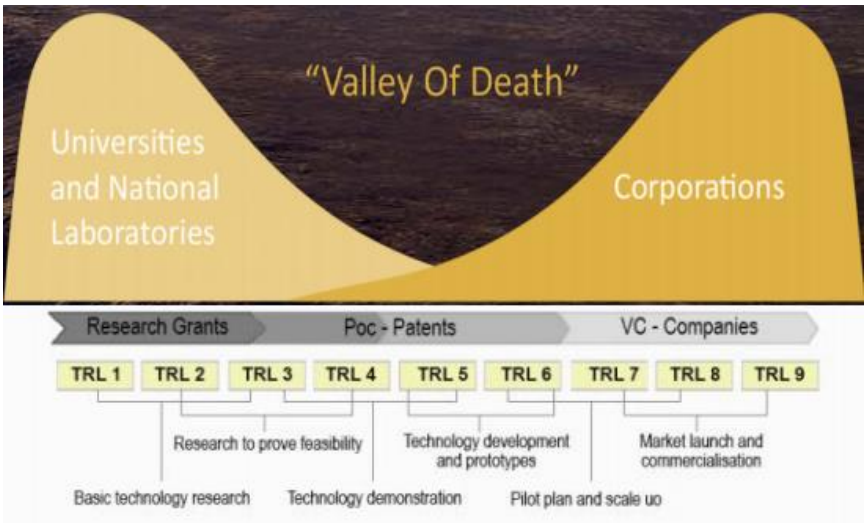


Figure 2: Valley of Death & TRL.

Another way to see the "valley of death" is through: Technology Readiness Level (TRL). This scale was developed by NASA in the 70s to evaluate the degree of maturation of the technology before integrating the technology in a system. TRL is a metric scale that serves to describe the degree of maturation of a technology. The scale of TRL consists of 9 levels where each value indicates the degree of maturation, the progress in the development of a technology. The "valley of Death" occurs between the values of 4 and 5, as shown in the Figure 2: Valley of Death & TRL.Figure 2.

According to the European Commission, TRL levels indicate:

- TRL 1: *"basic principles of the research are observed"*. Basic research begins its maturation through basic studies to evaluate the properties of technology.
- TRL 2: *"technology concept is formulated"*. At this stage, the potential practical applications are assumed but are not still tested and are not supported by detailed analysis which serve to demonstrate the possible hypotheses.
- TRL 3: *"experimental proof of concept"*. Analytical studies are carried out to verify the assumptions taken during the previous phase.
- TRL 4: *"technology validated in lab"*. Technology components are tested with the aim of highlighting how the results differ from what assumed analytically.

- TRL 5: *"technology validated in relevant environment"*. The experimental assembled is validates in real or simulated environments, verifying the problems experienced in the simulation.
- TRL 6: *"technology demonstrated in relevant"*. At this stage, the prototype is manufactured with the aim of comparing the results of laboratory tests with than assumed in the early stage of research.
- TRL 7: *"system prototype demonstration in operational environment"*. The prototype developed is very similar to operating system designed.
- TRL 8: *"system complete and qualified"*. The demonstration and validation phase are completed through testing in operational environment.
- TRL 9: *"actual system proven in operational environment"*. The new product or the process of the new technology is introduced in an operating environment.

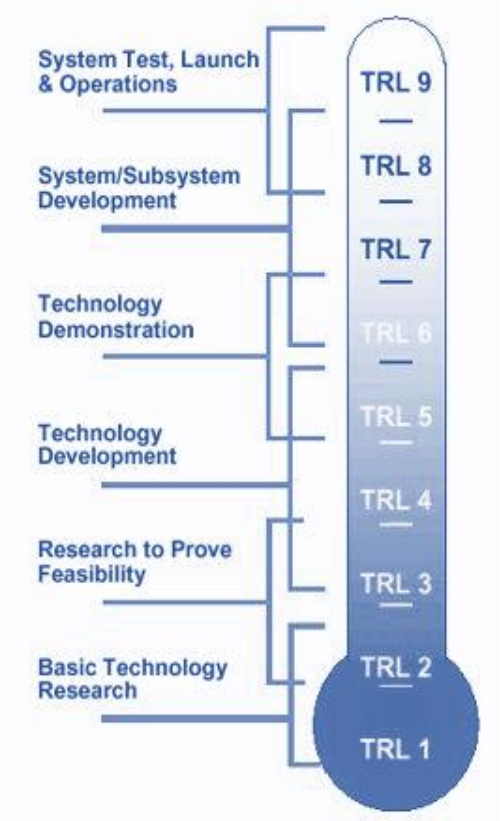


Figure 3: TRL - Technology Readiness Level.

2.3 TT and TTO

To address our work on research questions we have to talk about the Technology Transfer and Technology Transfer Office.

During the last years, there was an increase importance of commercialization of the technologies and of technologic transfer from universities and research institution to industries institution (Lockett & Wright, 2005), indeed for this reason, commercialisation of new inventions is becoming a critical phase for universities.

According to Bozeman (2000; p. 628), technology transfer is defined as *''the movement of know-how, technical knowledge, or technology from one organisational setting to another"*. The concept of technology transfer is not only related to university but also with many other organisations, such as private firms, government laboratories, non-profit research organisations etc. The technology can be transferred through the instruments such as, patents, licensing, creation of spinoff firms. Through technology transfer, universities could have more probability to exploit the commercial potential value of the new technologies in order to obtain revenue for the universities and also external financing.

Many universities have started to introduce a type of organisation called technology transfer office (TTO) because they realized that they could have an important role in the process of commercialisation

of the research. The TTO have the purpose to manage intellectual property and commercialisation activities. The type of organisation of the TTO could vary among universities but all TTOs have the same goals: facilitating and managing the disclosure of the inventions that could have a commercial potential (Thursby et al. 2001; Siegel et al., 2003).

Belitski et al., (2018) conducted a study to identify the role of TTO and of direct industrial funding that have in university research commercialisation in three countries (Azerbaijan, Belarus and Kazakhstan) characterised by a transition economy. The authors found that the TTO has a neutral impact on university research commercialisation, while direct industrial funding is *"the most efficient route of research commercialisation"*. They also suggest that TTO activity and direct industrial funding are not two successive steps in the commercialisation activity, but they are two alternative models. This study shows that the efficacy of technology transfer and of the TTO depends on organisational structures and ecosystem environment factors.

According to Siegel et al. (2003), the key stakeholders engaging in technology transfer have different motives and incentives. The key stakeholders are:

- university scientist;
- technology transfer office (TTO);
- firms and entrepreneurs.

The table below, Table 1, lists the actions and the motives of the three key stakeholders.

Key stakeholders in the transfer of technology from universities to the private sector

Stakeholder	Actions	Primary motive(s)	Secondary motive(s)	Perspective
University scientist	discovery of new knowledge	recognition within the scientific community—publications, grants (especially if untenured)	financial gain and a desire to secure additional research funding (mainly for graduate students and lab equipment)	scientific
Technology transfer office	works with faculty members and firms/ entrepreneurs to structure deals	protect and market the university's intellectual property	facilitate technological diffusion and secure additional research funding	bureaucratic
Firm/entrepreneur	commercializes new technology	financial gain	maintain control of proprietary technologies	organic/ entrepreneurial

Table 1: Study by Siegel et al., 2003.

The study conducted by Siegel et al. (2007), states that the main barriers that hinder an effective technology transfer are the cultural differences between universities and firms. According to Wilkinson (2006) the technology transfer process could be inefficient when the technology is in the early stage of development and when the development of the technology is driven without considering the possible markets.

O'Shea et al. (2005) in their study, found four possible factors that could impact positively the technology transfer. These factors are:

1. *"Institutional"*, such as a culture of academic entrepreneurship;

2. *"Financial"*, such as collaboration between university and industry;
3. *"Human"*, such as the presence of star scientists;
4. *"Commercial"*, such as TTO staff.

Instead, according to Lockett (2005), these factors could be: an entrepreneurial culture within the university, an understanding of the local ecosystem, the presence of structures that could support entrepreneurial activities, the TTO staff should have business and commercial skills, the presence of a network outside the university and a support by professional top management for spinoffs.
In a study, Krueger et al. (2008) indicate five principles that could serve to have a successful technology commercialisation program:

1. *"Leadership"*: universities should support entrepreneurship activities, through a clear vision and mission for the technology commercialisation;
2. *"Understanding and managing the context"*: the context and the local environment influence the university in its technology commercialisation activities;
3. *"Changing the culture"*: the increase of the market and strategic orientation of the university helps to increase entrepreneurial focus of university researches;
4. *"Engaging the ecosystem"*: the presence of a network that connects people, ideas and resources between university and local communities is important to facilitate the access of stakeholder that could offer their support, especially in early stage projects.
5. *"Leadership in the process"*: leadership, preferably from the private sector, must support the technology commercialisation activities from a point of view entrepreneurial.

2.4 Proof of concept program and Proof of concept center

After having described the main problems that hinder the commercialisation of the technology, we describe the possible solutions that the policy maker introduced to overcome these barriers. The legislators have started to create and to introduce new instruments that have the purpose to facilitate and promote the dissemination of the new technologies from the universities to the industry. These programs led the universities to increase the focus for the commercialisation activities, especially for the technologies that are patentable and can be licensed (Shane, 2004b). The license represents the way mostly used to commercialise in the public sector intellectual property (Lockett et al., 2005), because it allowed to universities to obtain returns on technological inventions without committing large amounts of time and resources (Lockett and Wright, 2005). As result, public funds are becoming the major source to overcome the problem of "funding gap".
In one of the first studies conducted related to this theme, Rasmussen and Sørheim (2012) analysed government schemes in six counties (Canada, Finland, Ireland, Norway Scotland and Sweden). They found three main types of public funding: proof of concept (PoC) schemes, pre-seed schemes and seed funding initiative. The PoC and pre-seed schemes seek to overcome the funding gap by demand side,

making more attractive the projects, in order to receive external funds, instead seed funding initiative seek to overcome the funding gap by supply side.

1. Proof-of-Concept (PoC) schemes: the purpose of this scheme is to reduce the uncertainty of the projects which are at early-stage supporting technological feasibility and verifying the industrial applicability of the research-based invention. The goal is to advance the technology at a level of development, providing the necessary funding, that allows to license to external industrial partners or to create a start-up to attract the interest of investors. Some programs do not provide only financing, but also support to the research groups, such as intellectual property rights (IPR) protection, technology verification and prototype construction, development of business plans, market studies and networking with external partners. The PoC program to be effective, should be accompanied by a supporting culture and by adequate infrastructure dealing with commercialisation at university level.
2. Pre-seed funding schemes: the purpose is to provide support in developing a business plan, strengthening the entrepreneurial group and networking with external partners. The logic of this type of scheme is to make the project more attractive to outside investors by reducing organizational uncertainty. Certain schemes do not provide financial resources directly but provide indirect support by sponsoring the human capital, the inventors, because they play a crucial role in commercialisation of advanced technologies. The approach is used to assist the business project development through the support of consultants. Other initiatives involve training programmes for entrepreneurs.
3. Seed funding initiative: the purpose is to reduce the risk for private actors to invest at an early-stage of commercialisation projects, because the lack of seed capital is the main obstacle that impede the development of the researches with commercial and growth potential. The approach used is the one called “gearing” mechanism where private investments are supplemented by public loans or public equity.

The following table recapitulates the main characteristics of these three government schemes.

Goal	Reduce the technological uncertainty of the project by verifying the technological feasibility of the project	Reduce the organisational uncertainty of the project by preparing the project organisationally for further investment	Reduce the investment risk associated with the project by providing funding that accept a higher risk than most private actors
Approach	Demand-side: Increase the attractiveness of USOs for investors	Demand-side	Supply-side: Increase the supply of early-stage funding
Type of government support	Usually 100% grant-based	Usually grant based but sometimes convertible to equity	Usually equity or loans
Manager of funds	Usually government agency	Varies, but often regional agent	Usually private agent or independent government unit
Funding decision	Usually by application and panel review, similar to research funding	Varies, but usually made at regional level	Investment decision accepting high risk
Type of activity supported	Technology development at project level	Market and management development by entrepreneurs or consultants	Venture launch
Main criteria for funding	Market potential of technology	Combination of individual and project characteristics	Growth potential of the new venture
Anticipated outcome	USO or license to existing firm	USO	High-growth USO

Table 2: Study by Rasmussen and Sørheim, 2012.

In another study conducted by Munari et al. (2018), always related to the initiatives introduced by governments and their efficacy, they provide a multilevel framework (organisational and contextual) that serves to evaluate the factors which condition the universities engagement in gap funding programs and condition how these programs are perceived, at level of effectiveness.

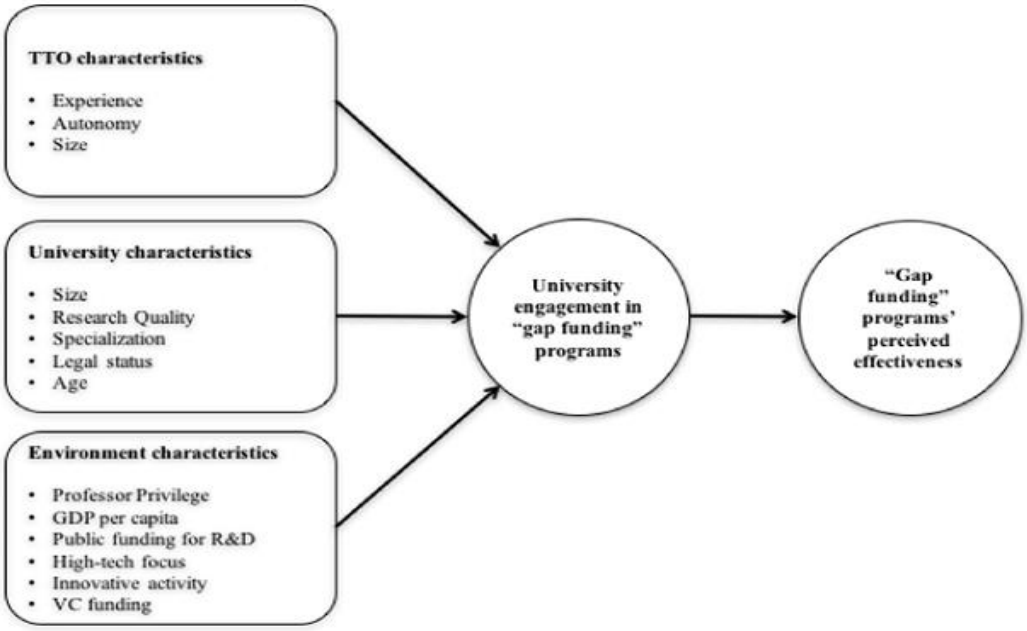


Figure 4: Study by Munari et al., 2018.

As shown in the Figure 4, these factors are: TTO characteristics, university characteristics and environment characteristics.

The authors found that two characteristics are critical: the size of TTO and the research of quality of the university. The authors state that the TTO should have a specific size to manage the types of gap funding programs. Instead, the quality of the research allows having a diversified portfolio of high-quality

companies in which to invest. This is true especially for seed funds. The authors also state that the universities with a small TTO and low research quality should collaborate to create a "critical mass" that could help in supporting projects and technologies. Moreover, they found that the professionals belonging to an internal TTO, perceive as more effective these programs and regional high-tech specialisation impacts positively on fund programs, in particular on PoC programs. This could be caused because in these regions there are more probabilities to exploit the results related to the commercialisation activities.

The proof of concept phase develops three level of activity: technological development (including prototype), market development (strategic market planning) and business development (business plan) (Jensen and Thursby, 2001). These activities do not only increase the likelihood of success of commercialisation, but also helps to reduce some of the risks associated with future investment (Thursby and Kemp, 2002; Jensen et al., 2003).

To better manage the Proof of Concept program and its activities, some universities have started to introduce a new type of organisation, Proof of Concept Center (PoCC). It could be a possible solution to overcome the problems that occur in the proof of concept phase, indeed, this phase is the most important and critical stage in the innovation process, stage that occurs between the invention of new technology and product development.

Gulbranson e Audretsch (2008, p. 250) define a PoCC as an institution *"devoted toward facilitating the spillover and commercialisation of university research"*. PoCC helps and facilitates the commercialisation of research and innovation from university to the market, because it provides funding at the research during the early phases, customised support for researchers, and networking with investors.

The financing supplied by PoCC serves to advance the development of the research project. It allows to verify the feasibility of the idea and to evaluate its commercial potential. After that the feasibility is demonstrated, outside investors can begin to be interested to finance the future development of the project.

Gulbranson and Audretsch (2008), analysing the Deshpande Centre at MIT and the Von Liebig Centre at UCSD found that the proof of concept center could facilitate the transfer of university innovation into commercial applications. In particular, they found that a new PoCC should be introduced in a university which satisfy these three requirements:

1. The university should produce technologies which are innovative and marketable;
2. The university should not be against the collaboration with external network which should include advisors, angel investors, venture capitalists and interested firms. The presence of this network allows to proof of concept centre to invest in risky project, knowing that there is a network that support the further development and commercialisation of new technology.

3. The university should have a technology transfer office (TTO) which is willing to work with the PoCC to facilitate the commercialisation process. Indeed, PoCC should be complementary to the TTO to accelerate the dissemination of technologies in the market (Maia and Claro, 2013).

Bradley et al. (2013) with a study related to 32 US University which introduced Proof of Concept Centre, provide the possible economic role of PoCC and the possible challenges that PoCC could potentially addressed. They found five challenges:

1. University entrepreneurs often lack relevant business and commercial skills;
2. Research group are often unwilling to conduct research oriented toward transferable technology;
3. University often lack the network that could be useful to have a successful technology transfer;
4. University policies do not provide adequate incentives to engage in technology transfer;
5. The difficult in obtaining external funds for startups, hinders the success of technology transfer.

The authors state that PoCC is important because it facilitates the technology transfer mitigating the possible challenges. It also accelerates the advancement of Proof of Concept phase. The authors also state that there are no significant differences between the level of R&D research funding in a university that introduced PoCC and an university without it.

Hayter and Link (2015) analysed the economic impact of PoCC through the number of spinoffs established each year after its introduction. They found that universities with a PoCC had a positive and statistically significant increase in the number of spinoffs, but they also suggested that this metric is only one to meaningfully measure the impact of the PoCC. Moreover, the authors state that PoCC could have the potential to become important in the innovation system of a university and even of a region or a nation.

After that, we described the problems that hinder the commercialisation of the new technologies, the possible solutions that could mitigate these problems, especially the PoC program, and how these are handled; we focused our study on trying to understand the best way to describe the Politecnico di Torino PoC Program. Reading the literature, we decided to develop our work according to a recent study conducted by Gümüsay and Bohné (2018). In this study, the authors provide a classification of possible inhibitors related to the acquisition of entrepreneurial competencies by nascent academic entrepreneurs to create a successful spin-off venture. Entrepreneurial competences are the ability of the entrepreneur to start and grow a venture and identify and successfully combine a variety of resources (Pensrose, 1959; Wright et al., 2012).

This study is conducted at one university, the University of Oxford. This paper is a qualitative research because through a triangulation of different kind of information, obtained with semi-structured one-to-

one interviews, written and electronic documentation and participant and non-participant observation, the authors extracted consistent evidences that are not quantitative data. To do this, the authors followed Gioia methodology.

The authors classified the inhibitor in three aggregate theoretical dimensions:

1. *"Relational inhibitors"* that hinder the identification and networking with the key people who could help in obtaining the entrepreneurial competencies.
2. *"Structural inhibitors"* that hinder the access and the acquisition of important resources needed to develop entrepreneurial competencies.
3. *"Cultural-cognitive inhibitors"* that hinder the feedback and the support in the development of entrepreneurial competencies.

The following figure, Figure 5, shows the classification of these inhibitors.

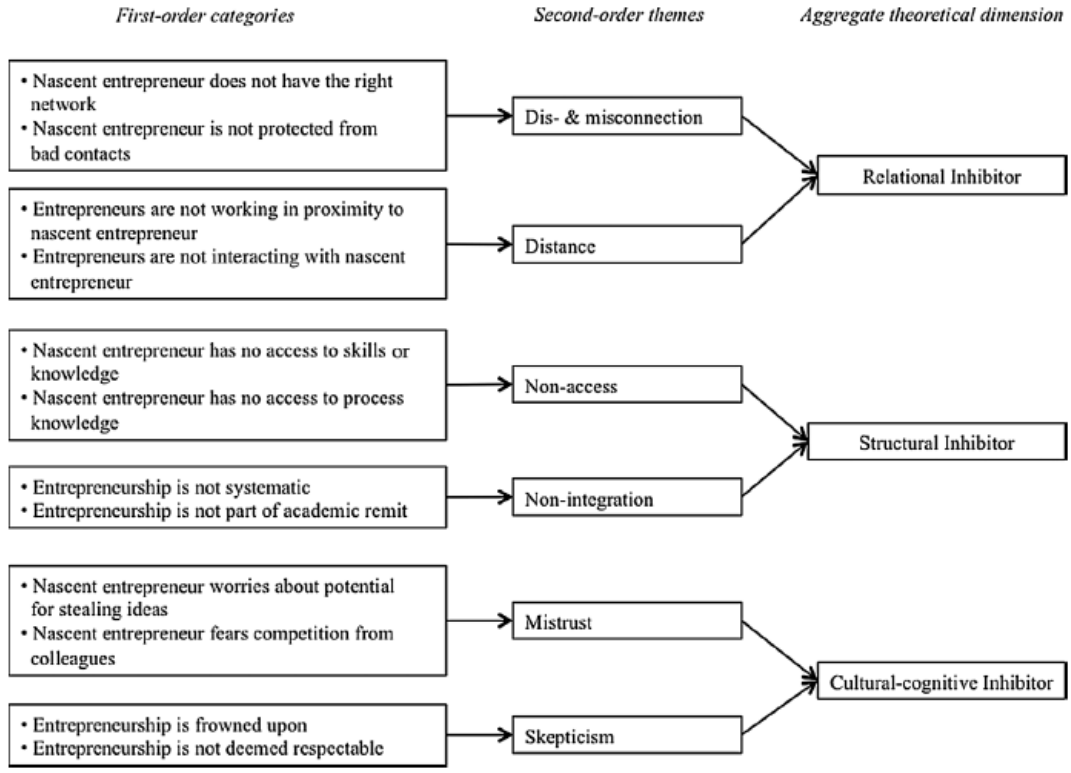


Figure 5: Study by Gümüsay and Bohné, 2018.

The study shows that the inhibitors exist both at individual and organisational level. Moreover, the authors state that these inhibitors act together: the effect of each inhibitor has an impact on the effect of other. The following table, Table 3, summarizes these effects.

To:	Relational	Structural	Cultural-cognitive
From:			
Relational	Aggravates introduction to beneficial contacts	Limits coalition building and networks to overcome structural barriers	Limits coalition building and networks to overcome views and perceptions of entrepreneurship
Structural	Limits identification potential of beneficial contacts, in particular experienced entrepreneurs at the university	Hinders integrative structures and knowledge access, which impedes systematic inclusion of entrepreneurship	Restricts incentives and resources to change attitudes
Cultural-cognitive	Discourages relationship identification and building	Reduces capability and interest to challenge existing structures	Promotes lack of transparency across and between individual and organizational levels

Table 3: Study by Gümüsay and Bohné, 2018.

We utilised this paper as guideline to develop our study, in particular, for the first research question. We started from this study, to try understanding what are the inhibitors which hinder the development and the commercialisation of research project conducted inside our university. Moreover, differently by the study of Gümüsay and Bohné, our study seeks to add a next step: it tries to understand if and how the PoC program mitigates these inhibitors. To answer to these questions, we based our work on the case study of the PoC program at Politecnico di Torino, following the Gioia methodology and conducing semi-structured, one-to-one interviews.

Chapter 3 - Politecnico di Torino Environment

Before talking about the methods and our research questions, we want to analyse the situation of the Technology Transfer at the Politecnico di Torino before of the Proof of Concept program: the created solution and its rules and rationales. Moreover, we want to describe the first Call, considered in our work, and add some other considerations about it.

3.1 Pre-Proof of Concept Situation

To describe the Politecnico situation before of Proof of Concept program, we analysed different Technology Transfer Office's documents. The main document is the "PoliSeed" project. It was a first approach, studied by some master's degree students of the Politecnico about Proof of Concept funds and pre-seed founds.

In this document, we found an accurate analysis of the Politecnico di Torino setting in 2015, the year before the Proof of Concept program. We can analyse the situation using two different points of view, both important for the development of the Technology Transfer Office and then, for the research projects.

The ways to commercialize the research projects and then to evaluate the Technology Transfer Office are two:

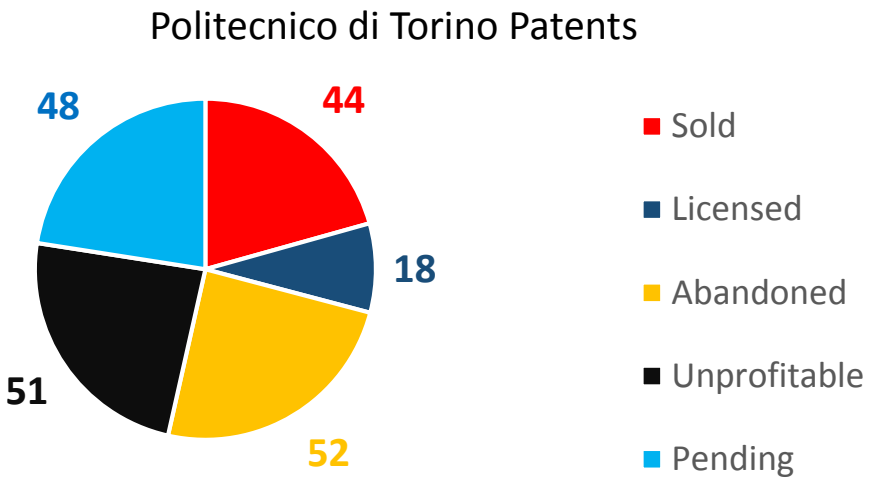
- Number of active Spin-off;
- Number of active Patents.

In the Politecnico di Torino the both numbers were really discouraging.

The Politecnico had thirty-eight (38) spin-off companies, but of these, only one could be considered successful.

Graphic 1: Politecnico di Torino Spin-offs in 2015.

Furthermore, also the Patents' number were negative, there were 213 patents, of these only 62 were profitable, 29%. Instead, the 48% were unused, abandoned and unprofitable. The last part was the pending patents.



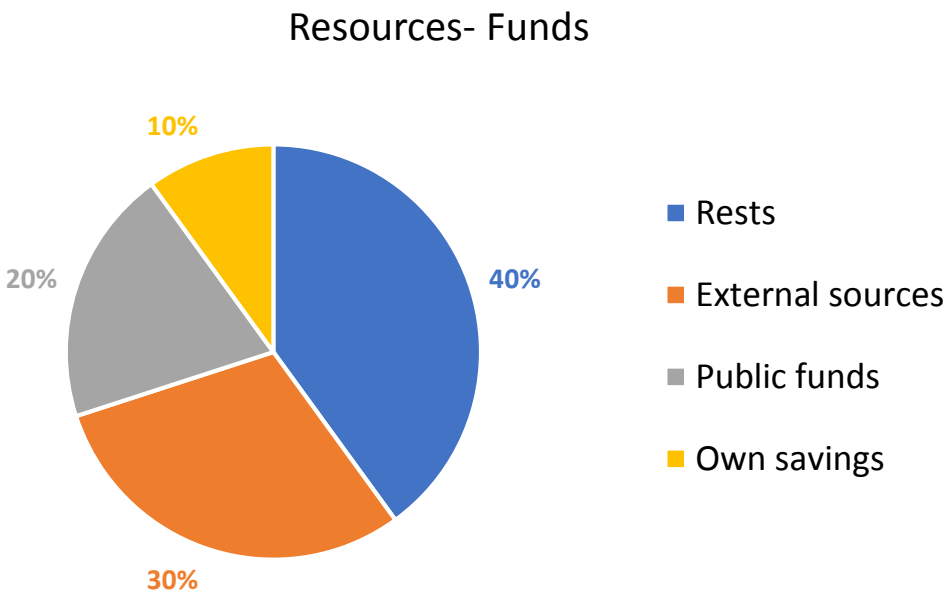
Graphic 2: Politecnico di Torino Patents in 2015.

According to an old survey addressed to researchers, professors, PhD student and researchers grant holder, these negative outcomes can be attributed to following reasons:

1. Lack of funding;
2. Lack of researchers' incentive;
3. Technology different from market needs;
4. Lack of business knowledge inside the research team;
5. High technology risk;

6. The industry world has high difficulty to access to university research, especially the SMEs.

The lack of funding problem was analysed more accurately: about 40% of interviewees used the rests of the financed research projects to develop its projects, about 30% used external funds and the last 30%, public funds from 20% and own savings 10%.



Graphic 3: Resources - Funds in 2015.

The main reason of this specific failure could be attributed to the *demand-pull* Technology Transfer activity, based on the external consulting demand, rather than *technology-push,* based to the promotion aimed to industry setting, through meetings and workshops, of technology coming from the Politecnico di Torino.

In general, all these problems pushed the Politecnico di Torino to look for some solutions. This led through the first Proof of Concept program at the Politecnico di Torino.

3.2 Proof of Concept: Rules and Rationales

The organization and management of the Proof of Concept program is trusted by the Technology Transfer Office.

The first Proof of Concept project started on June 6th, 2016. Before describing this first call, we want to explain the rationales and the meaning rules to understand the real value of it.

The Proof of Concept program have been created to develop, validate and subsequently commercialise the research projects coming from basic research of the Politecnico di Torino's researchers. In particular, funding projects will be able to develop in two different ways:

- Spin-off company;
- Patent filing and subsequent marketing.

To address the research project to the market, the Proof of Concept project wants to lead the project to overcome the "*valley of death*", 4-5 TRL level to arrive to the commercialisation state, 6-7 TRL level. It leads from a 3-4 TRL level, research state, until 6-7 TRL level, industry setting, in order to commercialise the future outcomes.

Obviously, the TRL jump depends on the type of developed projects. For example, the mechanical projects usually have a faster development rather than drug projects that have many and different steps of development: pre-clinical, clinical and FDA or similar approval. For these types of projects, it is necessary to establish a spin-off company.

Moreover, this last kind of projects needs of more funds for projects and more funds for every single TRL step rather than other kinds of project sectors. For these reasons, some projects could develop a final prototype at the end of their PoC program while others could prove only their concept, i.e. drugs and medical device projects.

Other two important objectives of the Proof of Concept project are:

- Funding for the young researcher's idea: Supporting the idea of young researcher providing a funding;
- Entrepreneurship soft-skills: Providing to the researchers a new entrepreneurship knowledge to develop and commercialize yours research projects.

We reported the announcement call in the Attachment 1.

The main rules to apply to own project and relative rationales are the following:

- Funds from € 5.000 to € 50.000: The Proof of Concept wants to be only a first step to reach the market and the commercialisation of the research projects. With these funds, as previously said, some teams are able to develop a first prototype while others can demonstrate the concept and/or others evidences of their work;
- The IP must be an exclusively or majority owned by the Politecnico di Torino: The university, to facilitate the commercialisation and to guarantee the right support and control on the IP, requires the transfer of the property right of the researchers. In fact, as said by Munari 2017, Italy is one of the exceptions that has the inventor ownership (professor's privilege);
- Timespan of maximum 6 months: To be able to control the whole program and all the projects, they have to be developed within 6 months, but usually for some administrative problems a lot of funding projects ask to extend the development period;
- The research must be defensible with the intellectual property (IP): It is possible to finance only projects with defensible Intellectual Property (IP) in order to be profitable at the end of the program or in future;
- At least one member for the team must be under 35: As said in Chapter 2, sometimes the professor does not have incentive to develop own projects or does not have time to dedicate on the project. For these reasons inserting young and ambitious researchers in the project team

could give some new opportunities to the project and to the researchers, for their future. They could develop and lead the project during the PoC program and in future;

- The project leader must be a full professor or full permanent research: To ensure the continuity of the project.

To sign up to this initiative, it was necessary the compilation of technology plan to reach the project's objective. This plan had to be formed by:

- Objectives of the project;
- Starting and final TRL of the project;
- The GANTT of the activity and relative Milestones of the project, maximum 6 months;
- Project costs until a maximum € 50.000 for project.

To be sure that the whole financing was used only for the PoC program there are eligible and ineligible costs in order to use the money only for consumable and direct goods to develop the project. In fact, for example the fund are not usable for inventory-able goods and the personnel costs are usable only for research scholarships during the development of the project and until a maximum of € 12.000. More information about the eligible and ineligible costs are available in the announcement call in the Attachment 1.

The consistence of these application documents and the whole project are evaluated from a jury, this is different for every project sector.

The juries are formed by the following members:

- Vice Rector for Technology Transfer, Prof. Emilio Paolucci, he was the only members equal for each jury;
- Professional Investor, expert in the valuation sector;
- Professional Entrepreneur, with experience in the valuation sector;
- Professor coming from the Interdepartmental Laboratory for Technology Transfer.

The sectors for the first call were:

- ICT, Electronics and Telecommunications;
- Industrial engineering, Mechanical, Automotive and Aerospace;
- Biomedical and Chemistry;
- Design and Architecture;
- Energy;
- Civil construction and Environmental.

The juries were formed as reported in the following table, Table 4.

Jury Sectors	Member Name	Role
ICT, Electronics and Telecommunications	Massimo Violante	Professor
	Rinaldo Ocleppo	Entrepreneur
	Mauro Odorico	Investor
Industrial engineering, Mechanical, Automotive and Aerospace	Mauro Velardocchia	Professor
	Nevio Di Giusto	Investor
	Nicola Redi	Investor
	Stefano Serra	Entrepreneur
Biomedical and Chemistry	Fabrizio Giorgis	Professor
	Valeria Ingrosso	Entrepreneur
	Pietro Puglisi	Investor
Design and Architecture	Angioletta Voghera	Professor
	Adriano Marconetto	Entrepreneur
	Pietro Puglisi	Investor
Energy	Vittorio Verda	Professor
	Giovanni Ceresa	Entrepreneur
	Nicola Redi	Investor
Civil construction and Environmental	Rajandrea Sethi	Professor
	Marco Rosso	Entrepreneur
	Piero Bergamini	Investor

Table 4: Proof of Concept Jury.

Every project was evaluated using definite aspects, the maximum global score was of 100 points. Instead, the minimum score to be financeable was 60 points. The criteria and the criteria's points were the following:

1. Applied project: the project and the relative jump of TRL: max 30 points;
2. Project team: competence, multidisciplinary and coherence of team project compared to the purposes of the project: max 20 points;
3. Technology's potential: compared to technology benchmark: max 15 points;
4. Budget: consistency between the budget and the aims of the Project: max 15 points;
5. Interview: questions from jury to the project team: max 20 points.

The total available fund for the first Proof of concept program was of € 450.000, the funds were assigned to every project following the project score in the final ranking.

To monitor the project progress and to supervise the use of the project financing, at the half and at the end of the project duration the team had to draw up a report for the Proof of Concept commission.

3.3 Call 2016: Projects and Considerations

The applied projects were fifteen, but of these the financed projects were twelve for a total funding of €430.200, while the rest of the projects did not reach the minimum score.

Sectors	Participants	Winners
Mechanical, Automotive and Aerospace	5	3
Biomedical and Chemistry	3	3
Civil construction and Environmental	2	2
Industrial Engineering	1	1
Energy	1	1
ICT, Electronics and Telecommunications	2	1
Design and Architecture	1	1
Total	15	12

Table 5: Projects' Sectors.

Project Number	Score
6	96
12	93
5	87
10	84
2	83
4	82
9	79
1	76
7	74
8	73
11	71
3	70
13	59
14	55
15	54

Table 6: Proof of Concept Ranking.

The next table, Table 7, shows the related number of the implicated department and the provenience of the team's member. We can see that the origin of the project are different, obviously some departments are closer than other to develop tangible projects, so the origin of the projects and the participants are higher in some departments rather than others, i.e. DIMEAS, Department of Mechanical and Aerospace Engineering is closer to develop product and prototype than DISMA, Department of Mathematical Sciences. Anyway, the participation was a mix of different people coming from different departments, in fact on eleven different departments in the Politecnico di Torino, the participants coming from nine different departments.

Furthermore, also the participation of young researchers, PhD Student and Student, was high, about 1/3 of total participants, this is an excellent result also due to Proof of Concept rule. Obviously, the higher number of participants were the Professors.

Departments	Projects	Total Participants	Professor	Researcher	Phd Student	Student	Other
DENERG	2	9	4	1	3	1	-
DAUIN	-	1	1	-	-	-	-
DET	2	7	3	1	3	-	-
DIMEAS	3	11	4	5	2	-	-
DIGEP	1	3	1	2	-	-	-
DISAT	1	2	1	-	1	-	-
DAD	2	6	3	2	1	-	-
DISMA	-	2	1	-	1	-	-
DISEG	1	3	1	2	-	-	-
External	-	3	1	1	-	-	1
TOTAL	**12**	**47**	**20**	**14**	**11**	**1**	**1**

Table 7: Participants.

To observe the multidisciplinary, we have reported an additional table, Table 8, to focus on the team composition. As we can observe, it is true that there are many departments involved but the multidisciplinary inside the research team is not high. There are six team with only members coming from the same departments, four with only one member coming from other departments or external to the Politecnico di Torino and only two teams have two members coming from different departments so different know-how.

These could be due to the low collaboration of different departments and the low knowledge among different department professors.

Project Number	N° Members	Professor	Researcher	PhD Student	Student	Participant's Department
3	6	3	-	2	1	DENERG x 4 DAUIN x 1 DET x 1
1	3	1	1	1	-	DIMEAS x 3
7	3	1	2	-	-	DIGEP x 3
10	6	2	3	1	-	DIMEAS x 5 External x 1
5	4	1	-	2	-	DET x 3 External x 1
8	3	2	-	1	-	DISAT x 2 External x 1
12	4	2	-	2	-	DAD x 2 DISMA x 2
4	3	1	2	-	-	DISEG x 3
9	3	1	2	-	-	DIMEAS x 3
6	4	2	1	1	-	DENERG x 4
2	3	1	1	1	-	DET x 3
11	5	3	2	-	-	DAD x 4 DENERG x 1

Table 8: Multidisciplinary.

To analyse the projects in an aggregate classification we sought a formulation to group the different projects. We looked for the solution in literature, but we did not find nothing, so we decided to create own classification of different dimension to merge different projects under a definite dimension.

We started to classify the projects in two dimensions:

- Technology Based: The project is the development of new product or technology. Usually, to develop the project, it should not be needed a lot time. Moreover, usually the final goal of the research team and Technology Transfer Office is to sell the patent about the project;
- Science Based: The project has a scientific component; the final product should be unknown at the beginning of the project because usually there are many different steps before obtaining it. For these reasons, the sectors of these projects should be drugs, medical device and ICT project. The drug projects, for example have different steps for the development: pre-clinical, clinical and FDA or similar approval. Therefore, to develop them it is necessary to establish a spin-off company. Moreover, the development periods are long, the cost for a single TRL level

high and then usually for them the Proof of Concept program is only a springboard to demonstrate the feasibility of the concept.

Using this first classification, we inserted eight projects in the Technology Based dimension and four projects in the Science Based dimension. In order to reduce the project numbers in the first dimension we made another sub-classification of this dimension, the following:

- Product Engineering: The project team develops a new product, Product Engineering, did not exist before. This new product usually answers to general and not definite needs of the customers, for these reasons it is usually difficult to commercialise it, it has been inserted in different areas where it exists a definite equilibrium, so it is difficult to find a buyer. The development of this type of projects is not expensive and the time is much shorter than Science Based, the projects are developed up to 6/7 TRL level and after they wait a buyer for the project and for the patent;
- Capital intensive: They are new products/technologies, they resolve a tangible need or are improvements of existing product, but to be adopted they have to prove in a relevant environment. They have to be verified, observed and tested for a specific time in working condition. Usually this is expensive so is difficult finding someone that wants to try them. The development period is not high, but the costs are high to recreate the real conditions, only the Proof of Concept program without a strong partnership is impossible to complete the project and commercialise the technology. In fact, it usually is necessary to test the project on the technologies and on the process of a partner.

In this way, we divided the eight projects in two different dimensions with four projects to everyone. At the end we obtained three different dimensions with four projects for everyone, an excellent number to build some adding consideration, not statistically relevant but interesting for the future research. In fact, only twelve observation were not a relevant statistic sample, but they are a good starting point to analyse qualitative and quantitative wise, even if it is not statistically relevant, parameters about the inhibitors for the research and about the selection and the development of the projects in the Proof of Concept program.

Making a more specific consideration, we decided to explicit some other natural dimensions in order to analyse projects, we will use these dimensions only to make same adding consideration.

We divided the Capital Intensive dimension in two different sectors:

- Civil: for civil infrastructure projects, they have to be verified and tested in civil infrastructure, for examples subway, railroad;
- Industrial: for projects in industrial setting, they have to be proved and tested on the process/production line of a partner, for examples dynamic cell, engine.

Moreover, we made a new dimension on the Science Based group:

- Drugs: For the projects in the drug setting, for this industry the development period is long and step by step the development is always more expensive. With Proof of Concept funds, it is possible proving the concept. To test the project, it is necessary to have absent infrastructures at the Politecnico;
- Software: ICT projects in different sectors, for examples healthcare device or digital service, the first step is less expensive and faster, it has to develop a software. The testing phase is entrusted to the Spin-off company establishing at the end of the software development and idea validation phases.

The following table, Table 9, shows the total dimension classification:

Dimension - Classification			Title of the patent object of the funded POC	Interview Number
Technology Based	**Product Engineering**		Stair-climbing wheelchair using hybrid locomotion system	**1**
			Smart, Active and Modular Probe & Measuring System	**7**
			A method and a system for generating steam in a planar structure using solar radiation or another radiation	**6**
			SounBe - Method and device for acoustic sensorial analysis of materials	**11**
	Capital Intensive	**Civil**	A deflecting module for an anti-sand barrier, a barrier thus obtained and a protection method from windblown sand	**12**
			ENERTUN – Energy tunnel segmental lining	**4**
		Industrial	Device for diagnosing railway bogies by applying an energy-autonomous measuring and transmitting bolt, and corresponding control method	**9**
			Controlling the fuel injection in a diesel engine	**3**
Science Based		**Software**	Method for detecting web tracking services	**2**
			Device and relative methodology for the acquisition and analysis of medical images of chronic wounds	**5**
		Drugs	Method for the preparation of cellularized constructs based on thermosensitive hydrogels	**10**
			Eudermic compositions	**8**

Table 9: Projects Classification.

3.4 Quantitative Observation

In this sub-charter we made some considerations on the different available documents, to make this we used the created dimensions, these considerations are not statistically relevant, but show a different point of view for the global outcome of this dissertation and for the final conclusions.

The first consideration on the global documents, pre and post Proof of Concept, is related to the TRL score in different phase and coming from different observers.

As we can see from the table below, Table 10, we had three different TRL observation:

- Starting TRL: it is the TRL of starting of Proof of Concept program, and coming from the Project leader;
- Final TRL: it is the TRL at the end of Proof of Concept program, supposed at the beginning of the program from the Project leader;
- TRL KTTM: it is the real observation of TRL level at the end of Proof of Concept program. This comes from KTTM, Knowledge Technology Transfer Manager, the manager that follows the patent and the project inside the Technology Transfer Office.

Starting from these data, we can observe that:

- There is a real increment of the TRL level for every project, some projects had more problems than other, every project has different characteristics, but all projects have incremented the TRL. The average real increment, the difference of TRL KTTM and Starting TRL, is 1.8 TRL points;
- Usually, there is a different from the Supposed Final TRL and the real final TRL that is the TRL KTTM. The average Supposed Final TRL is 5,5 points while the average of TRL KTTM is 5,1 points. This difference could be explained in two different ways, the first is an oversized and optimistic prevision of the project development, in fact it could be difficult to consider the future issues in the application phase. The second is an oversized of Starting TRL. The more likelihood is that this difference coming from a mix of both possibilities.

Dimension	Project Number	Starting TRL	Final TRL (sup)	TRL KTTM	Approval Funds
Product Engineering	**1**	3	6	5	€ 36.500
	7	3	6	5	€ 11.500
	6	3	4/5	5	€ 39.700
	11	6	7	6/7	€ 14.000
Capital Intensive	**12**	3	5	4	€ 43.000
	4	3	4	5	€ 43.000
	9	4	7	6/7	€ 41.500
	3	2	4	4	€ 47.500
Science Based	**10**	3	5/6	4	€ 41.000
	5	4	6	6	€ 36.000
	2	3	7	6/7	€ 36.500
	8	3	4	4	€ 40.000

Table 10:TRL of Projects.

An aggregate evaluation, using the dimension classification, is reported below, Table 11. Analysing the data, we can see that starting from a similar TRL level, the real final TRL is higher from the Product Engineering rather than the others two dimensions. Moreover, the increase of TRL level is more expensive for the Capital Intensive and Science Based projects.

In addition, separating the Drug and Software projects we can see a better classification. The drug projects are more expensive in relation to the Increase of TRL while the Software are faster and cheaper in relation to the Increase of TRL. The discussed results are the expected results coming from a correct classification of project inside the dimensions.

Dimension	Average Real Increase of TRL	Average TRL KTTM	Average Approval Funds
Product Engineering	1,6	5,4	€ 25.425
Capital Intensive	1,9	4,9	€ 43.750
Science Based	1,9	5,1	€ 38.375
Drug	1	4	€ 40.500
Software	2,8	6,3	€ 36.250

Table 11: TRL Vs Funds.

Another interesting consideration has been made on the score of Proof of Concept application, in fact starting from the found difference of development phases and TRL classification, we looked for other interesting difference for the found dimensions.

As said previously, the scores of the projects are assigned from a jury. Every jury has different members coming from the sector analysed. We reported the average point for every principal found dimension and for every single kind of jury's member. The outcomes of these analyses are reported on the following table:

Dimension	Global	Professor	Investor	Industry Expert
Product Engineering	79,5	80,5	74,8	82,5
Capital Intensive	81	86,8	74,2	82,8
Science Based	81,8	89	72	83,8

Table 12: Jury Scores.

We can observe that:

- The global score is similar for every dimension;
- The investor score and the industry expert score are standardised, the first around the 74 points while the second around the 82. Therefore, the investors have a more pessimistic vision of the project rather than industry experts, it could be ascribed to the experience of the investor;
- The professor, instead, looks like to have an irrational behaviour, the scores improved to the risk of the projects. Indeed, the Science Based that are the riskiest projects, it is difficult to develop a successful spin-off company or a drug, have the highest score. Instead, the Product Engineering, the least risky has the lowest score, the Capital Intensive is in the middle for both, risky and score. These behaviours could be explained with the lack of commercialised

experience of professor, in fact, usually they do not view new and disruptive technologies or drugs, characteristic of the Science Based dimension, so it could be transported from the enthusiasm from these new solutions that are more difficult but more attractive and revolutionary. Instead, the investor knows the difficulty and all the steps to develop these types of projects, it is its work, so it has a more conservative and caution approach. The same reasoning could be reported to the other two dimensions, though with lower points.

Another consideration related to the Proof of Concept score is the comparison between the PoC score and the real state of successful or unsuccessful. In a more specific way, we want to check if the project with a higher score have obtained a higher successful. In order to obtain this information, we analysed the data in the following table, Table 13.

We can see that there is no correlation between high score and high successful, rather it could be the opposite, but without a statist relevant sample this opinion is not observable, moreover this seems to be foolish. We can limit ourselves to observe the lack of correlation between high score and high successful. In fact, for example the two highest score, project #6 and #12 are both stuck, instead projects like #9 and #2 have obtained successful, even if in different ways for different characteristics.

However, obviously, the success of a project depends on different factors, for example team factor or administrative and management problem, and it is difficult evaluating them with a score. However, the result of these analyses provided an unexpected and strange result.

Moreover, we can observe that the both spin-off companies coming from Science Based and precisely from Software dimension. This is in line with the expected result coming from our classification.

Dimension	Project Number	Score PoC	Project State
Product Engineering	**1**	76	WIP - Contacts
	7	74	Stand - by
	6	97	Stand – by
	11	71	WIP - Contacts
Capital Intensive	**12**	93	Stand – by
	4	82	Contract
	9	79	Contract
	3	70	WIP - Contacts
Science Based	**10**	84	Looking for funds
	5	87	Spin – off
	2	83	Spin – off
	8	73	Looking for team and funds

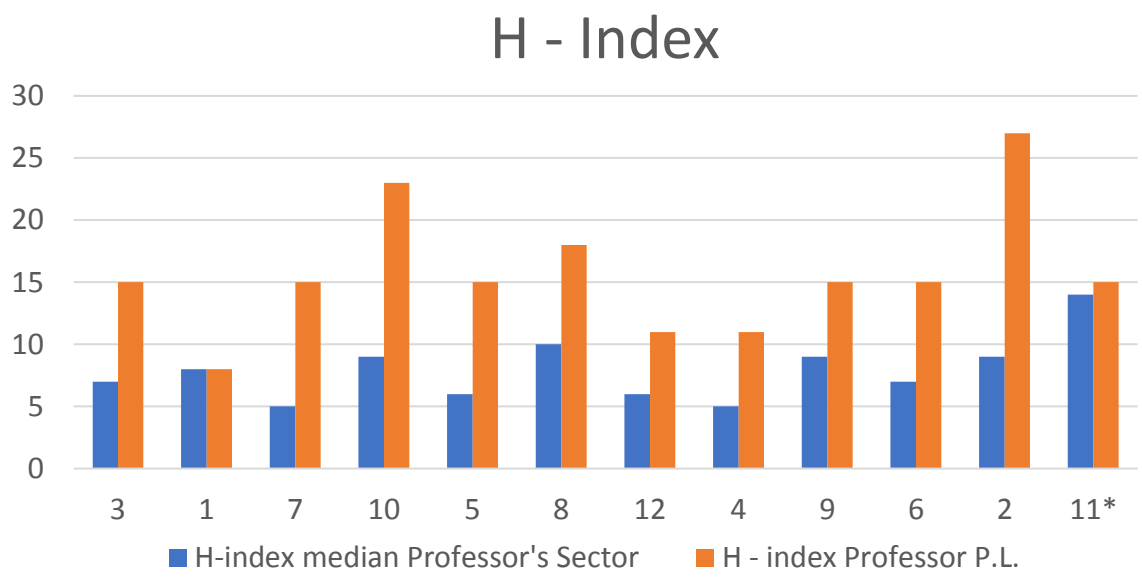
Table 13: Projects State.

The last observation on these quantitative and descriptive data is led to the necessity to know the distribution of the project leaders compared to the similar colleagues. In particular we compared the H-index of the Project leaders to the H-index median of professor's sector in order to know if who develops a research project prefers this activity to the publication or not.

The obtained data in the Table 14 and the following graph, Graphic 4, show that all the project leaders are located on the top H-index median part. Using this data, we can say that who develops a project already has a high H-index score, so it does not prefer an activity to the other but before starting the project, it has obtained a high consensus on the publication index. However, it is important to remember that the Politecnico di Torino is one of the best universities in Italy and in Europe, so it is more probable that there are the top-level professors.

Project Number	H-Index Project Leader	Type of Professor	*H-Index median of professor's sector	*H- Index P.L. (years)
3	16	Associate	**7**	**15**
1	8	Full	**8**	**8**
7	15	Associate	**5**	**15**
10	26	Associate	**9**	**23**
5	18	Associate	**6**	**15**
8	29	Associate	**10**	**18**
12	15	Associate	**6**	**11**
4	12	Associate	**5**	**11**
9	15	Full	**9**	**15**
6	15	Associate	**7**	**15**
2	31	Associate	**9**	**27**
11	20***	Associate	**14****	**15****

Table 14: H-Index.



Graphic 4: H-Index.

Chapter 4 - Data Analysis

4.1 Work Structure

Before talking about the analysis process, we classified the type of work developed. To find the correct collocation for our Case Study, we studied the research by Robert K. Yin in his book "Case Study Research: Design and Methods".

Our study, in according to R. Yin, is a holistic single case-study. The main reasons to be a single case are the following:

1. Our work is a testing work, it wants to confirm the existing literature and add a new step to it, because:
    a. The first goal is to find, confirm or deny the existing inhibitors for the commercialization of research projects, the first research question;
    b. The second goal is to add another step to the existing literature and proving how the Proof of Concept could help to overcome the found inhibitors;
2. Our case is a "revelatory case" (by R.Yin, 1994), because is the description of a phenomenon previously inaccessible because inexistent at the Politecnico di Torino.

Moreover, it is holistic rather than embedded because it examines a global program in a single university. In adding, in according to R. Yin, in this moment this study is a single observation so a single case-study, but in future it could be a multiple-case study with the analysis of subsequent calls, holistic if it will be developed with a replication logic and the same starting condition. While it will be an embedded multiple-case study if it will be developed under different condition and the outcomes will be compared to each other.

In a field where the main information is not quantifiable, it is difficult to write a scientific paper, because you have to find the way to extract consistent evidences in order to find answers to the research questions. Moreover, the literature in this field is limited, so we had to find an appropriate way to develop a new concept. The selected methodology we followed as guidelines comes from A. Gioia: main contributions come from works dated back as Gioia 2012 and Gioia 2004. These works made fundamental contributions, especially to develop a consistent and structured interview.

Another important contribution in addressing our work comes from the paper by "A. A. Gümüsaya, T.M. Bohné 2018"; as said previously, we started from this paper to develop our research. The first research question of our work is the same of Gümüsaya's paper: we investigated the inhibitors for the commercialization of projects coming from academic research teams. But we added a further step to it, we found if and how the Proof of Concept could help to overcome the inhibitors found on first step and

we linked the solutions found to inhibitors. Moreover, also the idea to utilize Gioia's methodology, comes from Gümüsaya's paper, who also used Gioia's methodology for their paper.

In order to build a consistent research, we followed Gioia's methodology and Gümüsaya's paper and we tried to add a further step to explain how the Proof of Concept can help the research teams.

Starting with this idea, we developed our research process. In every phase we reported a number in order to have an ordered sequence of steps throughout the thesis. The process can be summarized as follows:

1. Phase I – Context Literature, the chapter 2: The first step was to understand the context: doing this, we studied the literature with the purpose of having a first approach on the problem and building a preliminary list of possible inhibitors, to develop an initial interview format.
2. Phase II – Supposed Inhibitors List: Starting from the literature, especially from "A. A. Gümüsaya, T.M. Bohné 2018" paper and from experience of our research team, we developed a first list of supposed inhibitors and we classified them in three levels:
    i. Area of inhibitor: the highest dimension where the inhibitors are classified for thematic area;
    ii. Inhibitor: the middle dimension where the sub-inhibitors are grouped in a more general and abstracted definition;
    iii. Sub-inhibitor: it is the real issue found in literature or during the interviews.

    They were only a hypothetic list, a starting point to create the first interview protocol. Obviously, every areas, inhibitors and sub – inhibitors had to be confirmed by the next interviews.

    Moreover, as explained subsequently, the used approach to develop these three different levels of classification is a bottom up approach rather than a top down approach. It is impossible to develop a structured and consistent classification without starting from the lowest level, sub-inhibitor.
3. Phase III – Interview Protocol: Using the list of supposed inhibitors, we developed the interview protocol in order to have an impartial, structured and repeatable format. Having two different research questions we decided to split the interview protocol in two different parts:
    i. The first part, to find and/or confirm the inhibitors;
    ii. The second part, to understand, if and how, the Proof of Concept program helped the research team to alleviate or overcome the aforementioned inhibitors.
4. Phase IV – Interview: We conducted twelve interviews, coming from the first Proof of Concept call.
5. Phase V – Interview Coding: We transcribed and coded the whole sample of interviews in order to indicate the words of the interviewee to find the real inhibitors to the commercialization of research project, for the 1st part of interview, and the solution to overcome them, provided by PoC program for the 2nd part of it. At the end of every interview, we pivoted the inhibitors list to check that every mentioned problem by interviewees could

find an answer on an inhibitor and especially on sub-inhibitors. If some of the mentioned problems did not find a correct and appropriate inhibitors and sub-inhibitors, we created one for it and added to the inhibitors list.

6. Phase VI – Definitive Inhibitor List: At the end of whole sample of interviews and coding, we deleted the supposed inhibitors that did not reflect a real problem. In this way, we obtained a definitive and real inhibitor list.
7. Phase VII – Link Between Inhibitors and PoC Solutions: Once we had a definitive inhibitor list, we linked it to every inhibitor the solution of interviewees explained to us. In conclusion, we have a list of inhibitors and the respective Proof of Concept solutions, if there is one. The elaborations on the inhibitors and on the linking from inhibitors to Proof of Concept solution were developed to the middle dimension in order to obtain an appropriate compromise. In fact, the inhibitor is the most relevant collection category, moreover from the point of view of literature's content it is the most appropriate dimension.

The last two tasks will be argued on the next chapter, chapter five.

4.2 Gioia's Qualitative Method - Literature

Before talking about the Supposed inhibitor List and the Interview Protocol, we have to explain the main criteria and steps of Gioia's methodology.

There are different types of qualitative methodologies, we get used this study to lead our selection: "Finding theory-method fit: a comparison of three qualitative approaches to theory building", 2017. This is a study that compare the three best emerging qualitative methodologies.

Using this study, we selected Gioia's methodology for the main following reasons:

1. Differently from other qualitative methodologies, for example the Eisenhardt's methodology, the Goia's methodology is usually used in the single cases study;
2. Differently from other qualitative methodology, for example the Langley's methodology, the Gioia's methodology is a structured and repeatable approach;
3. It is the best solution to link a single case study to the qualitative method;
4. It is robust, it uses a triangulation of different data sources, but flexible, the interview is the main data and its protocol must be updated, if necessary, during the process of interviews;
5. It is the best method to create and develop theoretical concepts, essential for our study, moreover it is easy to link found concept to the existing literature, for our case the found inhibitors to the literature.

The theory of Gioia's methodology come from "Seeking Qualitative Rigor in Inductive Research: Notes on the Gioia Methodology", a paper of 2012, where Dennis A. Gioia, Kevin G. Corley and Aimee L. Hamilton explained how is possible to write a scientific paper making a semi – structured interview without quantitative evidences.

Gioia's methodology provides the connecting bridge to link the interviewee's real opinions, qualitative information, with "Grounded Theory". "Grounded Theory" is a theory developed by Glaser and Strauss (1967), which uses an inductive approach, developed step by step without literature or previous hypothesis, to describe a qualitative phenomenon. It can be summarized in four different steps:

1. Identification of the core category: Selecting a defined research question and focusing the research on it;
2. Open coding: Analysing all the obtained documents using the open coding approach, inductive approach to elaborate the documents adding step by step more information to the model;
3. Axial coding: Going back to the theory on which the problems highlighted in the coding phase is based, describing the issues on different levels with always more details;
4. Selective coding: integrating the different problems, to obtain a global theoretical scheme.

Gioia's methodology describes a way to collect data in a structured way, to be able to elaborate the results using the "Grounded Theory" approach. It is an inductive approach, which uses different sources of data, but the main source is the semi – structured interview. The protocol of it must to be structured but flexible and applicable on different interview contexts. Moreover, it must to be editable, in order to add important topics born during previous interviews. This methodology pays extraordinary attention to interviewee's opinion and voice to the information obtained.

The process of Gioia's methodology can be summarized as follows, using a scheme coming from Gioia 2012 (p. 26):

"Step:

1. *Research Design:*
    a. *Articulate a well-defined phenomenon of interest and research question(s) (research question[s] framed in ''how'' terms aimed at surfacing concepts and their inter-relationships)*
    b. *Initially consult with existing literature, with suspension of judgment about its conclusions to allow for the discovery of new insights*
2. *Data Collection:*
    a. *Give extraordinary voice to informants, who are treated as knowledgeable agents*
    b. *Preserve flexibility to adjust interview protocol based on informant responses*
    c. *''Backtrack'' to prior informants to ask questions that arise from subsequent interviews*
3. *Data Analysis:*
    a. *Perform initial data coding, maintaining the integrity of 1st-order (informant centric) terms*
    b. *Develop a comprehensive compendium of 1st-order terms*
    c. *Organize 1st-order codes into 2nd-order (theory-centric) themes*
    d. *Distill 2nd-order themes into overarching theoretical dimensions (if appropriate)*

e. Assemble terms, themes, and dimensions into a ''data structure''

4. *Grounded Theory Articulation:*
   a. *Formulate dynamic relationships among the 2nd-order concepts in data structure*
   b. *Transform static data structure into dynamic grounded theory model*
   c. *Conduct additional literature review to refine articulation of emergent concepts and relationships"*

To better understand the application of Gioia's methodology, we analysed a paper by Kevin G. Corley and Dennis A. Gioia, "Identity Ambiguity and Change in the Wake of a Corporate Spin-off", which uses such methodology. This paper talks about the changes of spin-offs during their life and to do it the authors made a triangulation of three different kind of data: eighty semi-structured one-to-one interviews, written and electronic document and observation. Leaving out the contents of the paper and focusing on how the data have been analysed, we can observe that, as well as reported in Gioia Methodology, they made a semi-structured interview and after this, they aggregated the same problems in a more general phrase called 1st Order Concepts. All 1st Order Concepts with the similar base of problem have been grouped in more abstract 2nd Order Themes, and the themes with the same global area have been brought together in a final Aggregate Dimension. The step by step aggregation are the same described on "Grounded Theory".
The outcome of this process is shown in figure, Figure 6.

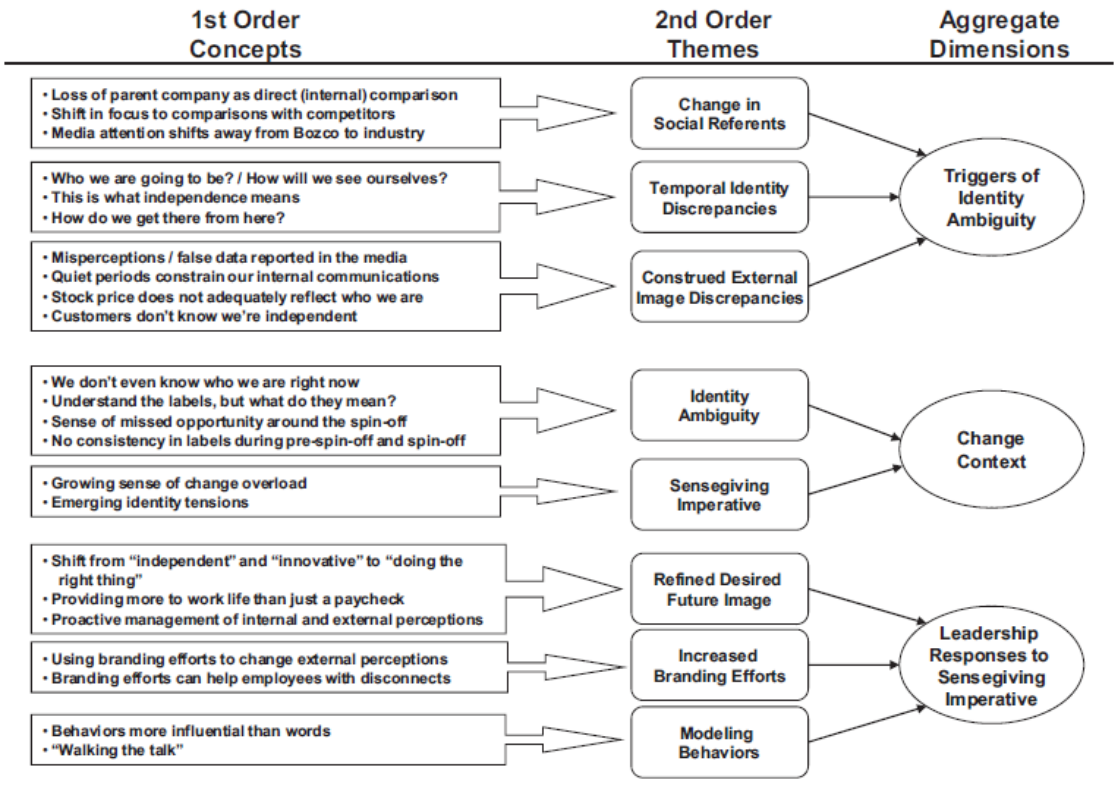


Figure 6: Example of Data Structure, Gioia, 2004.

4.3 Structure of interview protocol – Phase II e Phase III

In this sub-chapter we analysed two phases, in the first part the Phase II, Supposed Inhibitors List, and in the second part the Phase III, Interview Protocol.

PHASE II - Supposed Inhibitors List

After studying the implication of Gioia's methodology, we studied the correct way to create a flexible but complete interview protocol. This part has been very delicate because it is important, as said in Gioia 's methodology, to avoid influencing interviewees in their answers.

In order to create the interview protocol, we decided to start from our fixed points that are:

1. Literature on "Proof of Concept";
2. Personal knowledge;
3. Gioia's methodology.

Starting from this point of view, during a meeting we decided to deviate from our initial idea, to create the interview protocol, towards a more structured deductive approach. In fact, according with Gioia 2012 it is impossible to be completely uninformed about the literature. Moreover, how would it be possible to build an interview protocol without the use of some literature?

For these reasons we decide to use common sense and develop the interview protocol using the literature, in order to address in the best way, the whole work. This was only a starting point to lead the work; all hypothesis had to be confirmed during interviews and moreover in according with Gioia 2012 we adapted the interview protocol and subsequently the data structure list during the interview phase.

After these reflections we drawn up a hypothetical list of inhibitors and sub – inhibitors respectively the second and the first order category of Gioia's methodology, with the purpose of performing a further step, to create a first base interview protocol. In fact, starting from a hypothetical list of inhibitors we have been able to go back to possible question for every inhibitor, in order to create an interview question list.

For every inhibitor, we described the rationale that we followed to create each of them. In adding, over the Inhibitors, the second-order categories, we added sub-inhibitors, the first-order categories. The idea was to select the question for the interviewee starting from second – order categories but imagining the way to lead the interviewee in order to help him/her if he/she did not understand the question with the first–order categories. Moreover, the hypothetical first order category was a first scheme to classify the interviewee's answer for the coding step.

Obviously, as said before, every inhibitors and sub – inhibitors were only a starting point to create a first interview protocol. Every inhibitors and sub- inhibitors had to be confirmed during the interviews.

List of inhibitors from literature and knowledge

First–order and second-order Categories

1. The research team does not have access to external sources of financing
    a. The team does not know the people or the right people to receive the financing
    b. The team does not have the necessary fame to receive external fund

One of the first problem known in the literature and for personal knowledge is the impossibility for the research team to have access to external funds to develop their own idea. We imagined two possible kinds of motivations.

2. The research team does not have managerial skills to "sell" the technology
    a. The team is not able to understand the customers' needs to address the research to the market
    b. The team does not have the necessary communication with the market to understand the real needs of the customers

To sell a technology, you need to have managerial skills, understand the costumers' needs and address the research. Moreover, to understand the needs, the team has to be able to communicate with customers.

3. The research team does not find legitimacy of its scientific value outside the academic setting
    a. The industry does not understand the potential of this new technology
    b. The team does not have the scientific knowledge to entry in the industry
    c. The team does not have the reputation/fame to entry in the industry

Sometimes the work of academics is not acknowledged outside the academic setting. We suppose it could be possible for three different type of problems: lack of fame by team research; lack of knowledge of industry issues; different language and goals between academic environment and industry environment.

4. The research team's supply of a technology is misaligned with the industry demand
    a. The team's technology is different from market needs
    b. Usually the technology is disruptive and is difficult to insert inside the existing technology

The research projects are usually misaligned with the industry needs, it could be because the ideas and the projects are disruptive compared with technology used in industries or maybe because the developed technology is different by firms' problems.

5. The research team does not have the right visibility outside the academia
    a. The world does not know the team's research
    b. The team is not able to open a communication bridge with the external world

Outside the academic setting, the researchers do not have the visibility and fame to be known, in this way the world hardly knows the team's project.

6. The research team scarcely interacts with other technology providers

   a. The team does not collaborate with other teams or firms to have access on complementary technology
   b. The research team thinks to have all the competences inside the research group
   c. The research team does not want to collaborate with other groups, because it does not want to lose the control of the project

It could be possible that the different research teams do not collaborate for different reasons, we have supposed three. The first phrase is totally general to classify the different answers not classifiable on other sub -inhibitors, the other two are more specific and talking about the possibility to introduce other people inside the project team. Introducing other people inside the team could be dangerous because the head project could lose the control of the project.

7. The research team strives to find third parties willing to share the technological risk
   a. The research team does not find the investors to share the technological risk

Considering the early stage of the research project, it could be difficult to find the right investors to share the technology risk: in fact, due to the early stage of project, the investment and the risk of failure are too high. To invest, the investor must think that this technology could be winning, and, in addition, it has to have great confidence on the project team.

8. The research team does not have any instrument to signal its own commitment on the development of the technology
   a. The external world does not know the research and the commitment of the research team

In the case of risk sharing, it could be difficult to signal the commitment of research team towards the investors, for this reason the investors could decide not to invest on the technology.

9. The research team does not have the capability to build a network of stakeholders interested in the technology
   a. The research team does not able to explain to investors the potential of the project therefore the investors do not want to invest on the research
   b. The research team is not able to talk with all stakeholders

For the research team, it could be complex to build a network of stakeholders interested in technology, the reasons for it could be found on the complexity and difficulty to understand the technology, or on the difficulty for the research team to talk with the right stakeholders.

10. The research team is not protected from opportunistic behaviours by third parties
    a. The research team does not have the knowledge to protect itself from opportunistic behaviours
    b. The research team is not able to select the right shareholder

c. The research team does not develop projects with other companies or project teams because it is afraid to be fooled, for this reason the outcomes of research are not driven from industry needs

The research projects could be of value and the team could be not able to protect itself from opportunistic behaviour of external actors. This could be for different reasons: lack of knowledge to protect itself, wrong selection of shareholder or other reasons not specified.

11. The research team is not working in proximity of companies interested in the exploitation of the technology
    a. The geographic localization of the team is not the best place to develop the project

Some research teams could not be born in an inappropriate geographic localization, in this way it could be difficult to demonstrate the feasibility of idea. Instead, the same idea in another geographic localization could have been of value.

12. The research team does not have direct channels to approach companies interested in the exploitation of the technology
    a. The research team does not have the ability to "sell" the research

The research team could not find shareholders interested in the exploitation of technology because it is not able to explain the potential of its idea.

13. The research team has a high focus on theoretical contents rather than applied ones
    a. The research of team is theoretical driven rather than market driven

The team could have a high focus on theoretical contents rather than applied one, it could be possible for the high focus of researchers on problems treated by the literature rather than market needs.

14. The research team does not fully understand the technological needs of the industry
    a. The research team does not know the best application of its research
    b. The research of inventors is not driven by market's needs, but rather from the possibility of publishing

The research team could develop a new technology without knowing the real application of it, the research could be led by the publisher's needs.

15. The research team's academic career incentives privilege basic research over applied research
    a. The research's team is driven by the need to publish, to improve the academic career

The researchers could have more incentives to develop a basic research than an applied one, this could be due to speed up the publication process. Moreover, the researches could only focus on literature problems and lose the problem of applied research.

16. The research team worries about potential for stealing ideas
    a. The team thinks that collaborating is dangerous to maintain control on the project

The team could be worried about stealing ideas, for this reason it could decide to avoid the collaboration with other research teams.

17. The research team fears competition for resource acquisition from other research groups
    a. The team is afraid of opportunistic behaviour from other research groups and lose important team members.

The team could be afraid to lose some important team members, it could possible because the competition for the acquisition of skilled members inside the academic setting is high.

PHASE III - Interview Protocol

At the end of the creation of the supposed inhibitors, we focused our attention on the creation of the protocol interview and we grouped the similar second-order categories, the inhibitors, in order to avoid some mistakes or the overlap of the questions. In others words we used a bottom up approach, starting from inhibitors to obtain the higher level dimension. At the end of this step we have found four different areas of inhibitors, which constitute the final dimension of the Gioia's methodology. The diverse areas show their different problems through their corresponding inhibitors.

The four areas identified of inhibitors are:

1. Development Environment /Structural
2. Cultural
3. Team Knowledge
4. Market Application and Environment Application

The followed figure, Figure 7, shows the supposed inhibitors tree.

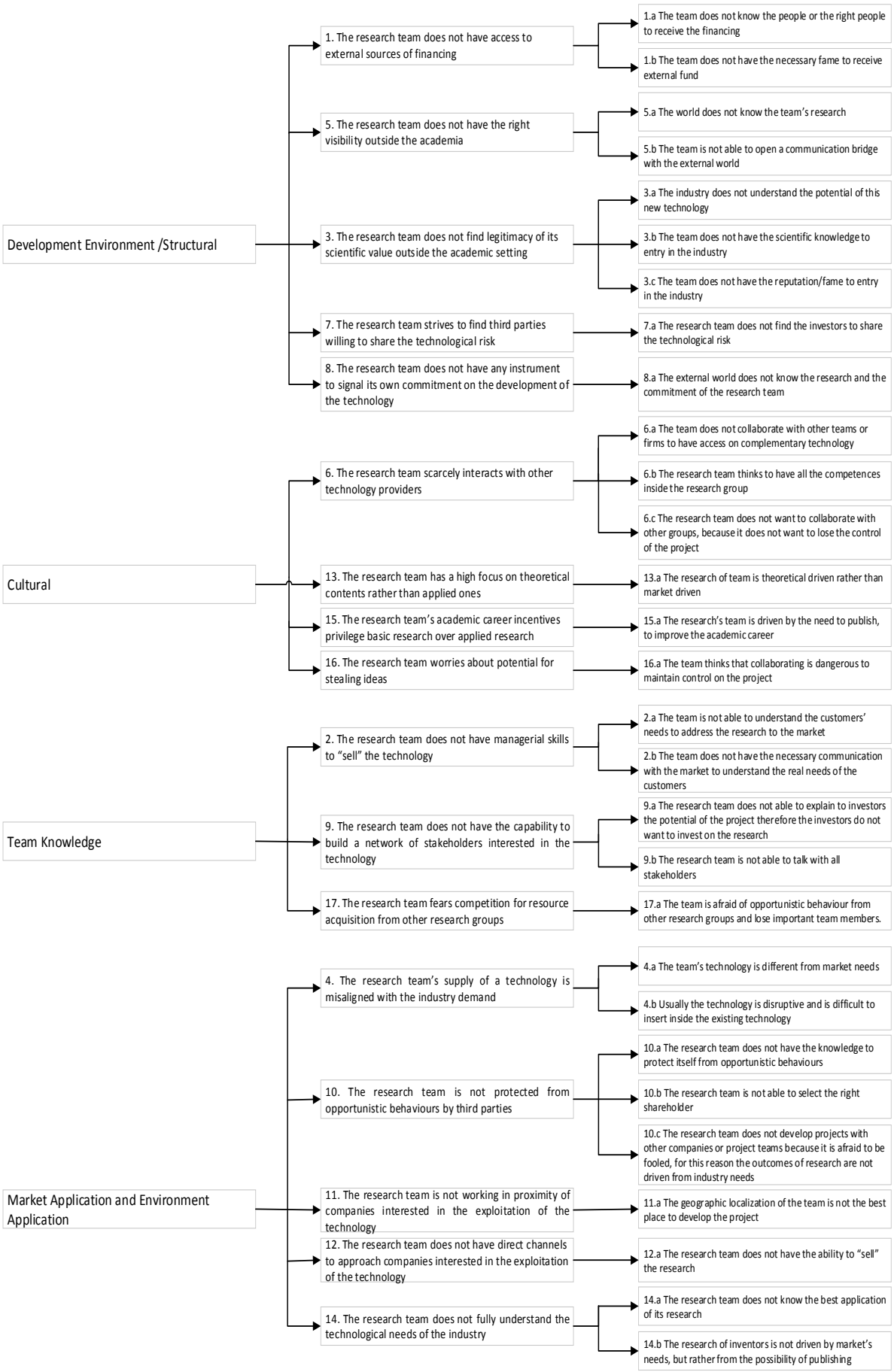


Figure 7: Supposed Inhibitors Tree.

The below tables show the different areas, inhibitors and sub-inhibitors linked. Moreover, for every inhibitor we associated a question and sometimes, if necessary to obtain detailed information, some sub-questions. For every question is associated a question code to link easily the question on the interview protocol to correlated inhibitors.

Development Environment /Structural		
Inhibitors	Questions	Question code
1. The research team does not have access to external sources of financing a. The team does not know the people or the right people to receive the financing b. The team does not have the necessary fame to receive external fund	How do you finance your research projects (e.g. remains)? a. How is financing split among the Politecnico (excluding the PoC program) and external sources, on the total of 100? b. Which external sources?	DEVELOP 1
5. The research team does not have the right visibility outside the academia a. The world does not know the team's research b. The team is not able to open a communication bridge with the external world	How often are you contacted by firms/associations to develop new research projects?	DEVELOP 2
3. The research team does not find legitimacy of its scientific value outside the academic setting a. The industry does not understand the potential of this new technology b. The team does not have the scientific knowledge to entry in the industry c. The team does not have the reputation/fame to entry in the industry	How is your research perceived outside the academic setting? [Ext. COMP.] a. And inside (colleagues, even other departments, etc.)? [Int. COMP.]	DEVELOP 3
7. The research team strives to find third parties willing to share the technological risk a. The research team does not find the investors to share the technological risk	Is there the willingness of your business partners to share the risk related to the development of a new technology?	DEVELOP 4
8. The research team does not have any instrument to signal its own commitment on the development of the technology a. The external world does not know the research and the commitment of the research team	How do you report your commitment to potential investors/partners? a. Are there any obstacles?	DEVELOP 5

Table 15:Development Environment /Structural -- Inhibitors & Questions.

Cultural		
Inhibitors	Questions	Question code
6. The research team scarcely interacts with other technology providers a. The team does not collaborate with other teams or firms to have access on complementary technology b. The research team thinks to have all the competences inside the research group c. The research team does not want to collaborate with other groups, because it does not want to lose the control of the project	How and where do you look for complementary technologies/competencies to develop your technology? a. What difficulties do you find in access to complementary partners/technologies?	CULT 1
13. The research team has a high focus on theoretical contents rather than applied ones a. The research of team is theoretical driven rather than market driven	Does your research focus more on the theoretical dimension (e.g. developing new models) or applied dimension (e.g. developing new technologies)?	CULT 2
15. The research team's academic career incentives privilege basic research over applied research a. The research's team is driven by the need to publish, to improve the academic career	How is your research activity split between the publication and the technology's development/commercialisation, on the total of 100? a. Why do you prefer one activity to another? b. What is the role of career incentives in the academic setting?	CULT 3
16. The research team worries about potential for stealing ideas a. The team thinks that collaborating is dangerous to maintain control on the project	What are the main barriers related to the collaboration with other partners?	CULT 4

Table 16: Cultural -- Inhibitors & Questions.

Team Knowledge		
Inhibitors	Questions	Question code
2. The research team does not have managerial skills to "sell" the technology a. The team is not able to understand the customers' needs to address the research to the market b. The team does not have the necessary communication with the market to understand the real needs of the customers	How is the technology's "marketing" process structured? a. Did you find any difficulties?	TEAM 1
9. The research team does not have the capability to build a network of stakeholders interested in the technology a. The research team does not able to explain to investors the potential of the project therefore the investors do not want to invest on the research b. The research team is not able to talk with all stakeholders	How far is your network extended? a. Is there anyone interested to the technology?	TEAM 2
17. The research team fears competition for resource acquisition from other research groups a. The team is afraid of opportunistic behaviour from other research groups and lose important team members.	With reference to the other research groups, are there competitive dynamics in the resources acquisition?	TEAM 3

Table 17: Team Knowledge -- Inhibitors & Questions.

Market Application and Environment Application		
Inhibitors	Questions	Question code
4. The research team's supply of a technology is misaligned with the industry demand a. The team's technology is different from market needs b. Usually the technology is disruptive and is difficult to insert inside the existing technology	Does your research start from market needs or potential discoveries?	MKT APPLIC 1
10. The research team is not protected from opportunistic behaviours by third parties a. The research team does not have the knowledge to protect itself from opportunistic behaviours b. The research team is not able to select the right shareholder c. The research team does not develop projects with other companies or project teams because it is afraid to be fooled, for this reason the outcomes of research are not driven from industry needs	Do you think opportunistic behaviour with respect to technology/research by the external world may happen (e.g. partners)? a. And from academic setting? b. Eventually how can you protect yourself from these behaviours?	MKT APPLIC 2
11. The research team is not working in proximity of companies interested in the exploitation of the technology a. The geographic localization of the team is not the best place to develop the project	Where are the technologies' exploiters located? (in the region, abroad, etc.) a. How did you approach them?	MKT APPLIC 3
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology a. The research team does not have the ability to "sell" the research	What are the channels through which you come in contact with potential users/partners of your technology?	MKT APPLIC 4
14. The research team does not fully understand the technological needs of the industry a. The research team does not know the best application of its research b. The research of inventors is not driven by market's needs, but rather from the possibility of publishing	Do you have a clear overview of the market needs? How much has the development of your technology been driven by the market needs?	MKT APPLIC 5

Table 18: Market Application and Environment Application -- Inhibitors & Questions.

These questions have been used to lead the first part of interview, which is the part on inhibitors of commercialization of research project.

For the second part of interview, we selected the following questions:

1. What was the advantage offered by the PoC? *[topics to be addressed: market knowledge, network & partners, financial resources, university and internal process, research team]*
2. On what parameters has been the PoC program effective?
3. Have you reached the goals that you set?
    a. Do you think that the project has really grown in value?
    b. What TRL has been achieved so far?
4. Did the project generate interest by firms after the PoC program?
    a. Have agreements been concluded? Which kind?
5. What is the current state of the project? (abandoned project, start-up, agreements, etc.)?

   a. Are there any future plans for the developed technology?
6. Do you want says anything else that you think is relevant with respect to the PoC program?

Furthermore, we wrote, in the interview protocol, the rationale and the objectives of the interview, to ensure to provide the same information to every interviewee. We explained that the interview was divided in two parts: the first was based on research projects in general, the second on the winning project of PoC program and on PoC itself.

We asked the permission to record the interview, to transcribe it for the coding stage, moreover we have ensured the anonymity of interviewees, to be sure to fully exploit the potential of this interview, and to give the interviewee the freedom to express him/herself. The interview protocol is visible in Attachment 2, instead the complete list of inhibitors, sub- inhibitors and relative questions is available in Attachment 3.

We started the interviews using this protocol, but during the first five interviews we made some adjustments on it. After these adjustments, we found the correct way for the protocol, instead we waited until the end of the interviews to draw up the final list of inhibitors. Indeed, during the interview phase, we added new inhibitors and sub-inhibitors without deleting the old ones, in order to obtain a final complete list. By doing so, at the end of interview phase we could have a global point of view on all the interviews. The only exception was for inhibitor #14, where we decided to modify the phrase of the second-order category (the inhibitor phrase), in order to have a more appropriate sentence.

Talking about the protocol, as the Gioia Methodology says, the interview protocol, especially the starting protocol, have to be flexible to lead the interviewee's opinion. But after the first five interviews we did not feel the need to change the document. The changes we made were only an adjustment on the explanation before the interviews, along with some specifications of the old questions and some new questions. The new questions were one on the first part of interviews, namely the research of the inhibitors for the commercialization of research projects, and two for the second part of the interview, the Proof of Concept part.

The new question on the first part of the interview, was created for the addition of a new inhibitor, the number eighteen. It was created after the first interview and it concerns the limited time professors have for their own research, we will explain better it in the next sub – chapter 4. We added this new inhibitor in the cultural area. The sentences of inhibitors, sub-inhibitors and question are as follow:

Cultural		
Inhibitors	Questions	Question code
18. NEW The research teams do not have enough time to dedicate to the research a. NEW The researchers are very busy in the university life, among teaching, research and administrative obligations	How do you split your time among the activities that are required in your assignment, on the total of 100? (research, teaching, institutional commitments, etc.) a. Do you find the allocated time for your research activities adequate?	CULT 5

Table 19: Cultural -- Inhibitor New 18 & Question.

Instead, for the second part of the interview the following two question:

6. What is the current role of the project's members?
    a. What is the role of young researchers?
    b. And the seniors?
7. Do you think that an entrepreneurial training for young researchers of teams could help increasing the commercial possibilities of its technology?

The final protocol is available in the Attachment 4, the updated list of inhibitors, sub - inhibitors and relative questions is in the Attachment 5.

4.4 Pre – Interview, Interview and Post–interview – Phase IV and Phase V

In this sub-chapter we analysed two phases, in the first part the Phase IV, Interview, and in the second part the Phase V, Interview Coding.

PHASE IV - Interview

The interview phase has been a repetitive one. We want to explain the whole interview phase to understand the complexity and the large amount of material analyzed for this dissertation.
To lead this work, as mentioned previously, we used a triangulation of three different sources of evidence:

- Interviews;
- TTO documents;
- 1° call Proof of Concept Dataset.

The interviews are the central source of this work, but we also carefully analyzed complementary documents, to make the most of the interviews.
In fact, before every interview we re-examined all the documents related of the interviewee project. The principal documents analyzed are been:

- Apply documents on Proof of Concept project;
- Final report of the financed project;
- Middle presentation;
- Evaluation report of project;
- Curriculum vitae of every team member;
- Technology profile on Knowledge – Share (https://www.knowledge-share.eu).

The purpose of this analysis was to seek important information on which to investigate during the interview. To lead ourselves during the interview we have drawn up a report for every project and used it during the interview. The scheme of the Report is the following:

Report of Name of Project leader

Project Name:

Project Score:

Fund:

1- Requested:
2- Approved:

TRL:

1- Starting:
2- Ending:
3- KTTM Ending (KTTM Name):

Interview criticism:

Project Team:

Name and Surname of every member	Position inside the university	Department	Date of birth

Minutes of the application:

Name and Surname of every member of the commission	Position inside the commission	Knowledge

1) Project:

Summary, criticism and explanation of the project.

Score: …/30

2) Project Team:

Summary and criticism of the team project.

Score: …/20

3) Technology Potentiality:

Potential and innovation of the research.

Score: …/15

4) Budget:

Consistency between requested budget and the project development plan.

Score: …/15

5) Interview with the Evaluation Commission of PoC project:

Interview of Application on PoC project.

Score: …/20

Total Score: …/100

Knowledge - Share link: ….

The score of every item and the total score, as mentioned in the third chapter, are the points assigned by the PoC commission for the ranking of the first Proof of Concept call. For privacy reasons the interview reports are not attached in the dissertation.

As recommended in the Gioia 2012, we recorded all interviews and transcribed to facilitate the coding phase. We used a semi-structured interview protocol, adding other questions during the interview phase. In order to avoid influencing the interviewees' answers we let them talk and explain their point of view and problems.

PHASE V – Interview Coding

"Coding is the analytic process of examining data line by line or paragraph by paragraph (whatever is your style) for significant events, experiences, feelings, and so on, that are then denoted as concepts" (Strauss & Corbin, 1998)

There are two types of coding approach: deductive and inductive. Using the inductive approach, every coding label is identified while you are coding the text, instead the deductive coding is based on a pre-selected protocol of coding. We used a Deductive coding approach, in fact in our case the pre-selected protocol is the inhibitor list.

This type of coding phase has been used only for the first part of interview, the first research question. For the second part, the Proof of Concept part, we did not have the inhibitor list, we used an inductive approach to link the solutions provided by Proof of Concept program to the second – order inhibitors.

The Deductive Approach can be summarized as follows:

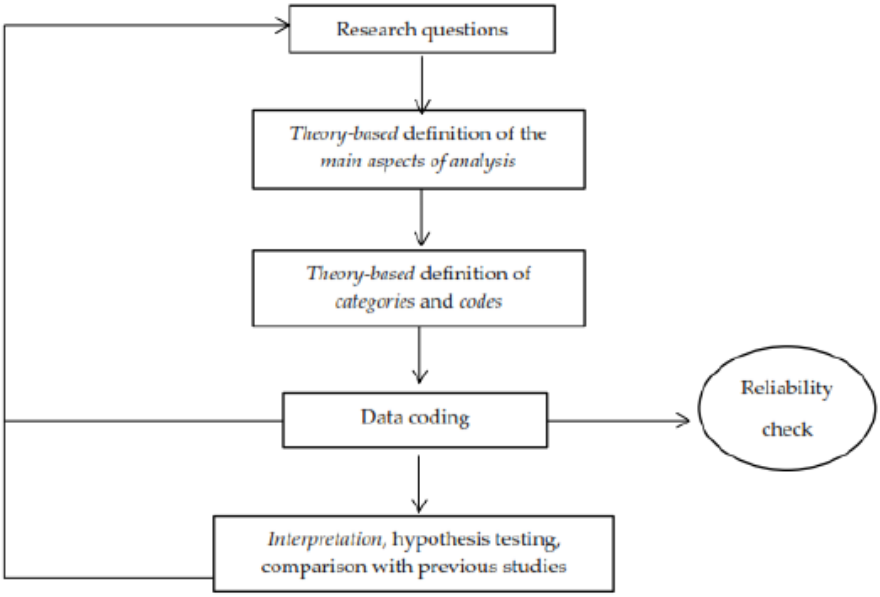


Figure 8: Coding - Deductive Approach.

Instead the Inductive Approach is the following:

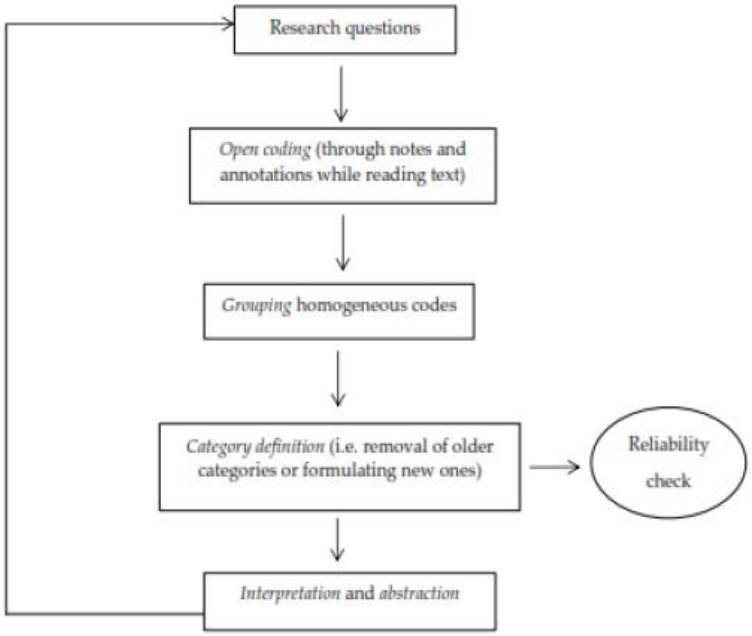


Figure 9: Coding - Inductive Approach.

Talking about the first part of interview, the first research question, we analyzed the transcriptions to code the interviews. Every important and relevant concept for our research question has been linked with one of the sub – inhibitors supposed by us. If some important concepts did not find the correct sub – inhibitors we created a new one. Moreover, if none of the created inhibitors, the second – level categories, deal with the issues we found, we added a new inhibitor and sub-inhibitor. An example of coding transcription is reported in the following Attachment 6.

The first inhibitors and sub-inhibitors list has been supposed from us using the literature and the experience of our research group; instead the final list is the result of the adjustments we made during the coding phase.

The final and complete list of inhibitors and sub-inhibitors is the followed. We added the description only for the new inhibitors that is the second-order categories.

However, we want to explain and clarify an important characteristic by the qualitative methodologies. If during an i-th interview is necessary to create new inhibitors or sub-inhibitors, it will not be needed to come back to analyse the previous interviewees, because it is a qualitative and not quantitative approach. On the other hand, it will be important to check the previous interviews and understand if the new inhibitors are attributable also to some previous interviewees.

In fact, a single word or phrase in a determinate context is sufficient to understand the interviewee's point of view. Moreover, after 3-4 interviews without adding new information to the research, the study could be considered concluded, it is saturated. In our case this happened at the end of eighth interview, but we preferred adding the last four interviews and having a global point of view in adding to an unassailable case study.

Final list of inhibitors

First–order and second-order Categories

1. The research team does not have access to external sources of financing
    a. The team does not know the people or the right people to receive the financing
    b. The team does not have the necessary fame to receive external fund
2. The research team does not have managerial skills to "sell" the technology
    a. The team is not able to understand the customers' needs to address the research to the market
    b. The team does not have the necessary communication with the market to understand the real needs of the customers
3. The research team does not find legitimacy of its scientific value outside the academic setting
    a. The industry does not understand the potential of this new technology
    b. The team does not have the scientific knowledge to entry in the industry
    c. The team does not have the reputation/fame to entry in the industry
4. The research team's supply of a technology is misaligned with the industry demand
    a. The team's technology is different from market needs
    b. Usually the technology is disruptive and is difficult to insert inside the existing technology
5. The research team does not have the right visibility outside the academia
    a. The world does not know the team's research

   b. The team is not able to open a communication bridge with the external world
   c. NEW The young researchers do not have the fame and visibility outside the academia, to receive the right visibility they look for an advisor (opportunistic behaviour)
6. The research team scarcely interacts with other technology providers
   a. The team does not collaborate with other teams or firms to have access on complementary technology
   b. The research team thinks to have all the competences inside the research group
   c. The research team does not want to collaborate with other groups, because it does not want to lose the control of the project
7. The research team strives to find third parties willing to share the technological risk
   a. The research team does not find the investors to share the technological risk
8. The research team does not have any instrument to signal its own commitment on the development of the technology
   a. The external world does not know the research and the commitment of the research team
9. The research team does not have the capability to build a network of stakeholders interested in the technology
   a. The research team does not able to explain to investors the potential of the project therefore the investors do not want to invest on the research
   b. The research team is not able to talk with all stakeholders
   c. NEW The research team is not able to talk to strong interlocutor
10. The research team is not protected from opportunistic behaviours by third parties
   a. The research team does not have the knowledge to protect itself from opportunistic behaviours
   b. The research team is not able to select the right shareholder
   c. The research team does not develop projects with other companies or project teams because it is afraid to be fooled, for this reason the outcomes of research are not driven from industry needs
   d. NEW The firm wants to have whole project for itself, also the IP
11. The research team is not working in proximity of companies interested in the exploitation of the technology
   a. The geographic localization of the team is not the best place to develop the project
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology
   a. The research team does not have the ability to “sell” the research
13. The research team has a high focus on theoretical contents rather than applied ones
   a. The research of team is theoretical driven rather than market driven

   b. NEW It is easier developing a new theoretical model, optimize an old research or to make a simulation on simulation environment rather than change the technological paradigm or developing a real research
   c. NEW The research is theoretical driven due to the lack of facilities
14. The research team develops projects without knowing the possible application
   a. The research team does not know the best application of its research
   b. The research of inventors is not driven by market's needs, but rather from the possibility of publishing
15. The research team's academic career incentives privilege basic research over applied research
   a. The research's team is driven by the need to publish, to improve the academic career
16. The research team worries about potential for stealing ideas
   a. The team thinks that collaborating is dangerous to maintain control on the project
   b. NEW The best ideas are followed/stolen more easily from other research team (opportunistic behaviour)
17. The research team fears competition for resource acquisition from other research groups
   a. The team is afraid of opportunistic behaviour from other research groups and lose important team members.
18. NEW The research teams do not have enough time to dedicate on the research
   a. NEW The researchers are very busy in the university life between teaching, research and administrative obligations

This new inhibitor was added after the first interview, in fact at the question "Do you want to add something?" the interviewee explained the necessity to have more time for the research, because being an academic means having several duties, such as example teaching, research and administrative obligations. We took this idea and added this new inhibitor and sub-inhibitor.

19. NEW The research team does not have enough resources, people, instruments, money
   a. NEW The university does not have enough academic incentive to the researcher to maintain people inside the research team
   b. NEW The research team does not have enough resources, instruments and/or right people, to develop projects
   c. NEW The research team does not have money to insert young researchers inside the research team

During the first interviews we understood the need to have the necessary resources to develop a winning research project. The necessary resources can be of different kinds, starting from the lack of structured future in the academic environment, such as the lack of professorships, concluding with the lack of fund for the new PhD program and the lack of the necessary instruments to develop the research project.

20. NEW The collaboration between research team and third parts is difficult due to different interest and background
    a. NEW Time is a problem for collaborations between different groups or firms because there is a misalignment of interest
    b. NEW Problem of communication between researchers with different backgrounds

Sometimes the collaboration between the research team and firms or other research group could be difficult, because the different actors could have different interest and background. This could make the cooperation between research group and third parties more complicated.

21. NEW Unfair behaviour among professors hinders the research
    a. NEW There are incorrect behaviours that favour only some professors

Inside the university there are unfair behaviours from some professors. In fact, some professors prefer their own interest over a collective interest. These behaviours could lead to some type of lobby inside the university setting.

22. NEW The research team does not find the right firms to "sell" new ideas/technologies
    a. NEW It is difficult to sell technologies because firms do not want to invest in innovation

In some industries, the technology market is very low, due to the economic crisis, especially in the industry of constructions and civil engineering. The procurements are won at downward costs, so the firms prefer cutting in innovation and new technologies.

The following figures, Figure 10 e Figure 11, show the global inhibitor tree provides by the increase of number of inhibitors and sub – inhibitors.

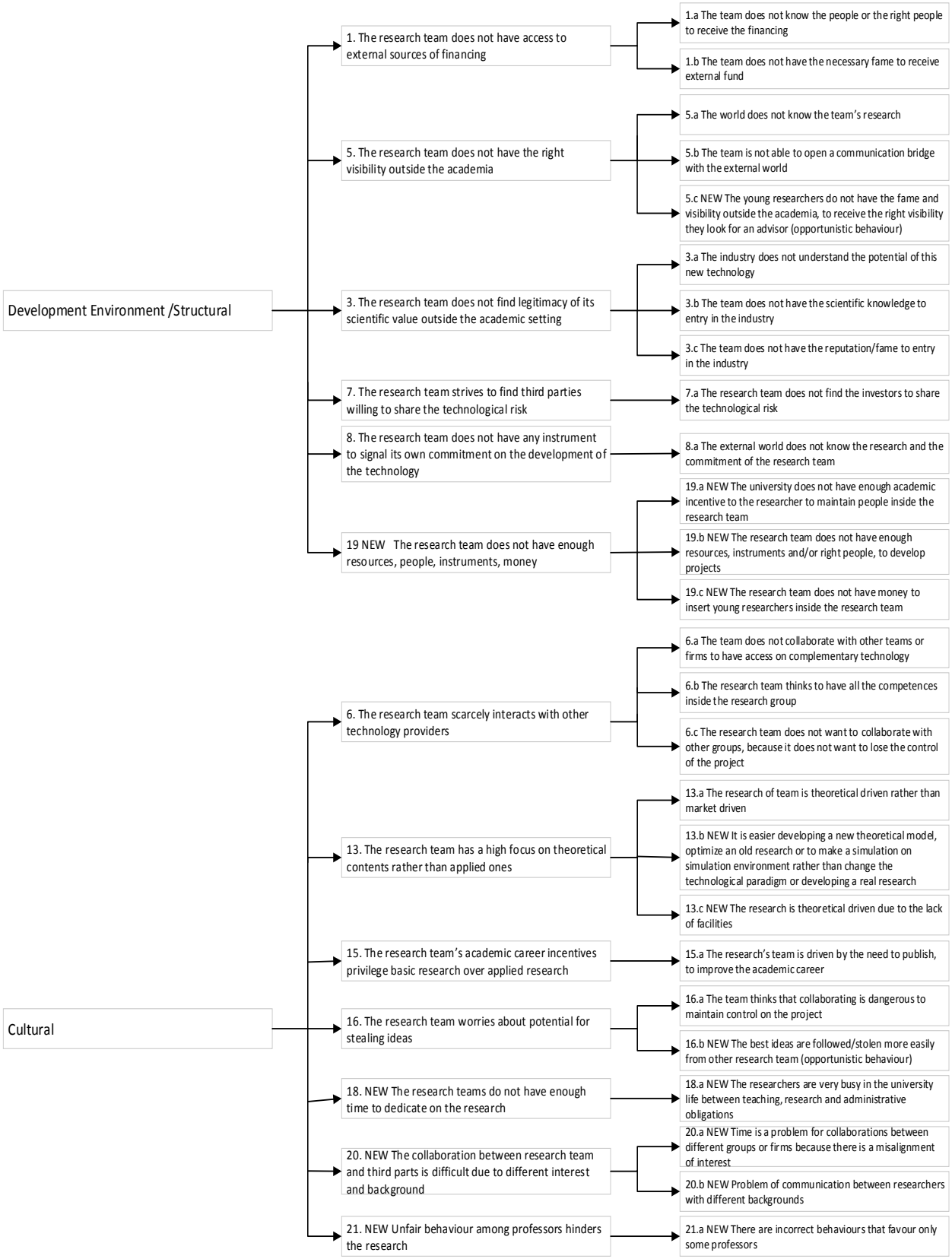


Figure 10: Global Inhibitors Tree -- Development Environment/Structural & Cultural.

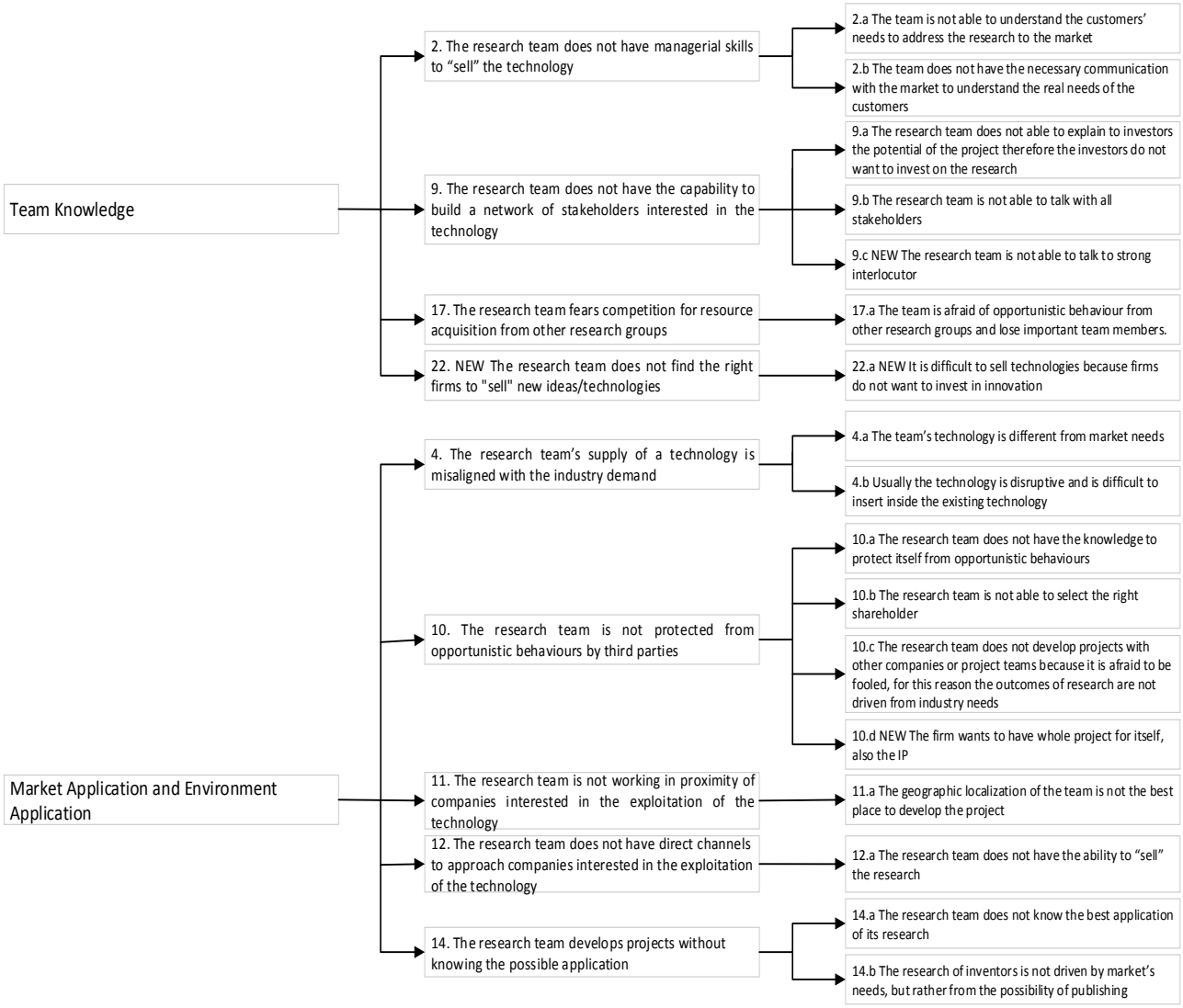


Figure 11: Global Inhibitors Tree -- Team Knowledge & Market and Environment Application.

Chapter 5 - Elaboration

5.1 Analysis of Inhibitors and Interviews – Phase VI

In this sub-chapter we analysed the Phase VI, Definitive Inhibitor List.
After the coding phase, described in chapter 4, we elaborated the information and the concepts extracted from the transcription of the interviews, to understand what the inhibitors are confirmed and what are not confirmed. We decided to do this analysis on the inhibitors, the second – order categories. We did not consider the sub – inhibitor because we did want to have a level of detail too specific and on the other hand, we did not consider the area inhibitors because to not have a level of detail too general with the risk to make of the considerations too approximate.
At the end of this elaboration, we decided to modify the inhibitors list delating some inhibitors and sub-inhibitor. In particular, we delated the inhibitors #2 and #17 and the sub-inhibitors #6.c and #16.a. We took these decisions because those inhibitors and sub-inhibitors concern to problems too general, so we preferred to insert inhibitors and sub-inhibitors more specific.
The final list of inhibitors and sub-inhibitors is the following.

First–order and second-order Categories

1. The research team does not have access to external sources of financing
    a. The team does not know the people or the right people to receive the financing
    b. The team does not have the necessary fame to receive external fund
3. The research team does not find a legitimacy of its scientific value outside the academic setting
    a. The industry does not understand the potentiality of this new technology
    b. The team does not have the scientific knowledge to entry in the industry
    c. The team does not have the reputation/fame to entry in the industry
4. The research team's supply of a technology is misaligned with the industry demand
    a. The team's technology is different from market needs
    b. Usually the technology is disruptive and is difficult to insert inside the existing technology
5. The research team does not have the right visibility outside the academia
    a. The world does not know the team's research
    b. The team is not able to open a communication bridge with the external world
    c. NEW The young researchers do not have the fame and visibility outside the academia, to receive the right visibility they look for an advisor (opportunistic behaviour)

6. The research team scarcely interact with other technology providers
    a. The team does not collaborate with other teams or firms to have access on complementary technology
    b. The research team thinks to have all the competence inside the research group
7. The research team strives to find third parties willing to share the technological risk
    a. The research team does not find the investors to share the technological risk
8. The research team does not have any instrument to signal its own commitment on the development of the technology
    a. The external world does not know the research and the commitment of the research team
9. The research team does not have the capability to build a network of stakeholders interested in the technology
    a. The research team does not able to explain to investors the potential of the project therefore the investors do not want to invest on the research
    b. The research team is not able to talk with all stakeholders
    c. NEW The research team is not able to talk to strong interlocutor
10. The research team is not protected from opportunistic behaviours by third parties
    a. The research team does not have the knowledge to protect itself from opportunistic behaviours
    b. The research team is not able to select the right shareholder
    c. The research team does not develop project with other companies or project teams because it is afraid to be fooled, for this reason the outcomes of research are not driven from industry needs
    d. NEW The firm wants to have whole project for itself, also the IP
11. The research team is not working in proximity of companies interested in the exploitation of the technology
    a. The geographic localization of the team is not the best place to develop the project
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology
    a. The research team does not have the ability to "sell" the research
13. The research team has a high focus on theoretical contents rather than applied ones
    a. The research of team is theoretical driven rather than market driven
    b. NEW It is easier developing a new theoretical model, optimize an old research or to make a simulation on simulation environment rather than change the technological paradigm or developing a real research
    c. NEW The research is theoretical driven due to the lack of facilities
14. The research team develops projects without knowing the possible application
    a. The research team does not know the best application of its research

   b. The research of inventors is not driven by market's need rather from the possibility of publishing
15. The research team's academic career incentives privilege basic research over applied research
   a. The research's team is driven of the need to publish to improve the academic career
16. The research team worries about potential for stealing ideas
   a. NEW The best ideas are followed/stolen more easily from other research team (opportunistic behaviour)
18. NEW The research teams do not have time to dedicate on the research
   a. NEW The researchers are very busy in the university life between teaching, research and administrative obligations
19. NEW The research team does not have enough resource, people, instruments, money
   a. NEW The university does not have enough academic incentive to the researcher to maintain people inside the research team
   b. NEW The research team does not have enough resources, instruments and/or right people, to develop projects
   c. NEW The research team does not have money to insert young researchers inside the research team
20. NEW The collaboration between research team and third parts is difficult due to different interest and background
   a. NEW Time is a problem for collaboration between different groups or firms because there is a misalignment of interest
   b. NEW Problem of communication between researchers with different background
21. NEW Unfair behaviour between professors hinders the research
   a. NEW There are incorrect behaviours that favour only some professors
22. NEW The research team does not find right firms to "sell" new ideas/technologies
   a. NEW It is difficult to sell technologies because the firms do not want to invest in innovation

The followed figure, Figure 12, shows the final inhibitors tree.

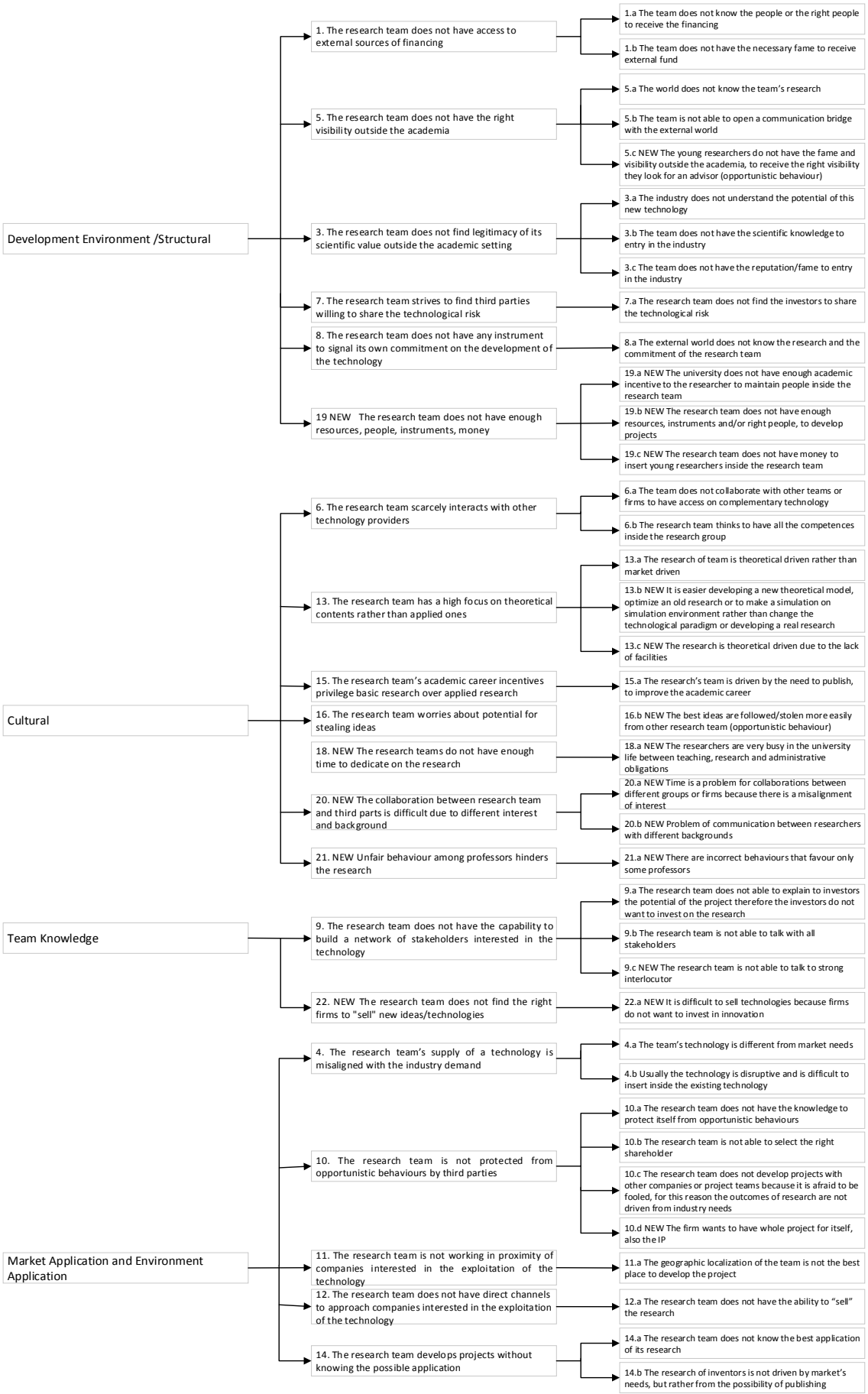


Figure 12: Final Inhibitors Tree.

The sample for the interviews coming from the first Proof of Concept call: we conducted twelve interviews. The following table, Figure 13, contains the date, the duration of each interview and the number of pages of each interview.

Project Number	Date	Interview duration	N° pages coding
1	16 July 2018	80 min	9
2	23 July 2018	59 min	13
3	24 July 2018	69 min	14
4	05 September 2018	58 min	10
5	06 September 2018	49 min	8
6	12 September 2018	63 min	10
7	25 September 2018	47 min	9
8	25 September 2018	66 min	11
9	02 October 2018	58 min	8
10	02 October 2018	47 min	8
11	08 October 2018	60 min	9
12	18 October 2018	50 min	7
TOTAL		**706 min**	**117**

Figure 13: Interviews.

After the coding phase, we elaborated the data and we calculated the answer frequencies in according this classification:

- The inhibitor has value 1, if it was confirmed by the i-th interviewee;
- The inhibitor has value 0, if it was not mentioned during the interview by the i-th interviewee;
- The inhibitor has value -1, if it was not confirmed by the i-th interviewee.

The following table shows for each inhibitor the answer frequencies.

It is important to highlight that in each interview, not every inhibitor was mentioned, as it is possible to note in the table. This occurs because, in according to Gioia methodology, to avoid influencing interviewees in their answers, we let them talk and explain their point of view and problems. Therefore, according to the given answers, not every argument was covered.

Analysing the frequency of each inhibitor, we noted that some inhibitors could be attributed for whole interviewee sample, while others could be attributed only for someone that have some common characteristics.

The first inhibitor table, Table 20, shows the found inhibitors for each interviewee, in particular, the inhibitors with the label ✓ are inhibitors confirmed, and those with the label ✗ are not confirmed.

Inhibitor	**Project Number**												**Frequency**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**0**	**-1**
1. The research team does not have access to external sources of financing ✓	1	1	1	1	1	1	1	1	1	1	1	1	12	0	1
5. The research team does not have the right visibility outside the academia ✗	-1	-1	-1	-1	1	-1	-1	-	-1	1	-1	-1	2	1	9
3. The research team does not find legitimacy of its scientific value outside the academic setting ✗	-1	-1	1	-1	-1	-1	-1	-1	-	1	-1	-	2	2	8
7. The research team strives to find third parties willing to share the technological risk ✓	1	1	1	1	-	1	-	1	-	1	1	-	8	4	0
8. The research team does not have any instrument to signal its own commitment on the development of the technology	-1	-1	-	-	-	-1	-	-	-	-	-	-	0	9	3
19. NEW The research team does not have enough resources, people, instruments, money	-	-	1	1	-	1	1	-	-	-	-	-	4	8	0
6. The research team scarcely interacts with other technology providers ✗	1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	2	0	10
13. The research team has a high focus on theoretical contents rather than applied ones ✗	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	1	0	11
15. The research team's academic career incentives privilege basic research over applied research ✓	-1	1	1	1	1	1	-1	1	-1	1	1	1	9	0	3
16. The research team worries about potential for stealing ideas	-	-	-	1	-	1	-	1	-	-	-	-	3	9	0
20. NEW The collaboration between research team and third parts is difficult due to different interest and background ✓	-	-	-	1	1	1	1	1	-	-	1	-	6	6	0
18. NEW The research teams do not have enough time to dedicate on the research ✓	1	1	1	1	1	1	-	1	1	1	1	-1	10	1	1
21. NEW Unfair behaviour among professors hinders the research	-	-	-	-	-	-	-	1	-	-	1	-	2	10	0
22. NEW The research team does not find the right firms to "sell" new ideas/technologies	1	-	-	1	-	-	-	-	-	-	1	1	4	8	0
9. The research team does not have the capability to build a network of stakeholders interested in the technology ✓	1	-	1	1	-	1	-	1	-	-	1	-	6	6	0
4. The research team's supply of a technology is misaligned with the industry demand	1	-1	-1	-1	-	1	-1	-	-	1	1	-1	4	3	5
10. The research team is not protected from opportunistic behaviours by third parties	1	-1	1	1	-1	1	1	1	-1	1	1	1	8	0	4
11. The research team is not working in proximity of companies interested in the exploitation of the technology	-1	-	-	-	-	-1	-	-	-	-1	-	-	0	9	3
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology	1	-	-	-	-	-	-	1	-1	1	1	1	5	6	1
14. The research team develops projects without knowing the possible application	-	-	1	-	1	-	-	1	-	1	1	-	5	7	0

Table 20: Inhibitors & Frequencies.

In this section, we will try to describe the reasons why the inhibitors are or are not confirmed by the research groups. For each inhibitor, we will report some phrases coming from the interviews to justify our considerations. To decide if an inhibitor is or is not confirmed, we did not consider the interview where those inhibitors are not mentioned. Therefore, we considered only the interview where the inhibitor is or not is confirmed explicitly by the interviewee. Only for the inhibitor that could be attributed to a specific problematic existing in literature, we will report the problem that could be related to the inhibitor and we will specify if, in our case, the inhibitor confirm or not the problem found.

1. The research team does not have access to external sources of financing
    a. The team does not know the people or the right people to receive the financing
    b. The team does not have the necessary fame to receive external fund

The inhibitor is confirmed by all interviewees. The research groups have the problem in the access to external funds to develop their own ideas. The firms finance the research team only to resolve their problems, so they pay only for a consulting agreement. Indeed, each research group has at least about € 500.000 of budget for the research in 5 years, especially coming from consulting agreements and international/European/national projects. If the research teams want to develop an own project, they will have to utilize international/European/national funds, these are very difficult to obtain because the project is still at early stage of development. Therefore, not finding no source of financing, they finance these projects with the remains of others past projects or with state research funds. The following phrases show these arguments:

> *"O progetti finanziati da fondi di istituti UE o nazionali (es. H2020) e per progetti più creativi fondi provenienti da fonti residuali di altri progetti…. Se hai una idea tua la devi pagare da solo, non hai strumenti di finanziamento e questo è un fattore limitante importantissimo.... Spesso capita che destiniamo degli utili di un'attività di ricerca A per coprire le esigenze dell'attività di ricerca B nascente."*

Before the Proof of Concept program, the funds coming from the Politecnico di Torino were low or absents. With the introduction of this program, the funds coming from Politecnico are increased. This could be deduced from a statement of a professor:

> *"Devo dire che negli ultimi anni, non so se continuerà questa tendenza, sono stati dati dei fondi, tra cui anche l'iniziativa del PoC, sono stati aperti dei bandi competitivi a supporto, ma anche è stato un po' esteso il finanziamento quello ordinario, chiamiamolo così, per cui qualche fondo per alimentare questa fase delle nuove idee."*

This inhibitor is attributable to the lack of funding but not to the reputation of Politecnico di Torino, the firms turn to the research groups because they recognise the prestige of Politecnico di Torino. This is confirmed by a statement of professor:

> *"Penso che le aziende, quando bussano alla nostra porta, bussano al Politecnico. In generale hanno un'idea che noi siamo in grado di risolvere, almeno dal punto di vista teorico, alcuni problemi. Poi molte volte ci capita di andare anche nel dettaglio pratico."*

As we found in literature, the inhibitor confirms that the lack of funding is one of the main problems that hinders the commercialisation of the new technologies. In accordance with the literature, the development of a new technology has the problem to obtain the necessary funding when it is still at early stage (Lindstrom and Olofsson, 2001; Murray 1999).

5. The research team does not have the right visibility outside the academia
    a. The world does not know the team's research
    b. The team is not able to open a communication bridge with the external world
    c. NEW The young researchers do not have the fame and visibility outside the academia, to receive the right visibility they look for an advisor (opportunistic behaviour)

The inhibitor is not confirmed by 9 out of 11 interviewees. The research groups do not have the difficulty to be known outside the academic setting because the external world knows the developed research inside the Politecnico di Torino. The firms turn to the Politecnico di Torino to have another vision related to the problem, they want to have the opinion from who observes the problem with another point of view. The firms seek to innovate collecting new ideas coming the research groups. These considerations are be deduced from a statement of a professor:

> *"Le aziende vengono al politecnico per raccogliere degli stimoli e innovare. Non sanno bene esattamente in che direzione andare e perciò, vanno in un punto dove il mondo viene visto da una prospettiva diversa. Possono quindi raccogliere gli stimoli, le opportunità e le idee che non hanno. Il nostro punto di osservazione è assolutamente particolare, chi lavora in NOME AZIENDA vede NOME AZIENDA, vede cuscinetti tutta la vita e quando gli va bene vede la parte più meccatronica di NOME AZIENDA… è ficcato dentro un acquario, chi si occupa di ricerca conosce un ambito di applicazione molto più ampio rispetto a chi lavora dentro un'impresa, nel quale molto spesso c'è la soluzione di un problema o c'è un'idea che può essere applicata a loro."*

Although, the inhibitor is not confirmed, it is necessary to highlight that a young researcher does not have the visibility and the fame to be known outside the academic setting. Therefore, the young researcher will have to rely on its superior with the risk of being subjected to opportunistic behaviours. An interviewee confirmed this situation with this statement:

> *"Ecco, questo al momento, secondo me, al Politecnico è difficile: se un ricercatore ad inizio carriera ha un'idea brillante dovrà rimettersi a qualcun altro e questo, secondo me,*

è un qualcosa che non va bene perché capite anche voi, è giusto che chi ha avuto un'idea brillante sia lui che la porti avanti direttamente con chi può essere interessato."

3. The research team does not find a legitimacy of its scientific value outside the academic setting
    a. The industry does not understand the potentiality of this new technology
    b. The team does not have the scientific knowledge to entry in the industry
    c. The team does not have the reputation/fame to entry in the industry

The inhibitor is not confirmed by 8 out of 10 interviewees. The work of the academics is acknowledged outside the academic setting. The firms turn to Politecnico di Torino because the university has the competences that the firms not have within them. The professors have an in-depth knowledge in a specific field compared to the firms. A professor stated:

"Ci vengono richieste expertise che loro non hanno. Quindi, NOME AZIENDA viene qui per chiedermi i materiali per l'accumulo termico perché ovviamente io ho avuto modo di approfondire la conoscenza, avendo anche io il corso di accumulo termico, non hanno quella persona che ha quell'expertise diciamo così verticale su quel topic, da un lato e dall'altro cercano ovviamente anche una competenza di tipo più ingegneristico spinto. Sono tutte le competenze che all'interno gli mancano e quando gli manca quella competenza si rivolgono al mondo dell'accademia."

Although the companies recognize the prestige of professors and of Politecnico, the contact between the firm and the research group are at personal level, so when the figure of professor is gone away, there could be the risk to lose the contact. This could be deduced from the following phrase:

"Si è riconoscibili come professori, come nome ma non tanto come team o come brand. Questo in effetti, secondo me, a volte è un problema perché poi quando questo professore per tanti motivi o per anzianità si ritira oppure magari si sposta, ecco che persa la persona è difficile poi per l'azienda cercare chi magari può continuare benissimo il lavoro. Magari era proprio lui che lo faceva solo che c'era il riferimento ancorato alla persona. Il riferimento in questo momento è più a me come Professore."

This inhibitor and that previously described, could be related to the problem found in literature: the university often lacks the network that could be useful to have a successful technology transfer (Bradley et al., 2013). But in our case, these two inhibitors, #3 and #5, are not confirmed by the research groups, differently from Bradley study. The single problem encountered is relative to the lack of brand "Politecnico" rather than personal contacts.

7. The research team strives to find third parties willing to share the technological risk
    a. The research team does not find the investors to share the technological risk

The inhibitor is confirmed by 8 out of 8 interviewees. For the research groups, it is difficult to find the right investors to share the technology risk, in fact, as described in the inhibitor #1, the firms only invest in projects that resolve their problems. The firm would like to have a functioning prototype that demonstrates the feasibility of the new technology. The problem occurs because in most cases the technology is too "embryonic", so it is difficult to have a functioning prototype for the lack of funding. Indeed, related to this, two professors stated:

> *"Non mi è mai capitato una cosa del genere. Ti pago a lavoro finito* (a prestazione)*, sì. La forma di condivisione del rischio se è intesa così devo dire che non mi è mai capitato, a me capita la prestazione."*

> *"Loro vorrebbero avere proprio quasi la dimostrazione un prototipo funzionante. Significa che loro vogliono che tu sviluppi tecnologie totalmente complementari rispetto alle loro, arrivi là e gli dai la prova lui la guarda "ah funziona" allora lui è sicuro."*

The inhibitor confirms what we found in literature: the investors are not willingness to share the technological risk because the nature too "embryonic" of the new inventions involves a high level of risk and uncertainty associated to the project. This increase the difficulty of validation, industrialization and commercialisation of the technology (Munari et al., 2018).

6. The research team scarcely interact with other technology providers
    a. The team does not collaborate with other teams or firms to have access on complementary technology
    b. The research team thinks to have all the competence inside the research group

The inhibitor is not confirmed by 10 out of 12 interviewees. The research groups do not have problems related to the collaboration with other, both internal and external to the university setting, this depends on the type of projects and on the type of complementary technology needed.
The inhibitor outcomes could be linked to the lack of multidisciplinary of the research teams, as we described in chapter 3. In fact, the teams are not multidisciplinary, so when they have a problem, they look for a collaboration with other teams or researchers.
We report two statements extract from two interviews to justify these considerations.

> *"Competizione: a livello di dipartimento no. A livello di Politecnico leggerissimo, proprio poco… anzi* (collaboriamo) *soprattutto con i colleghi degli altri dipartimenti, mi riferisco al DET e al DAUIN, c'è un bel clima di collaborazione."*

> *"Collaboriamo moltissimo con altri dipartimenti: collaboriamo moltissimo con gli informatici e con i matematici. Non abbiamo grossi problemi. Il centro che gestisco* (centro smart data) *ha ovviamente rafforzato il legame però non abbiamo mai avuto grossi attriti…. Tendenzialmente siamo abbastanza grandi da poter risolvere i problemi internamente,*

magari con la collaborazione con altri dentro il Politecnico però senza dover andare fuori."

13. The research team has a high focus on theoretical contents rather than applied ones
    a. The research of team is theoretical driven rather than market driven
    b. NEW It is easier developing a new theoretical model, optimize an old research or to make a simulation on simulation environment rather than change the technological paradigm or developing a real research
    c. NEW The research is theoretical driven due to the lack of facilities

The inhibitor is not confirmed by 11 out of 12 interviewees. In each research, the theoretical and the applied contents are balanced, so there are both theoretical and applied contents. The researches are not never purely theoretical. The researches financed by the firms are usually more applied, while those developed by the research group are more theoretical. The last could start both from a gap in literature and from the interaction with the firms. Although the inhibitor is not confirmed, during an interview, a project leader expressed an interest aspect: to publish more easily, many academics prefer to develop a new research based on "fashionable" ideas of other people rather than to develop a research from a new and original idea. Therefore, almost all the publications are optimization or incremental studies of existing researches. Moreover, it is easier to develop a new research on simulation environment because it is less risky and faster. This could be deduced from the following affirmation:

"Avere un'idea originale non è banale e non è scontato, perciò molti di noi preferiscono lavorare su idee altrui: guardando la produttività scientifica in senso generale è estremamente più facile trovare gente che si occupa del dettaglio, dell'ottimizzazione di qualcosa che già esiste piuttosto che trovare quello che ha cambiato paradigma. Oggi si ha l'incentivo a fare cose più piccole, come simulazione e modellazione di qualcosa che già esiste, piccoli delta di incremento rispetto ad approcci innovativi...Meglio fare le cose che non esistono, meglio la simulazione che la realizzazione."

In some cases, the research is theoretical driven because the experiments are very complex and due to the lack of appropriate facilities that allow to effectuate them. Therefore, the research groups must simulate these studies.

"Ci sono poi, delle attività che sono prevalentemente di tipo numerico, teorico fondamentale, dove gli esperimenti sono necessariamente per loro natura molto complessi da fare o comunque non alla nostra portata per le facility che abbiamo qui a disposizione e allora a quel punto privilegiamo l'aspetto più teorico."

The inhibitor could be related to the conflicts of interests between commercial and academic work (McAdam et al., 2009). As we described in chapter 2, many academics are interested in advancing in

their university career, so their research could be theoretical driven. In our case, this is not confirmed because almost all research groups also focus in applied contents.

15. The research team's academic career incentives privilege basic research over applied research
    a. The research's team is driven of the need to publish to improve the academic career

The inhibitor is confirmed by 9 out of 12 interviewees. Almost all the interviewees agree that the researchers are driven of the need to publish in order to improve the academic career. The researchers could have more incentives to develop a basic research than an applied one, even if it is more difficult to publish a research without the applied content, as confirmed by the project leader in the previously inhibitor #13. Although the incentives system tends to favour the development of basic research, the professors that won PoC call, have the H-index greater to the H-index median of professor's sector, as described in the chapter 3. Therefore, they are driven of the need to publish, but they are able also to manage the applied contents. To justify these considerations, we reported a statement of an interviewee:

> *"Per noi ha pesato 100 la pubblicazione e zero la commercializzazione, per anni questo, anche perché una volta per andare avanti in questo contesto dovevi pubblicare. A me non piace però così stanno le cose, è condizionata fortemente questa scelta, purtroppo, dalla strumentalizzazione che si è fatta delle pubblicazioni perché uno non dovrebbe essere valutato in quel modo ma essere valutato in maniera diversa."*

In accordance to what we found in the literature, the inhibitor confirm that many academics are mainly interested to advance in their university career, so they have few incentives for the post-invention research and for the commercialisation of the new technology (Maia and Claro, 2013). Therefore, the academics is driven of the need to publish to improve their academic career, even if in our case, after having reach a considerable H-index level, the professors also dedicate to applied researches.

20. NEW The collaboration between research team and third parts is difficult due to different interest and background
    a. NEW Time is a problem for collaboration between different groups or firms because there is a misalignment of interest
    b. NEW Problem of communication between researchers with different background

The inhibitor is confirmed by 6 out of 6 interviewees. The management of the collaboration among different teams could be difficult because the difference of background and knowledge makes difficult the communication among teams. Moreover, there is a problem related to the time because each team has its own interests and different priority level. The internal collaboration usually works better compared to that external This could be deduced by a statement of a professor:

"Molto spesso sì, perché anche tra colleghi ingegneri non ci capiamo e con l'esterno ancora di più. Io guardo l'aspetto termico e le performance e lui guarda la mescola. La comunicazione tra ingegneri con diversi background non è mai una cosa scontata."

18. NEW The research teams do not have time to dedicate on the research
    a. NEW The researchers are very busy in the university life between teaching, research and administrative obligations

The inhibitor is confirmed by 10 out of 11 interviewees. Professors carry out different activities, such as teaching, research and other administrative obligations. For this reason, the time dedicated to the research is not never enough, so professors cannot follow the research activities as they would like. Moreover, the promotion and the commercialisation of the new technologies require a lot of time and professors cannot follow also these activities. Indeed, related to this, two professors stated:

"Un elemento di inibizione è il tempo disponibile! Abbiamo almeno 4 mestieri da fare tutte le mattine quando ci alziamo: didattica, ricerca, trasferimento tecnologico e impegni istituzionali. Certamente la promozione delle nostre idee, i contatti con gli imprenditori e l'aspetto più manageriale è un macro-mondo ulteriore che non è fattibile da praticare, richiede un modello organizzativo diverso, non si ha abbastanza tempo anche sapendolo e volendolo fare."

"Non riesco a seguire benissimo i ragazzi in laboratorio, non riesco a dedicare il tempo che meriterebbe. Non mi blocca però non riesco a farle, forse le potrei fare meglio (la ricerca)*."*

9. The research team does not have the capability to build a network of stakeholders interested in the technology
    a. The research team does not able to explain to investors the potential of the project therefore the investors do not want to invest on the research
    b. The research team is not able to talk with all stakeholders
    c. NEW The research team is not able to talk to strong interlocutor

The inhibitor is confirmed by 6 out of 6 interviewees. For the research team, it could be complex building a network of stakeholders interested in technology because it is difficult to talk to strong interlocutor that have the possibility to allocate budget for the research. Moreover, the interlocutor has to be technically knowledgeable to really understand the new developed technology. This could be deduced from the following affirmation:

"Se il tuo interlocutore è debole all'interno dell'organigramma aziendale magari ci può credere ma non può allocare le risorse quindi l'accordo non va in porto."

As previously said in the inhibitor #3, the network is built especially on the trust between the two parts, so if one of these is gone away, the partnership could end. Indeed, an interviewee stated:

> *"Avevi un contratto che funzionava benissimo con una persona e questa va via dall'azienda e tu ti ritrovi ad interfacciarti con una persona che è completamente diversa a cui non importa niente, con cui non ti trovi, con cui non ti capisci. È molto facile. A me è successo almeno due volte."*

The inhibitor confirms the study of Bradley (2013), the university often lack the network that could be useful to have a successful technology transfer. Therefore, the research teams are not able to build a network of stakeholders that could be interested to the new technology.

After having described the inhibitors that could be attributed to whole interviewees sample, we tried to analyse the remaining inhibitor to understand if they could be attributed only for someone that has some common characteristics. To do this, we tried to reflect following the classification of the PoC projects, described in chapter 3. Using this classification, we found that some inhibitors could be attributed to a specific dimension. As for previously inhibitors, we will try to describe the reasons why the inhibitors are or are not confirmed by the research groups.

10. The research team is not protected from opportunistic behaviours by third parties
    a. The research team does not have the knowledge to protect itself from opportunistic behaviours
    b. The research team is not able to select the right shareholder
    c. The research team does not develop project with other companies or project teams because it is afraid to be fooled, for this reason the outcomes of research are not driven from industry needs
    d. NEW The firm wants to have whole project for itself, also the IP

The inhibitor could be attributed only for the Technology-Based dimension and it is confirmed by 7 out of 8 interviewees. The team could be not able to protect itself from opportunistic behaviour of external actors, so the research groups have the risk that the firms appropriate of the product or project. This risk is higher for the Technology-Based dimension rather than Science-Based dimension due to the nature of the Technology-Based project: these projects develop a product that could be commercialise in the short term, while for the Science-Based project, the development is in the long term. Moreover, Science Based projects are based on tacit know-how of the researchers that is not transmissible, while, the Technology Based have less tacit know-how because it is based on a product. A professor stated:

> *"Tendenzialmente io ogni volta che vado a trovare un partner industriale comincio le mie presentazioni con una slide che racconta le peggiori pratiche dell'interazione accademia-*

industria. Aiuta a sgombrare il campo dal fatto che essere consapevoli che siano le peggiori pratiche rassicura l'industria nel capire che noi non le seguiamo e che però ci fa piacere di non subirle… Sono capitati molti casi in cui si chiacchierava per 5-6 ore di fila con un industriale in una di queste occasioni di incontro e poi non si avviavano poi delle collaborazioni di ricerca, e viceversa lo si ritrovava qualche anno dopo con delle soluzioni analoghe, si vedeva una traccia"

Following, we will report the tables that show for each dimension, the inhibitors that are or are not confirmed.

Inhibitor – Product Engineering	**Project Number**			
	1	**6**	**7**	**11**
8. The research team does not have any instrument to signal its own commitment on the development of the technology	-1	-1	-	-
19. NEW The research team does not have enough resources, people, instruments, money	-	1	1	-
16. The research team worries about potential for stealing ideas	-	1	-	-
21. NEW Unfair behaviour among professors hinders the research	-	-	-	1
22. NEW The research team does not find the right firms to "sell" new ideas/technologies	1	-	-	1
4. The research team's supply of a technology is misaligned with the industry demand ✓	1	1	-1	1
11. The research team is not working in proximity of companies interested in the exploitation of the technology	-1	-1	-	-
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology	1	-	-	1
14. The research team develops projects without knowing the possible application	-	-	-	1

Table 21: Inhibitors -- Product Engineering.

Inhibitor – Capital Intensive	**Project Number**			
	3	**4**	**9**	**12**
8. The research team does not have any instrument to signal its own commitment on the development of the technology	-	-	-	-
19. NEW The research team does not have enough resources, people, instruments, money	1	1	-	-
16. The research team worries about potential for stealing ideas	-	1	-	-
21. NEW Unfair behaviour among professors hinders the research	-	-	-	-
22. NEW The research team does not find the right firms to "sell" new ideas/technologies ✓	-	1	-	1
4. The research team's supply of a technology is misaligned with the industry demand ✗	-1	-1	-	-1
11. The research team is not working in proximity of companies interested in the exploitation of the technology	-	-	-	-
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology	-	-	-1	1
14. The research team develops projects without knowing the possible application	1	-	-	-

Table 22: Inhibitors -- Capital Intensive.

Inhibitor – Science Based	**Project Number**			
	2	**5**	**8**	**10**
8. The research team does not have any instrument to signal its own commitment on the development of the technology	-1	-	-	-
19. NEW The research team does not have enough resources, people, instruments, money	-	-	-	-
16. The research team worries about potential for stealing ideas	-	-	1	-
21. NEW Unfair behaviour among professors hinders the research	-	-	1	-
22. NEW The research team does not find the right firms to "sell" new ideas/technologies	-	-	-	-
4. The research team's supply of a technology is misaligned with the industry demand	-1	-	-	1
11. The research team is not working in proximity of companies interested in the exploitation of the technology	-	-	-	-1
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology ✓	-	-	1	1
14. The research team develops projects without knowing the possible application ✓	-	1	1	1

Table 23: Inhibitors -- Science Based.

22. NEW The research team does not find right firms to "sell" new ideas/technologies
    a. NEW It is difficult to sell technologies because the firms do not want to invest in innovation

The inhibitor could be attributed only for the Civil dimension (project number 4 and 12), a sub-dimension of Capital Intensive dimension, and it is confirmed by 2 out of 2 interviewees. In some industry, such as civil construction sector, that is going through a period of severe crisis, the firms do not invest in innovation because they seek to cut the costs as much as possible. In particular, they choose to cut the costs for the innovation because they are the easiest to cut and they are not considered important by the industry. Moreover, the technologies in these industries are consolidated, so only some niche invests in innovation. Therefore, it is difficult to find available firms in investing in innovation. This could be deduced from the following affirmation:

> *"Poi devo dire che nell'ambito particolare mio, diciamo che l'industria delle costruzioni civili in Italia soffre ormai negli ultimi 20 anni di una carenza di innovazione e di una dimensione caratteristica dell'imprese relativamente piccola… Anche il fatto di utilizzare tecnologie ormai datate, sono poche nicchie di produzione che invece si rivolgono ancora all'innovazione. Questa è una problematica molto specifica al settore."*

However, there is a theme of local demand; if the technology developed by the research teams satisfies a specific need existing in the local area, there are more probability to successful transfer the technology.

4. The research team's supply of a technology is misaligned with the industry demand
    a. The team's technology is different from market needs

b. Usually the technology is disruptive and is difficult to insert inside the existing technology

The inhibitor could be attributed both to Product Engineering dimension and Capital Intensive dimension. For the first dimension is confirmed, while for second dimension is not confirmed. The Product Engineering projects develop new technologies that answer to general need but not necessarily identify clearly the customer. Moreover, it could be difficult integrate the new product in the existing production process of the firms, so they should modify their production process. For these reasons, the new technologies developed by research groups belonging to Product Engineering dimension, not always are aligned with the industry demand. Indeed, a professor stated:

> *"Il mondo industriale ti pone un problema e dopo che gli dai la soluzione, il mondo industriale prosegue con il suo sviluppo commerciale… è difficile trovare il modo di ingegnerizzare e sviluppare… Le aziende hanno le loro filiere e quindi hanno già deciso prima cosa vogliono fare"*

While, for the Capital Intensive dimension, the inhibitor is not confirmed by 3 out of 3 interviewees, because these projects focus toward problems that have the firms and that are not able to resolve themselves. The ideas to develop a new technology born with the interaction with the firms. This could be deduced by a statement of a project leader:

> *"Più che un bisogno mi concentro su un problema che realmente esiste e poi trovo delle soluzioni a cui loro non hanno pensato che magari ricadono in qualcos'altro di totalmente diverso, provo a pensarlo in modo diverso da loro. Le idee vengono dal contatto con l'azienda perché se io mi chiudo qua non so benissimo cosa succede a livello di produzione, loro dicono a noi che cosa ci vuole e noi di conseguenza pensiamo."*

In conclusion, in the first case, the inhibitor is confirmed because not always the technology identifies clearly the customer; in the second case, the inhibitor is not confirmed because the research teams focus on the real problems of the firms.

12. The research team does not have direct channels to approach companies interested in the exploitation of the technology
    a. The research team does not have the ability to "sell" the research

The inhibitor could be attributed to Science Based dimension, in particular to Drugs dimension (project number 8 and 10), and it is confirmed by 2 out 2 of interviewees. The research team could not find stakeholders interested in the exploitation of technology because it is not able to explain the potential of its idea, due to the lack of adequate business skills. In fact, developing scientific basic researches, the research teams do not create a network, so they do not have the opportunity to interact with the "external

world. Moreover, the research groups have the relational problem due to the nature too embryonic of the project that complicates the relationship. The research team work with technologies that have a level of TRL too low.

In addition, in the Turin area there are not pharmaceutical firms that could be interested to these projects, so the commercialisation could be a problem. In according to a professor, it could be useful the figure of intermediary that could facilitate the "sale" process. Indeed, an interviewee stated:

> *"Potrei essere più brava. Io in particolare potrei essere più brava perché sono nata come professoressa e come una scienziata, mi piace insegnare. Spiegare quello che faccio è sempre stato mirato a spiegare l'aspetto della conoscenza e non per vendere un prodotto. Non mi sono mai formata troppo perché le mie conoscenze arrivano proprio da un'altra parte… Secondo me manca un mediatore…Se io avessi avuto con me sempre, o in molti casi dove contava, un mediatore che sapeva avremmo colmato questo problema. Un mediatore che vendesse e che facesse da ponte in modo più efficace. Secondo me, ci vuole un traduttore e allora ci si valorizza."*

14. The research team develops projects without knowing the possible application
    a. The research team does not know the best application of its research
    b. The research of inventors is not driven by market's need rather from the possibility of publishing

The inhibitor could be attributed only to Science Based dimension and it is confirmed by 3 out of 3 interviewees. The research team could develop a new concept without knowing the real application of it. This could happen especially for the Science Based projects because they work with projects that are at early stage of the development, so it is difficult knowing the best application in this early phase. Indeed, related to this, a professor stated:

> *"Sì. Il fatto di avere anche tante volte problemi di alto livello fa sì che sia difficile capire chi esattamente possa utilizzarli, perché tu hai una platea molto ampia. Devo dire che faccio fatica a capire sempre a chi rivolgermi e se dovessi fare dei nomi adesso sarei in difficoltà."*

For the remaining inhibitors not analysed because they do not have an adequate frequency, we will try to suppose the reasons why these inhibitors were not attributed to no dimension class. The remaining inhibitors are #8, #19. #16, #21 and #11. The reasons could be:

- Some inhibitors, such as the inhibitor #8 or #11, are not mentioned by the interviewees because they did not consider inhibitors for the commercialisation of the university research.

- Some inhibitors are not mentioned, because to avoid influencing interviewees in their answers, we let them talk and explain their point of view and problems. Therefore, according to the given answers, not every argument was covered.
- Some inhibitors could be confirmed only by someone for personal motive. For example, the inhibitor #21, we did not consider a general inhibitor due to the low answer frequency, so we supposed that it was a problem connected to the person and to its experience within the academic setting.
- Some inhibitors could be not mentioned because, even if for the interviewee the problem could exist, he preferred to not speak about this problem for fear or because he felt uncomfortable talking about a specific problem.

5.2 Proof of Concept Solutions – Phase VII

In this sub-chapter we analysed the Phase VII, Link between Inhibitors and PoC Solutions.
The previously part talked about the first research question, the identification of the inhibitors that hinder the commercialisation of the research projects. In this section, we will try to link the found inhibitors with the provided solution by the PoC program, in order to answer to the second research question.
Differently from the previously part where we used a deductive approach, for this section, we decided to utilize an inductive approach to link the found solutions to the second – order categories, the found inhibitors.
For all interviewees, the Proof of Concept program mainly provides financial resources, even if limited, that are useful for the research groups to develop the new technology and consequently increasing the level of TRL of the technology. With these funds, the research team could build more easily a first prototype for the Technology-Based projects or could verify that the concept works for the Science-Based projects. We reported several statements of the professors:

> *"Ha semplicemente detto che avrebbe fornito un po' di risorse mirate per avanzare il livello di TRL e mi ha consentito di raggiungere questo obiettivo…Mi ha dato la risorsa per far evolvere questo progetto prima che qualche azienda ci mettesse delle risorse ulteriori di ricerca."*

> *"Il finanziamento avuto con il PoC è stato utile per avere, appunto, proprio il primo prototipo per poter, in qualche modo, far vedere ai soggetti interessati a questa tecnologia che quello che facciamo non è necessariamente solo teorico…Questo credo che sia un aspetto molto importante poi nella ricerca, perché è proprio la dimostrazione dell'esperimento, l'esperimento stesso."*

> *"Ho partecipato al PoC perché, nel momento del bando, avevamo quest'idea che non era supportata da progetti, da altri finanziamenti…Siccome volevamo dare seguito, avevamo*

fatto qualche prova di laboratorio ma non avevamo il dispositivo, il dimostratore tecnologico e quello significava di investire dei fondi liberi. Il PoC dava esattamente quella quantità di soldi iniziale per costruire un primo dispositivo. Quindi ci sembrava l'ambito ideale per provare questa cosa qui."

"Secondo me, il PoC è stato quello che mi ero immaginata… un finanziamento un po' consistente che ti permettesse di fare un pezzo su un'idea, un brevetto. Il nostro brevetto era molto sull'idea che su un dispositivo e che quindi ti facesse fare quel pezzo fondamentale per andare dall'idea e quindi dal brevetto al dispositivo, ad un primo prototipo, provare il concetto, proprio il proof of concept. Provare il concetto che hai pensato, hai fatto due cose in laboratorio e hai visto che più meno può funzionare. il vantaggio è stato l'avvicinamento, mi ha fatto arrivare a quel TRL."

"Sicuramente è stata un'occasione per ricevere un finanziamento che potesse permettere di fare un passaggio dal modello artigianale, realizzato praticamente a finanziamento zero, autoprodotto, con un salto di qualità per cui il modello adesso è diventato un prototipo molto più che dignitoso"

It is very important to highlight that these financial resources are fundamental for the research groups to develop their own project, curiosity driven projects. Indeed, all interviewees claimed that without the financing of the PoC program, they would not have alternative sources to finance their own projects. This could be deducted from several statements of the interviewees:

"I soldi servono per far crescere la tecnologia…in alternativa non avremmo portato avanti l'idea, non li avremmo messi noi."

"Non li ho fatti (con altri soldi) *perché fondi liberi da utilizzare come volevo non li ho mai avuti perché alla fine tutti gli altri finanziamenti arrivavano su cose molto precise e soprattutto quelli aziendali arrivavano sempre su cose molto precise."*

Therefore, the PoC program resolves the lack of external sources of financing (inhibitor #1) and the lack to find third parties willing to share the technological risk (inhibitor #7).

The research groups, having a functioning prototype, could demonstrate more easily that the new technology works to the firms potentially interested, so they have greater credibility toward the firms. Therefore, they could better explain the potential of the projects. This could be deduced by the statements of some professors:

"Investimento piccolissimo, mirato e un po' studiato su esigenze che avevamo di renderlo più comprensibile, più funzionale e più appetibile da parte di un'azienda."

"Avrei avuto problemi di credibilità…Le parole sono importanti ma se uno ha un oggetto fisico in mano si convince prima."

The research groups could create a new network with the firms with the possibility of concluding partnership agreements. A project leader stated:

> *"Ci ha dato delle opportunità di renderci credibili agli occhi di queste aziende, qualora ne avessero bisogno. Si è creato un sistema di relazioni. Per esempio, adesso abbiamo in pista qualche attività di ricerca commerciale con questi e abbiamo fatto rete con loro…Quindi questo ci ha permesso di entrare in un network...Adesso noi abbiamo questa collaborazione in divenire con NOME AZIENDA che è una società sul territorio che fa service metrologici, vendono il servizio. Le varie aziende manifatturiere medie non fanno l'investimento di comprare lo strumento da 200 mila euro, ma comprano il servizio di misura dall'azienda"*

With the PoC program, the researchers could have the possibility to interact with top manager, overcoming the technical figures. Relative to this, an interviewee stated:

> *"Credo che il merito* (del PoC*) è stato quello di mettere in comunicazione le persone del Politecnico con personaggi di alta levatura…è stato molto utile nel consentire all'inventore, appunto a chi presenta l'idea di essere messo in contatto con questi manager di alto livello uscendo fuori dalle figure tecniche."*

Moreover, thanks to the PoC program, there was a greater integration between TTO and research teams, the quality and the number of interactions between project and external stakeholders is increased.
Therefore, the PoC program resolves the lack of the capability to build a network of stakeholders interested in the technology (inhibitor #9) and offers the possibility to the research groups to interact to strong interlocutors.
The PoC program and the TTO network help to mitigate the relational problem that characterise the research teams belonging to Science Based dimension, in particular, for Drugs dimension. With the funding provided by the PoC program, the research groups could verify that the concept works, so they could have grater probability to understand the better application for the new discovery (inhibitor #14). Moreover, in this way, the research groups obtain greater credibility towards the firms and through the TTO network, such as TechShare Day event, the research groups have the opportunity to show to "external world" their own new inventions (inhibitor #12). The following phrases justify these considerations:

> *"Ci ha facilitato poi nei rapporti con le imprese. Nel momento del TechShare sicuramente, benché non fossero aziende magari così specificamente orientate al nostro tipo di prodotto. Sicuramente, diciamo che dà un approccio diverso, cioè un biglietto da visita completamente diverso rispetto al modello che avevamo…Maggiore credibilità e anche è stata un'occasione per ripensare alle attività legate al brevetto, renderlo più strutturato e più comunicabile."*

> *"Ci ha permesso di misurarci effettivamente con il mercato perché se tu parli con te stesso credi di sapere come funziona il mondo, ma in realtà il mondo è molto diverso. Abbiamo partecipato a 2-3 fiere…Abbiamo intervistato 150 persone…Il PoC è stato efficacie a dare una spinta ad andare verso quella direzione lì."*

Following, we will report the inhibitors that could be resolved or mitigated indirectly by the PoC program. These inhibitors are:

- Inhibitor # 18. During the interviews, we found that one of the problems is the available time that have the professors. The PoC program do not resolve directly this problem because. Obviously, it does not offer addition time to the professor, but it could mitigate this problem indirectly. The PoC program provide financial resources and, in this way, the research teams can make research scholarship to add new researchers (full time equivalent) that can dedicate to the research.
- Inhibitor #19. The research teams could not have enough financial resources, instruments and researchers, especially young researchers, to develop their projects. As previously described, the PoC can resolve this problem because it provide financial resources, but only for the duration of the program.
- Inhibitor # 10. As previously described, the research teams belonging to Technology Based dimension have the risk to be subjected to opportunistic behaviour. The PoC program do not provide directly instruments to protect themselves from these types of behaviours. However, the PoC program resolve this problem because it imposes in the announcement a rule that allows the participation only to the technology with intellectual property protection.
- Inhibitor #20. The research groups could have the problem in the management of the collaboration among different groups due to different background and different level of interest. The PoC program could help to resolve, at least in part, this problem because it includes, as rule, the possibility to address a part of financing to pay an external consultation, so the research teams could require an external consultation, avoiding that to arise this type of problem.
- Inhibitor #4. As we previously described, the Product Engineering projects have the problem that developed technologies are misaligned with industry demand. The PoC program do not resolve directly this problem, but it could mitigate it indirectly. During the evaluation phase, the commission, composed of professors, investors and industry expert, could suggest to the research teams the possible better applications of the technology.

Instead, the inhibitors that cannot be resolved or mitigated by the PoC program are the following:

- Inhibitor #22. The Capital Intensive dimension, in particular Civil dimension, have the problem that in some industry, such as civil construction sector, the firms do not invest in

innovation. The PoC program could facilitate the relationship and the birth of a new network between firms and university, but it does not resolve completely this problem because this is a structural problem that characterise industry.

- Inhibitor #15. As concerns the incentives to improve the academic career, the PoC program do not have no effect on this system. It cannot influence the system of evaluation of the academic career, so to modify this system would be necessary other types of instruments.

Chapter 6 - Conclusion

6.1 Outcomes

The purpose of this dissertation is identifying and classifying the possible inhibitors for the commercialisation of research in the university setting and understanding if the Proof of Concept program provides solutions able to resolve or mitigate the inhibitors or part of them.

The results of the first research question are summarized in the Table 24 which shows the final list of the found inhibitors, the second – order categories, and for each of these, it is indicated if the inhibitor was confirmed or not by the interviewees.

Inhibitor	
1. The research team does not have access to external sources of financing	Confirmed
3. The research team does not find a legitimacy of its scientific value outside the academic setting	Not confirmed
4. The research team's supply of a technology is misaligned with the industry demand	Confirmed Not confirmed
5. The research team does not have the right visibility outside the academia	Not confirmed
6. The research team scarcely interact with other technology providers	Not confirmed
7. The research team strives to find third parties willing to share the technological risk	Confirmed
8. The research team does not have any instrument to signal its own commitment on the development of the technology	Not mentioned
9. The research team does not have the capability to build a network of stakeholders interested in the technology	Confirmed
10. The research team is not protected from opportunistic behaviours by third parties	Confirmed
11. The research team is not working in proximity of companies interested in the exploitation of the technology	Not mentioned
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology	Confirmed
13. The research team has a high focus on theoretical contents rather than applied ones	Not confirmed
14. The research team develops projects without knowing the possible application	Confirmed
15. The research team's academic career incentives privilege basic research over applied research	Confirmed
16. The research team worries about potential for stealing ideas	Not mentioned
18. NEW The research teams do not have enough time to dedicate on the research	Confirmed
19. NEW The research team does not have enough resources, people, instruments, money	Not mentioned
20. NEW The collaboration between research team and third parts is difficult due to different interest and background	Confirmed
21. NEW Unfair behaviour among professors hinders the research	Not mentioned
22. NEW The research team does not find the right firms to "sell" new ideas/technologies	Confirmed

Table 24: Inhibitors -- Confirmed VS Not Confirmed.

Our study demonstrated the existing of a gap between the university research and the commercialisation of the new technologies. This gap is not always caused by the same problems because there are some differences among the projects setting and among the research teams. Therefore, there are inhibitors that are general, while others are specific only for determinate sectors, our found dimensions.
We found that the general inhibitors concern high level problems that characterise all the research groups, and these are mainly:

- The lack of funds to finance their own projects, curiosity driven projects, because the firms finance the research teams only to resolve their problem;
- The difficulty to find the right investor to share the technologic risk, because they want to have the certainty that the new technology works and is advantageous for them;
- The incentive system that favour the publications to advance in academic career, so they focus only on this aspect, to the detriment of the commercialisation activity;
- Problems that could be born in the collaboration between research teams and third parts coming from the difference of background and different level of interests:
- The professors do not have enough time to dedicate themselves to the research as they would like, so they cannot follow also commercialisation activities;
- The difficulty to build a network with the possible interested stakeholders and especially, the difficulty to talk to strong interlocutors.

We found that the specific inhibitors concern problems of lower level that only characterise some dimensions. Each dimension has specific problems, caused by the different type of technology and by the different type of sector in which the research groups work. In fact, we found:

- The Product Engineering dimension develops technologies that are misaligned with the industry demand because the technologies are disruptive and difficult to integrate in the existing production process of the firms; while the Capital intensive one does not have this problematic because it develops projects focused towards the firm's problem.
- The Capital Intensive dimension, in particular the Civil dimension, faces structural difficulties of an industry that do not invest innovation;
- Science Based dimension has the problem to interact toward the "external world" due to the nature too "embryonic" of the technologies.

We linked the found inhibitors with the existing problem in literature, as shown in the Table 25.We found that some inhibitors confirm the problems of the literature, while others deny it. Inhibitors not linked to any problematic, could be relative to new problems not already described in literature, or could be attributed not directly, but indirectly to more problem of the literature.

Inhibitor	Literature	
1. The research team does not have access to external sources of financing	The development of a new technology has the problem to obtain the necessary funding when it is still at early stage (Lindstrom and Olofsson, 2001; Murray 1999).	In accordance
3. The research team does not find a legitimacy of its scientific value outside the academic setting	University often lack the network that could be useful to have a successful technology transfer (Bradley et al., 2013).	Not in accordance
5. The research team does not have the right visibility outside the academia	University often lack the network that could be useful to have a successful technology transfer (Bradley et al., 2013).	Not in accordance
7. The research team strives to find third parties willing to share the technological risk	The nature of the new inventions is still too "embryonic", and this involves a high level of risk and uncertainty associated to the project. This increase the difficulty of validation, industrialization and commercialisation of the technology (Munari et al., 2018)	In accordance
9. The research team does not have the capability to build a network of stakeholders interested in the technology	University often lack the network that could be useful to have a successful technology transfer (Bradley et al., 2013).	In accordance
13. The research team has a high focus on theoretical contents rather than applied ones	There are the conflicts of interests between commercial and academic work (McAdam et al., 2009)	Not in accordance
15. The research team's academic career incentives privilege basic research over applied research	Many academics are mainly interested to advance in their university career, so they have few incentives for the post-invention research and for the commercialisation of the new technology (Maia and Claro, 2013)	In accordance

Table 25: Inhibitors - Literature.

The results of the second research question are summarized in the Table 26. The table shows the inhibitors that are resolved or not by the PoC program and the relative solution. Moreover, we added a further classification, dividing the solutions in direct or indirect. An indirectly solution is when the PoC program does not provide a direct solution, but its context, its characteristics, its rules or provided resources could mitigate indirectly the inhibitor. While a directly resolved solution is when the PoC directly resolves the found inhibitor.

As shown in the table, the PoC program provides financial resources that allow the research teams to develop their own projects and consequently to increase the TRL level of the technology. The research teams can build a first prototype, and, in this way, they could gain greater credibility towards the firms. Therefore, the research teams could better explain the potential of the projects and they could have the possibility to build a network with stakeholders interested to the technology.

The PoC program can help to improve the relationship between the TTO and the research teams. There could be possibilities to create a better relationship that could allow to TTO to support more efficaciously the research team in the commercialisation process.

Inhibitor		Proof of Concept Solution
1. The research team does not have access to external sources of financing	Direct solution	The Proof of Concept program provides financial resources, useful for the research groups to develop the new technology and increasing the level of TRL of the technology. The research team could build more easily a first prototype or could verify that the concept works.
4. The research team's supply of a technology is misaligned with the industry demand	Indirect solution	During the evaluation phase, the commission could suggest to the research teams the possible better applications of the technology.
7. The research team strives to find third parties willing to share the technological risk	Direct solution	The Proof of Concept program provides financial resources, that allow the research groups to build more easily a first prototype that demonstrates the functioning of the new technology.
9. The research team does not have the capability to build a network of stakeholders interested in the technology	Direct solution	The research groups, having a functioning prototype, could better explain the potential of the projects. Moreover, the researchers could have the possibility to interact with top manager, overcoming the technical figures.
10. The research team is not protected from opportunistic behaviours by third parties	Indirect solution	The PoC program imposes in the announcement a rule that allows the participation only to the technology with intellectual property protection.
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology	Direct solution	Verifying the concept, the research groups obtain greater credibility towards the firms and through the TTO network, they have the opportunity to show to "external world" their own new inventions.
14. The research team develops projects without knowing the possible application	Direct solution	With the funding provided by the PoC program, the research groups could verify that the concept works, so they could have grater probability to understand the better application for the new discovery
15. The research team's academic career incentives privilege basic research over applied research	No solution	The PoC program cannot influence the system of evaluation of the academic career. To modify this system would be necessary other types of instruments.
18. NEW The research teams do not have enough time to dedicate on the research	Indirect solution	The PoC program provide financial resources and the research teams can make research scholarship to add new researchers (full time equivalent) that can dedicate to the research.
19. NEW The research team does not have enough resources, people, instruments, money	Direct solution	With the funding of PoC program, the research team can acquire resources, instruments and add young researchers, to develop their projects, but only for the duration of the program.
20. NEW The collaboration between research team and third parts is difficult due to different interest and background	Indirect solution	The PoC program includes, as rule, the possibility to address a part of financing to pay an external consultation, so the research teams could require an external consultation, avoiding that to arise this type of problem.
22. NEW The research team does not find the right firms to "sell" new ideas/technologies	No solution	The PoC program could facilitate the relationship, but it does not resolve the problem because this is a structural problem that characterise industry.

Table 26: Inhibitors - PoC Solutions.

Our study shows that the PoC program is coherent with the found inhibitor because it resolves some general and some specific problems.

In our case, as described in the chapter 3, the professors that participated in the first call of the PoC program are located on the top H-index median part. We can say that the professors dedicate both to the publication aspects and to application aspects. This shows that it is not true that PoC program are

appealing mainly to researchers interested in pure applied technologies. In fact, professors and researchers participated to the PoC program, after having spent time and resources in publication (as demonstrated by the high consensus on the publication index), considering the PoC as a new step through the development of a technology.

As described in the chapter 3, the total available fund for the first Proof of concept program was of € 450.000, and the total funding was of €430.200. As the result, the PoC program created: two spin-offs and two partnership contracts, three research groups are having contacts with the firs and five projects are stuck. For this reason, we can considerer the PoC program a successful initiative. The PoC program generated value for the university and generated wealth for local economy and also from the social point of view, because of the possibility to create employment i.e. spin-offs. It is important to highlight the crucial role of the PoC: without the investment of PoC, the research teams would not have developed any projects and no benefit would have been generated.

We did not find a correlation between high score and success of the project. For example, as said in the chapter 3, the two projects with the highest score are stuck. This proves that some issues cannot be solved by the PoC program. There is a problem of lack of incentives, the professors do not have incentives to dedicate to the commercialisation of the new technologies. The academic career system tends to promote only the publication aspects, so the professors do not have the incentive to dedicate in commercialisation activities. Moreover, there is the problem concerning the team that is a common problem for everyone, but it does not depend on the type of technology developed by the research teams, but it depends on the internal organisation of the university. The team is a fundamental part in the commercialisation activities, without this, there is the risk that the project stops, as happened for some projects of the PoC program. The professors cannot dedicate to the commercialisation activities; therefore, it is important the presence of young researchers inside the research teams, that can dedicate and also risk in these types of activities.

Finally, the PoC program is a useful instrument to align some goals of the university. It helped the university to overcome structural problems: it helped the insertion of new young researchers in academic setting and in the research teams., it helped the research groups to open towards the external world and consequently to create a network with the possible investors. But obviously, this is only the first step to resolve these structural problems, and in this moment, it is not enough, for example could be useful creating a second step of Proof of Concept only for the best projects in the first step.

6.2 Open point

This study is a single case-study about the Proof of Concept program at the Politecnico di Torino. It was conducted only on the first call of the PoC program of 2016. Currently, it is taking place the fourth call, while the second call finished and the third is almost complete.

Our results were obtained analysing the twelve projects of the first call. In the future, it could be necessary to deepen the analysis, conducting the same study also on the projects of the next calls. As said in the chapter 4, additional case-study concerning the next PoC program calls of the Politecnico di Torino, could transform the study in a holistic multiple case-study, more relevant from the qualitative point of view, so more relevant from the statistical point of view.

A starting point for future studies is shown in the Table 27. We tried to classify the projects coming from the second PoC call, following the classification described in the chapter 3.

Deepening this study, it will be possible to confirm the found result, deny some results and add new ones.

Title of the patent object of the funded POC	Classification	Funds
Module of ventilation and biological purification of internal and external air to an environment	Product Engineering	€ 42.000
Aircraft equipped with a new anti-ice system integrated in the primary structure	Capital Intensive	€ 44.000
Device and method for the detection of the motion of a passenger car and the estimation of its sideslip angle	Product Engineering	€ 35.000
Nanotune – optimizing nanoremediation	Science Based	€ 48.664
Bromide enhanced ozonation of wastewater with high loads of ammonia nitrogen	Science Based	€ 16.900
Capacitors for power resonant systems	Science-Based	€ 16.100
Cooltied – cooling topologies for integrated electric drives	Capital Intensive	€ 38.000
Method and apparatus to estimate the total mass of a running vehicle and its distribution among the wheels Apparatus	Capital Intensive	€ 38.000
Ecg watch: wearable wireless electrocardiogram	Product Engineering	€ 36.700
Digital sensor to measure the instantaneous flow of pressure networks	Capital Intensive	€ 32.000

Table 27: Classfication of 2° Call.

Finally, it could be interesting to develop a different research with the purpose to deepen and to understand the reason why there are of the differences among the score given by the different jury's member, the result that we found and discussed in the chapter 3.

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Attachment 1

POLITECNICO DI TORINO

Compagnia di San Paolo

Decreto n. 246 del 6 Giugno 2016

IL RETTORE

1. Vista la Legge 7/08/1990, n. 241 recante "*Nuove norme in materia di procedimento amministrativo e di diritto di accesso ai documenti amministrativi*";
2. Visto il D. Lgs. 30/06/2003, n. 196, recante "*Codice in materia di protezione dei dati personali*" e successive modificazioni ed integrazioni;
3. Visto lo Statuto del Politecnico di Torino emanato con D.R. 418 del 29/11/2011 in vigore dal 06.12.2011;
4. Visto il Regolamento Generale d'Ateneo del Politecnico di Torino emanato con D.R. 134 del 07/06/2012 in vigore dall'11/06/2012;
5. Visto il Regolamento di Amministrazione e Contabilità del Politecnico di Torino approvato dal Consiglio di Amministrazione del 22/03/2013, emanato con D.R. 218 del 3/6/2013, in vigore dal 3/6/2013;
6. Tenuto conto degli indirizzi espressi nel Piano strategico "Orizzonte 2020" in tema di trasferimento tecnologico;
7. Vista la Convenzione pluriennale (2016-2018) fra il Politecnico di Torino e la Compagnia di San Paolo siglata in data 21/12/2015;
8. Tenuto conto che nell'ambito della convenzione pluriennale 2016-2018 con la Compagnia di San Paolo, è stato deciso di destinare risorse volte all'avvio di una iniziativa di "*Proof of Concept funding*" (PoC), con lo specifico scopo di finanziare le attività necessarie per permettere il passaggio delle tecnologie da uno stadio iniziale di sviluppo ad uno sufficientemente evoluto da consentire di apprezzarne le potenzialità a livello industriale, al fine di ridurre il rischio tecnologico e di favorirne il successivo sfruttamento, eventualmente anche tramite la costituzione di imprese Spin-off del Politecnico di Torino;
9. Visto il Documento programmatico pluriennale e in particolare il progetto dal titolo "Adottiamo un brevetto";
10. Visto il documento programmatico annuale relativo al progetto "Adottiamo un brevetto" per l'anno 2016 e la relativa nota di accettazione inviata dalla Compagnia di San Paolo in data 14/03/2016, prot. 2016.AAI1068.U1316/AR/pv;
11. Vista la delibera del Consiglio di Amministrazione del 31/05/2016, approvativa del presente bando;

DECRETA

1. di emanare il "bando per il finanziamento di progetti di Proof of Concept"

Il Rettore

1

POLITECNICO DI TORINO

Compagnia di San Paolo

Bando per il finanziamento di progetti di Proof of Concept

PREMESSE

Il Politecnico di Torino, attraverso l'Area di Trasferimento Tecnologico e Relazioni con l'Industria (TRIN), persegue da tempo politiche attive di trasferimento tecnologico ed, in particolare, ha riconosciuto negli ultimi anni l'importanza di intervenire sui meccanismi di valorizzazione dei risultati ottenuti dalle attività di ricerca scientifica svolta nei propri Dipartimenti e messi in atto da giovani ricercatori.

Quello che dovrebbe essere il naturale processo di trasferimento tecnologico non è, a oggi, ancora un processo sufficientemente strutturato. Questa considerazione è dimostrata, ad esempio, dal fatto che negli ultimi anni in Italia poco più del 20% dei brevetti depositati dalle Università siano stati oggetto di licenze o opzioni, con la conseguenza che le tecnologie ad essi correlate non hanno trovato un'applicazione industriale rimanendo, quindi, ad uno stato embrionale di sviluppo.

Alla luce di quest'analisi e considerato che alla base del problema ci sia spesso la difficoltà dei ricercatori-inventori di reperire fondi per proseguire nelle attività di sviluppo tecnologico (realizzazione di un prototipo o dimostratore e validazione del funzionamento) e di promozione verso l'esterno della tecnologia, il Politecnico di Torino ha deciso di avviare un programma interno specificamente rivolto a favorire il processo di valorizzazione dei risultati della ricerca scientifica da parte di giovani ricercatori.

Nell'ambito della pluriennale collaborazione con la Compagnia di San Paolo, è stato quindi deciso di destinare risorse all'avvio di un'iniziativa di "*Proof of Concept funding*" (PoC), con lo specifico scopo di finanziare le attività necessarie a permettere il passaggio delle tecnologie da uno stadio iniziale di sviluppo ad uno sufficientemente evoluto da consentire di apprezzarne le potenzialità a livello industriale. Ciò al fine di ridurre il rischio tecnologico e di favorirne il successivo sfruttamento, eventualmente anche tramite la costituzione di imprese Spin-off del Politecnico di Torino.

Con il supporto dell'Area TRIN, il presente bando ha quindi la finalità di finanziare le attività di Proof of Concept di tecnologie sviluppate nel Politecnico di Torino giunte ad un significativo stadio di sviluppo. Il bando è rivolto ai giovani ricercatori interessati a promuovere e realizzare la commercializzazione di tecnologie innovative e ai titolari dei diritti morali di invenzioni brevettate con il Politecnico di Torino, eventualmente anche tramite il successivo avvio di imprese Spin-off del Politecnico di Torino.

In tale contesto il Politecnico di Torino potrà non essere l'unico soggetto titolare della proprietà intellettuale, ovvero il bando permette e riconosce anche la presenza, tra i soggetti co-titolari della stessa invenzione, altri enti o organizzazioni senza scopi di lucro (Università, enti pubblici, associazioni no-profit, etc.).

Il Politecnico di Torino renderà disponibile, ai soggetti riconosciuti vincitori ed idonei, una somma in denaro basata sulla proposta di finanziamento presentata, per lo svolgimento del progetto e la realizzazione delle attività proposte.

POLITECNICO DI TORINO

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Art. 1 - INFORMAZIONI GENERALI

1.1 OBIETTIVI

Il bando Proof of Concept ("bando PoC"), è uno strumento di finanziamento **che intende supportare i giovani ricercatori** nella realizzazione delle attività necessarie a **trasferire verso una realtà industriale** una soluzione brevettata o in corso di brevettazione.

Obiettivo fondamentale del bando PoC è l'avanzamento sulla scala TRL (Technology Readiness Level, allegato A), dai livelli minori (2-3), tipici delle tecnologie oggetto dei brevetti, verso livelli superiori (5-7), progredendo quindi da un'idea ad un prototipo funzionante, per arrivare successivamente sino alla scala industriale.

L'avanzamento nella scala TRL potrà avere quindi, come risultato, l'adozione della tecnologia sviluppata da parte di una realtà industriale o la creazione di una spin-off.

Un'altra finalità del bando è quella di offrire ai giovani ricercatori la possibilità di acquisire o consolidare *soft-skill* quali cultura ed iniziativa imprenditoriale.

1.2 FINANZIAMENTO

L'importo complessivo disponibile per il 2016 è di 230.000€. Ciascun Progetto potrà essere finanziato per un minimo di 5.000€ euro ed un massimo di 50.000€.

1.3 DURATA DEL PROGETTO

I progetti potranno avere una durata massima di 6 mesi a decorrere dalla data di avvio prevista entro 30 giorni dopo la pubblicazione della graduatoria. Entro il detto termine, potrà altresì essere comunicata una diversa data di avvio da parte del Responsabile di Progetto, all'indirizzo poc@polito.it, che in ogni caso non potrà essere successiva ai 3 mesi dalla pubblicazione della graduatoria.

Art.2 - REGOLE PER PRESENTARE DOMANDA

2.1 Definizioni e glossario

Commissione di Valutazione (e monitoraggio):
commissione incaricata della valutazione e del monitoraggio dei Progetto.

Data di avvio del Progetto:
data della prima attività inerente il Progetto, secondo le modalità descritte nei Paragrafi 1.3 e 6.

Data di priorità:

data di deposito della prima domanda di brevetto relativa ad una determinata invenzione.

NDA:
Non Disclosure Agreement (Accordo di Riservatezza/Confidenzialità).

Progetto:
l'elaborato presentato in risposta al presente bando.

PCT:
il PCT o Trattato di Cooperazione in materia di Brevetti (Patent Cooperation Treaty), è un trattato internazionale multilaterale gestito dall'Organizzazione mondiale per la proprietà intellettuale (OMPI), con sede a Ginevra, per il deposito unificato di domande di brevetto valide in uno o più degli Stati aderenti al trattato.

Responsabile di Progetto:
ricopre il ruolo di coordinatore del Progetto PoC, è il responsabile dell'uso dei fondi che saranno stanziati per il Progetto ed avrà la responsabilità di firmare i documenti richiesti durante lo svolgimento delle attività PoC (deliverable) e della rendicontazione.

Team di Progetto:
è l'insieme delle persone coinvolte nello svolgimento delle attività previste nella domanda di finanziamento presentata.

Quali componenti del Team di Progetto, sono ammessi tutti gli afferenti al Politecnico di Torino in qualità di dipendenti o interni non dipendenti (Post-Doc Assegnisti di Ricerca, Dottorandi, Borsisti di ricerca, tesisti, ecc.), così come definiti dal Regolamento del Politecnico di Torino relativo alla Proprietà Industriale e Intellettuale (http://www.swas.polito.it/services/docuff/Default.asp?id_documento_padre=40623).

Possono essere ammessi nel team di Progetto, studenti dei corsi di laurea triennale o laurea magistrale che abbiano intrapreso un percorso di tesi di laurea presso il Dipartimento di afferenza del Responsabile di Progetto.

E' anche possibile l'inserimento nel Team di Progetto di membri afferenti ad enti esterni al Politecnico di Torino, in accordo con quanto previsto nel punto 1c dell'art. 2.2.3 che segue.
Non è previsto un limite massimo per i membri del team.

2.2 REQUISITI DI AMMISSIONE

2.2.1 Ambito Tecnologico

I progetti potranno riguardare le seguenti tematiche:

- ICT, Elettronica e Telecomunicazioni
- Civile, Edile, Ambientale
- Meccanica, Automotive e Aerospaziale
- Biomedicale e Chimica
- Fisica, Materiali, Nanotecnologie
- Design, Architettura
- Ingegneria Industriale (es. Matematica, Informatica, ecc.)
- Energia

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2.2.2 Ammissibilità dei progetti

Sono ammissibili progetti per lo sviluppo di tecnologie che soddisfino almeno uno dei seguenti requisiti

- sia stata depositata una domanda di brevetto in Italia, con **data di priorità** non antecedente gli 8 mesi dal termine per la presentazione della domanda di partecipazione al seguente bando;
- sia stata depositata una domanda **PCT**, con data di priorità, non antecedente i 26 mesi dal termine per la presentazione della domanda di partecipazione al seguente bando;
- sia stata depositata una domanda di brevetto europeo, non ancora concessa alla data di presentazione della domanda di partecipazione;
- siano oggetto di brevetti concessi ed attivi in almeno 4 stati oltre all'Italia, alla data di presentazione della domanda di partecipazione;
- siano in corso le procedure di deposito a seguito del parere positivo espresso della Commissione Brevetti del Politecnico di Torino, in data antecedente alla data di pubblicazione del presente bando.

In ogni caso sono finanziabili solo invenzioni protette da brevetto o domanda di brevetto di titolarità esclusiva o maggioritaria del Politecnico di Torino. In quest'ultimo caso, i progetti sono ammessi solo nel caso in cui i soggetti co-titolari siano uno o più Università o Enti Pubblici di ricerca o altre organizzazioni senza fini di lucro e soltanto qualora l'ente co-titolare si impegni, con apposito atto (allegato F), a destinare gli eventuali primi proventi derivanti dallo sfruttamento del brevetto stesso, al Politecnico di Torino sino al raggiungimento dell'ammontare del finanziamento erogato.

Per partecipare al bando PoC è necessario l'accordo di tutti gli inventori, tramite firma dell'apposito form (allegato G).

Nel contesto del presente bando, ogni brevetto può essere oggetto di una sola domanda di partecipazione.

Il Responsabile di Progetto può presentare più di una domanda di partecipazione per brevetti diversi, nel rispetto delle regole del presente bando.

2.2.3 Team di Progetto

Il progetto candidato dovrà soddisfare tutti i requisiti obbligatori elencati di seguito, pena la non ammissibilità alla fase di selezione.

1- Composizione del Team:

a) Almeno un soggetto che, al momento della presentazione della domanda di partecipazione al bando PoC, abbia età inferiore ai 35 anni e sia titolare di un/una contratto/posizione di: assegnista di ricerca, dottorando di ricerca, borsa di ricerca o ricercatore a tempo determinato di cui alla lettera a) del comma 3 art.24 della L.240/2010 (c.d. RTD tipo A); (**requisito obbligatorio**)

b) Il Responsabile di Progetto, all'atto di presentazione della domanda di partecipazione al bando PoC, deve risultare titolare di una posizione a tempo indeterminato presso il Politecnico di Torino (professori di prima

o seconda fascia oppure ricercatori di ruolo nominati ai sensi dell'ordinamento antecedente all'entrata in vigore della legge 240/2010), ovvero essere in servizio presso il Politecnico di Torino con contratto di ricercatore a tempo determinato di cui alla lettera b) del comma 3 art.24 della L.240/2010 (c.d. RTD tipo B). Il requisito deve permanere, pena revoca del finanziamento, per tutta la durata del Progetto. A tal fine si precisa che si terrà conto dell'eventuale periodo di proroga contrattuale; (**requisito obbligatorio**)

c) Altri membri del team: soggetti (persone fisiche) afferenti ad enti od organizzazioni senza scopo di lucro diversi dal Politecnico di Torino (Università, enti pubblici, associazioni no-profit, etc.); (**requisito facoltativo**)

2- Almeno un componente del Team di Progetto, afferente al Politecnico di Torino, dovrà essere titolare dei diritti morali (inventore), relativi all'invenzione protetta da brevetto, o domanda di brevetto, di titolarità totale o parziale del Politecnico di Torino, oggetto della domanda di partecipazione al bando PoC.

3- Ogni soggetto di cui al punto 1a, potrà risultare come membro del team di un solo Progetto;

4- Qualora lo stesso soggetto di cui al punto 1a, risulti essere coinvolto in più team di Progetto, sarà considerata solo la prima proposta presentata ed attestata dal relativo protocollo.

2.2.4 Altri requisiti di ammissibilità

Qualora nel Progetto sia indicato il coinvolgimento di un'azienda interessata alla tecnologia oggetto del bando, a pena di esclusione dovrà essere sottoscritto un NDA con la medesima.

2.2.5 Attività e *deliverable* del Progetto

In ogni Progetto presentato nell'ambito del presente bando devono essere chiaramente riportate le seguenti informazioni, pena la non ammissibilità del Progetto:

- Titolo e numero di riferimento Interno (nella forma aaaa_nnn, es. 2010_086) della domanda di brevetto oggetto della domanda PoC
- Indicazione di almeno una possibile applicazione della tecnologia proposta;
- Benchmark tecnologico ed analisi dello stato dell'arte relativo all'applicazione proposta;
- Un piano delle attività necessarie per la realizzazione del Proof of Concept e delle relative tempistiche, contenente quanto segue:
  - Analisi e descrizione dei requisiti e delle specifiche di progetto;
  - Personale necessario (Team di Progetto) e relativa qualifica per svolgere le attività;
  - Elenco del materiale consumabile e dei relativi costi (allegato D);
  - Elenco di eventuali servizi/consulenze che si prevede di commissionare ad enti esterni al Politecnico di Torino e relativi costi (allegato D);
  - Livello di TRL di partenza e livello che si intende raggiungere al termine del Progetto;
- Fasi per la realizzazione del dimostratore organizzate in *milestone* e tempo necessario per svolgere le attività previste, con chiara descrizione del risultato finale atteso;
- Un piano di testing del PoC sviluppato e dei risultati attesi.

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2.3 COSTI AMMISSIBILI

Le categorie di costo ammissibili sono le seguenti:

Costi legati allo sviluppo della tecnologia:

- Spese per la progettazione, la consulenza o le lavorazioni necessarie alla realizzazione di prototipi e/o dimostratori, sviluppo del sito web;
- Spese per l'acquisizione di materiali consumabili e licenze periodiche per software;
- Spese per beni non inventariabili;
- Spese per personale non dipendente nella forma di borsa/e di ricerca, limitata/e al periodo di durata del Progetto e per un ammontare massimo di 12.000 euro;
- Spese per missioni, vitto ed alloggio, utili allo sviluppo della tecnologia (solo per personale afferente al Politecnico di Torino).

Costi legati alle altre attività

- Spese per attività di promozione della tecnologia (es. materiale informativo, divulgazione, affitto spazi, catering ecc.);
- Costi legati alla partecipazione a congressi, finalizzati alla promozione della tecnologia (spese di iscrizione, viaggi, vitto e alloggio, ecc.). **Il limite massimo di spesa ammissibile per questi costi corrisponde al 10% del budget totale previsto per il Progetto.**

I costi ammissibili devono riferirsi al periodo compreso tra la data di pubblicazione della graduatoria finale e la data del termine delle attività del Progetto.

Tutte le spese devono essere quietanzate entro e non oltre il 31/12/2017 pena la non ammissibilità.

Le modalità di rimborso dei costi ammissibili sono consultabili nell'allegato B "Linee per la rendicontazione"

Art. 3 - PROPRIETÀ DEI RISULTATI E DIRITTI DI PROPRIETÀ INDUSTRIALE ED INTELLETTUALE

Tutti i diritti di proprietà industriale ed intellettuale sui risultati derivanti dallo svolgimento delle attività previste dal Progetto spettano al Politecnico di Torino, fermo restando il riconoscimento dei diritti morali spettanti a ciascun inventore/autore ai sensi della vigente normativa.

Art. 4 - MODALITA' DI PARTECIPAZIONE E SCADENZE

Il form compilato della domanda di partecipazione (allegato C), corredato di tutta la documentazione richiesta, dovrà essere presentato dal Responsabile di Progetto, a pena di esclusione, esclusivamente via mail, all'indirizzo poc@polito.it fino alle ore 12.00 del 05/07/2016.

Alla domanda di partecipazione, a pena di esclusione, dovrà essere inoltre allegata la seguente documentazione:

- Form per il budget (allegato D)
- CV scientifico del Responsabile del Progetto (massimo 2 pagine)
- CV di ogni altro componente del team (massimo una pagina)
- Lettera di approvazione per la partecipazione alle attività PoC, di **tutti** i membri del team di Progetto di cui al punto 1a dell'art. 2.2.3, firmata dai rispettivi Direttori di Dipartimento di afferenza (allegato E);
- Nulla osta sottoscritto da **tutti i titolari** dei diritti morali sul brevetto, alla presentazione della domanda per il bando PoC e successivo svolgimento delle attività (allegato G);
- Ove applicabile, lettera di accettazione dell'ente/i terzo/i co-titolare/i del brevetto, oggetto della domanda di partecipazione, delle regole del presente bando ed impegno a destinare al Politecnico di Torino gli eventuali i primi proventi dello sfruttamento (allegato F);
- Laddove sia indicato il coinvolgimento di un'azienda interessata alla tecnologia oggetto del bando, NDA sottoscritto dal legale rappresentante dell'azienda (allegato H);
- NDA firmato da tutti i membri del team di Progetto con impegno alla riservatezza per almeno 3 anni (allegato I).

Dopo aver effettuato l'invio della domanda e della documentazione, il Responsabile di Progetto riceverà un'e-mail di conferma dell'esito positivo dell'invio.

Non saranno prese in considerazione domande e documenti che perverranno su supporto cartaceo o con modalità diverse da quelle sopra indicate o presentate dopo la data di scadenza del bando.

Sarà considerata solo la prima proposta presentata, attestata dal relativo protocollo. Non sarà pertanto possibile integrare o modificare i documenti inviati.

Art.5 - PROCESSO DI VALUTAZIONE

Il processo di valutazione consiste nelle seguenti fasi:

1. controllo formale della regolarità ed ammissibilità delle proposte;
2. valutazione di ciascuna proposta da parte della Commissione;
3. formazione della graduatoria finale.

5.1 Controllo formale della regolarità ed ammissibilità delle proposte

Alla chiusura del bando, sarà fatto, dall'Area TRIN, un controllo formale della regolarità ed ammissibilità delle proposte pervenute, al fine di verificare che ogni domanda sia completa di tutta la documentazione indicata all'art. 4 (regolarità) e che soddisfi tutti i requisiti di ammissibilità previsti nel bando all'art. 2.2 (ammissibilità).

Le proposte prive dei requisiti previsti non saranno ammesse alla valutazione da parte della Commissione di Valutazione. In questo caso sarà data comunicazione al Responsabile di Progetto della non ammissibilità della domanda.

5.2 Valutazione delle proposte

Le domande di partecipazione al bando PoC saranno valutate da un'apposita Commissione di Valutazione, con composizione diversa a seconda del settore industriale, oggetto della domanda, di cui all'art. 2.2.1.

Ogni Commissione di Valutazione sarà nominata dal Rettore ed avrà la seguente composizione:

- Vice Rettore per il Trasferimento Tecnologico;
- Un investitore professionale, con esperienza in investimenti nel settore della tecnologia oggetto della domanda di partecipazione al PoC;
- Un imprenditore con provata esperienza industriale, nel settore della tecnologia oggetto della domanda di partecipazione al PoC;
- Un membro del Comitato di Indirizzo per il Laboratorio Interdipartimentale per il Trasferimento Tecnologico.

I progetti ammessi saranno valutati sulla base dei seguenti criteri. Ad ogni criterio di valutazione è assegnato un punteggio massimo, la cui somma totale corrisponde a 100.

Nella prima seduta ogni commissione potrà ulteriormente dettagliare i Criteri di Valutazione nel rispetto dei principi di seguito riportati nel presente bando.

Criteri di valutazione:

1) **Progetto presentato:** il Progetto presentato è sostenibile in relazione all'obiettivo di aumento TRL dichiarato ed il raggiungimento di tale obiettivo costituisce un incremento di valore per la tecnologia sviluppata? (punteggio massimo 30 punti)
2) **Team di Progetto:** le competenze del team sono coerenti con le attività previste nel Progetto? (punteggio massimo 20 punti)
3) **Potenziale della tecnologia:** sulla base del benchmark tecnologico (punteggio massimo 15 punti)
4) **Budget:** coerenza tra il budget previsto e le finalità del Progetto (punteggio massimo 15 punti)
5) **Colloquio con la Commissione di Valutazione** (punteggio massimo 20 punti)

Saranno ritenuti finanziabili i progetti con una valutazione minima di 60/100.

Nel caso che due o più domande di partecipazione abbiano ricevuto lo stesso punteggio, sarà favorita quella:

- che prevede un tempo più breve per lo svolgimento delle attività;

- che ha ottenuto il punteggio più alto in relazione al Criterio di Valutazione n1;

Le proposte giudicate ammissibili saranno finanziate, in ordine di graduatoria, fino all'esaurimento delle risorse disponibili.

Gli esiti della valutazione saranno approvati dal Rettore che, con proprio decreto, renderà nota la graduatoria dei progetti finanziabili, nei limiti del budget disponibile.

La graduatoria verrà pubblicata nella sezione del portale MyPoli: Siti dell'Amministrazione\Area Trasferimento Tecnologico e Relazioni con l'Industria (TRIN)\POC- Proof of Concept @ Polito

(https://www.swas.polito.it/intra/TRIN/Default.asp?id_documento_padre=127087)

e nell'albo ufficiale del Politecnico di Torino.

Tale pubblicazione costituisce comunicazione ai sensi e per gli effetti della Legge 241/90 (Disciplina sul procedimento amministrativo) e del D.Lgs. 104/2010 (Codice del Processo Amministrativo) e ss.mm.ii.

Dalla data di pubblicazione della graduatoria finale del concorso all'Albo Ufficiale decorre il termine per eventuali impugnazioni.

Art.6 - AVVIO DELLE ATTIVITA' e INVIO DEI DELIVERABLE

Si considera come avvio ufficiale del Progetto la data di inizio dell'attività.

I progetti potranno avere una durata massima di 6 mesi a decorrere dalla data di avvio prevista al massimo entro 30 giorni dopo la pubblicazione della graduatoria. Potrà entro il detto termine essere comunicata una diversa data di avvio dal Responsabile di Progetto all'indirizzo poc@polito.it, che in ogni caso non potrà essere successiva ai 3 mesi dalla pubblicazione della graduatoria.

In assenza di tale comunicazione il Progetto si intenderà avviato decorsi 30 giorni dalla pubblicazione della graduatoria.

Ogni *deliverable* dovrà essere inviato dal Responsabile di Progetto all'area TRIN esclusivamente tramite mail all'indirizzo poc@polito.it. Sarà responsabilità del Responsabile di Progetto accertare l'avvenuto ricevimento delle comunicazioni da parte degli uffici.

Art.7 - ASSEGNAZIONE DEL FINANZIAMENTO

Le risorse assegnate saranno gestite direttamente dal Dipartimento del Responsabile di Progetto. Il Dipartimento avrà autonomia di gestione delle risorse assegnate, nel rispetto delle regole definite dal presente bando, dal regolamento del Politecnico e dalle normative nazionali.

L'assegnazione avverrà secondo le seguenti modalità:

- 50% alla data di avvio delle attività PoC;
- 50% a seguito dell'approvazione del rendiconto e della relazione finale da parte della Commissione di Valutazione.

Solo in concomitanza con la consegna della prima relazione, il Responsabile di Progetto potrà richiedere alla Commissione, una diversa allocazione del budget residuo tra le voci di costo presenti, sempre nei limiti dell'importo finanziato e in accordo con le regole del bando.

Variazioni relative alle singole voci di costo, rispetto al budget autorizzato, dovranno essere preventivamente autorizzate dal Vice Rettore per il Trasferimento Tecnologico e riportati nelle relazioni intermedie e finali.

Ogni richiesta di autorizzazione dovrà essere inviata all'indirizzo poc@polito.it.

Art. 8 - MONITORAGGIO DEI RISULTATI

La stessa Commissione di Valutazione sarà responsabile del monitoraggio dello stato di avanzamento delle attività progettuali ed i costi ad esse connessi. Sulla base dei documenti prodotti dal Team di Progetto, la Commissione di Valutazione giudicherà lo stato di avanzamento delle attività.

I fruitori del finanziamento dovranno redigere entro 15 giorni dal raggiungimento della metà del periodo di durata del progetto, indicato nella domanda di partecipazione, una relazione completa sullo stato di avanzamento dei lavori. Nella relazione dovranno essere messi in evidenza gli obiettivi raggiunti ed una motivazione dell'eventuale variazione degli obiettivi previsti (in termini di budget e di tempo).

E' inoltre richiesta una relazione finale entro 30 giorni dal termine previsto per le attività indicate nella domanda di partecipazione. Nella relazione dovranno essere messi in evidenza i risultati raggiunti in base agli obiettivi dichiarati nella domanda di partecipazione e l'esito dei test effettuati sulla tecnologia.

In caso di valutazione negativa da parte della Commissione di Valutazione, potrà essere revocato il finanziamento assegnato, nella parte ancora da erogare.

Art. 9 - RENDICONTO FINANZIARIO

E' previsto l'invio di un rendiconto finanziario, contenente la documentazione giustificativa delle spese già quietanzate, entro 15 giorni dal raggiungimento della metà del periodo di durata del Progetto, indicato nella domanda di partecipazione. Inoltre è prevista una rendicontazione finale entro 30 giorni dal termine del periodo di attività indicato nella domanda di partecipazione.

Il rendiconto, insieme ad una relazione dettagliata delle attività dovrà essere inviato secondo le modalità riportate nell'art. 6 e nell'allegato B.

Art. 10 - CONTATTI e CHIARIMENTI

Per i chiarimenti di natura giuridico-amministrativa, gli interessati potranno inviare richieste scritte esclusivamente a mezzo posta elettronica all'indirizzo: poc@polito.it.

I suddetti chiarimenti potranno essere richiesti fino al quinto giorno antecedente il termine indicato nel bando per la presentazione delle candidature e saranno riscontrati dal Politecnico, in forma anonima, nella sezione del portale MyPoli: Siti dell'Amministrazione\Area Trasferimento Tecnologico e Relazioni con l'Industria (TRIN)\POC- Proof of Concept @ Polito

(https://www.swas.polito.it/intra/TRIN/Default.asp?id_documento_padre=127087), almeno tre giorni prima del termine ultimo di presentazione delle domande.

In caso di problemi tecnici, è possibile ricevere assistenza fino alla chiusura del bando inviando una mail all'indirizzo: poc@polito.it

Le risposte pubblicate sul sito a seguito di richiesta integreranno le prescrizioni del bando.

Art. 11 - RESPONSABILE DEL PROCEDIMENTO

E' designato quale responsabile del Procedimento, ai sensi e per gli effetti della Legge 241/1990 s.m.i., il Dr. Shiva Loccisano, Responsabile dell'Area Trasferimento Tecnologico e Relazioni con l'Industria (TRIN).

Art. 12 - TRATTAMENTO DEI DATI PERSONALI

Con riferimento alle disposizioni di cui al D. Lgs. 196/2003, concernente la tutela delle persone e di altri soggetti rispetto al trattamento dei dati personali, i dati forniti dai candidati tramite l'istanza formeranno oggetto di trattamento nel rispetto della normativa suddetta e degli obblighi di riservatezza, per provvedere agli adempimenti connessi all'attività concorsuale.

Art. 13 - PUBBLICIZZAZIONE BANDO

Il testo del bando sarà pubblicato all'albo ufficiale disponibile sul sito Intranet del Politecnico alla sezione *Documenti ufficiali – Albo online d'Ateneo*, al seguente indirizzo:

http://www.swas.polito.it/dotnet/albo_online/

Tale pubblicazione costituisce comunicazione ai sensi e per gli effetti della Legge 241/90 (Disciplina sul procedimento amministrativo) e del D.Lgs. 104/2010 (Codice del Processo Amministrativo) e ss.mm.ii.
Dalla data di pubblicazione del bando di concorso all'Albo Ufficiale decorre il termine per eventuali impugnazioni.

Art. 14 - LISTA DEGLI ALLEGATI

- ALLEGATO A: Tabella TRL;
- ALLEGATO B: Modalità di rendicontazione;
- ALLEGATO C: Form per la domanda di partecipazione al bando PoC;
- ALLEGATO D: Form per il budget;

- ALLEGATO E: Form per l'autorizzazione a svolgere le attività PoC per i soggetti descritti al punto 1a del paragrafo 2.3.3;

- ALLEGATO F: Form per l'ente co-titolare del brevetto oggetto della domanda di partecipazione;
- ALLEGATO G: Form per il nulla osta di tutti gli inventori del brevetto oggetto della domanda di partecipazione;
- ALLEGATO H: Accordo di Confidenzialità per l'azienda coinvolta;
- ALLEGATO I: Accordo di Confidenzialità di tutti i membri del team di Progetto.

Attachment 2

Protocollo intervista PoC

INIZIO REGISTRAZIONE

L'obiettivo dell'intervista è, in primis, di comprendere le problematiche con cui i gruppi di ricerca si scontrano durante lo sviluppo di un progetto, e in seguito, capire se e come questi problemi possono essere in parte risolti dal "Proof of Concept".

L'intervista ha scopo puramente di ricerca ed i risultati saranno presentati in maniera completamente anonima.

Ci autorizza a registrare l'intervista in modo da essere sicuri di non perdere informazioni importanti per la nostra ricerca? Le registrazioni verranno utilizzate solo da noi e per fini di questa ricerca e le registrazioni saranno mantenute dal team di ricerca.

Domande parte 1: Inhibitors

I: Incominciamo la nostra intervista facendo riferimento alla sua esperienza in progetti di ricerca e nello sviluppo di tecnologie che non hanno previsto il sostegno dei progetti PoC. Per semplificare, nel rispondere alle domande può far riferimento ai progetti di ricerca/tecnologici sviluppati prima di due anni fa.

Domande:

I: Le prime domande dell'intervista saranno relative a come conducete I progetti di ricerca e di sviluppo tecnologico

1. La vostra ricerca privilegia maggiormente la dimensione teorica (es. sviluppare nuovi modelli) o applicata (es. sviluppare nuove tecnologie)? [CULT 2]
2. Quanto pesa nella vostra attività di ricerca la pubblicazione e quanto la commercializzazione della tecnologia? [CULT 3]
3. La sua ricerca parte da bisogni del mercato o potenziali scoperte effettuate da lei o dal suo gruppo di ricerca? [MKT APPLIC 1]
4. Avete una chiara overview di quelli che sono i bisogni del mercato?
    a. Quanto lo sviluppo della sua tecnologia è stato guidato dai bisogni del mercato? [MKT APPLIC 5]

I: Uno degli aspetti cruciali nei progetti di ricerca/sviluppo tecnologico è rappresentato dai partner tecnologici e dagli investitori. Concentrandoci su questi le chiedo:

1. Come è percepita la sua/vostra ricerca al di fuori del mondo accademico? [DEVELOP 3]
2. Quanto spesso siete contattati dalle imprese/associazioni per sviluppare nuovi progetti di ricerca? [DEVELOP 2]
3. Quanto è sviluppata la vostra rete di contatti con investitori/ stakeholders interessati nella tecnologia? [TEAM 2]
4. Come e dove ricercate tecnologie/competenze complementari allo sviluppo della sua tecnologia?
    a. Quali difficoltà trova nell'accesso a partner/tecnologie complementari? [CULT 1]
5. Quali sono le principali barriere legate alla collaborazione con altri partner? [CULT 4]

6. Teme comportamenti opportunistici in relazione al contenuto della tecnologia/ricerca da parte di terze parti (es. partners/research teams)? Eventualmente come si protegge da tali comportamenti? [MKT APPLIC 2]
7. Esiste volontà nei vostri partner commerciali di condividere il rischio legato allo sviluppo di una nuova tecnologia? [DEVELOP 4]
8. Come fate a segnalare il vostro committment a potenziali investitori/partners?
    a. Intravede degli ostacoli? [DEVELOP 5]

I: Focalizziamoci ora sul finanziamento dei progetti di ricerca

1. Come finanziate i vostri progetti di ricerca?
    a. Fatto 100, quanto peso ha il Politecnico (escluso il PoC) e quanto le fonti di finanziamento esterne?
    b. Quali fonti esterne? [DEVELOP 1]
2. Con riferimento agli altri gruppi di ricerca, intravede la presenza di dinamiche competitive nell'acquisizione di risorse? [TEAM 3]

I: Un altro aspetto cruciale della ricerca di tipo tecnologico è, infine, la commercializzazione della tecnologia. In merito a questo:

1. Come avviene il processo di "marketing" della tecnologia?
    a. Trovate delle difficoltà?
    b. Per quale motivo credete vi siano queste difficoltà? [TEAM 1]
2. Dove sono localizzati geograficamente di solito i potenziali sfruttatori delle tecnologie da voi sviluppate? [nella regione, estero ecc] [MKT APPLIC 3]
3. Quali sono i canali attraverso cui entrate in contatto con i potenziali utilizzatori/partner della vostra tecnologia? [MKT APPLIC 4]

Vuole aggiungere qualcosa di rilevante su questa prima fase di intervista relativa alle problematiche che si possono verificare durante le fasi di sviluppo di un progetto?

Domande parte 2: PoC

I: In quest'ultima parte dell'intervista le chiediamo di pensare al PoC che ha vinto con il suo team di ricerca.

7. Alla luce delle difficoltà che abbiamo evidenziato prima, qual è stato il vantaggio offerto dal PoC? *[temi da toccare sono: conoscenza mercato, network & partners, risorse finanziarie, università e processi interni, team di ricerca]*
8. Su quali dimensioni pensa che sia stato particolarmente efficace?
9. Con il PoC ha raggiunto gli obiettivi che si era prefissato?
    a. Pensa che il progetto sia cresciuto realmente di valore?
    b. Che TRL ha raggiunto?
    c. Era quello prefissato?
10. Il progetto ha generato interesse da parte di aziende dopo il PoC?
    a. Si sono conclusi accordi? Di che tipo?
11. Qual è lo stato attuale del progetto (progetto abbandonato, start-up, licenziato, accordi, ecc ecc)?
    a. CI sono progetti futuri per la tecnologia sviluppata?
12. Ci vuole dire qualche altra cosa che pensa sia rilevante in relazione a come il PoC ha agito sulla sua ricerca?

I: Grazie per il tempo, l'intervista si può concludere qui. Possiamo ricontattarla nei prossimi mesi nel caso in cui avessimo qualche rapido dubbio da risolvere?

CHIUDERE REGISTRAZIONE

Attachment 3

Development Environment /Structural		
Inhibitors	**Questions**	**Question code**
1. The research team does not have access to external sources of financing a. The team does not know the people or the right people to receive the financing b. The team does not have the necessary fame to receive external fund	Come finanziate i vostri progetti di ricerca (es. residui)? a. Fatto 100, quanto peso ha il Politecnico (escluso il PoC) e quanto le fonti di finanziamento esterne? b. Quali fonti esterne?	DEVELOP 1
5. The research team does not have the right visibility outside the academia a. The world does not know the team's research b. The team is not able to open a communication bridge with the external world	Quanto spesso siete contattati dalle imprese/associazioni per sviluppare nuovi progetti di ricerca?	DEVELOP 2
3. The research team does not find legitimacy of its scientific value outside the academic setting a. The industry does not understand the potential of this new technology b. The team does not have the scientific knowledge to entry in the industry c. The team does not have the reputation/fame to entry in the industry	Come è percepita la sua/vostra ricerca al di fuori del mondo accademico? [COMP. Est.] a. E all'interno (colleghi, anche altri dipartimenti etc)? [COMP. Interna]	DEVELOP 3
7. The research team strives to find third parties willing to share the technological risk a. The research team does not find the investors to share the technological risk	Esiste volontà nei vostri partner commerciali di condividere il rischio legato allo sviluppo di una nuova tecnologia?	DEVELOP 4
8. The research team does not have any instrument to signal its own commitment on the development of the technology a. The external world does not know the research and the commitment of the research team	Come fate a segnalare il vostro committment a potenziali investitori/partners? a. Intravede degli ostacoli?	DEVELOP 5

Cultural		
Inhibitors	**Questions**	**Question code**
6. The research team scarcely interacts with other technology providers a. The team does not collaborate with other teams or firms to have access on complementary technology b. The research team thinks to have all the competences inside the research group c. The research team does not want to collaborate with other groups, because it does not want to lose the control of the project	Come e dove ricercate tecnologie/competenze complementari allo sviluppo della sua tecnologia? a. Quali difficoltà trova nell'accesso a partner/tecnologie complementari?	CULT 1
13. The research team has a high focus on theoretical contents rather than applied ones a. The research of team is theoretical driven rather than market driven	La vostra ricerca privilegia maggiormente la dimensione teorica (es. sviluppare nuovi modelli) o applicata (es. sviluppare nuove tecnologie)?	CULT 2
15. The research team's academic career incentives privilege basic research over applied research a. The research's team is driven by the need to publish, to improve the academic career	Fatto 100, quanto pesa nella vostra attività di ricerca la pubblicazione e quanto lo sviluppo/commercializzazione della tecnologia? a. Perché predilige una attività all'altra? b. Quale ruolo hanno gli incentivi e la valutazione delle carriere ambiente accademico?	CULT 3
16. The research team worries about potential for stealing ideas a. The team thinks that collaborating is dangerous to maintain control on the project	Quali sono le principali barriere legate alla collaborazione con altri partner?	CULT 4

Team Knowledge		
Inhibitors	**Questions**	**Question code**
2. The research team does not have managerial skills to "sell" the technology a. The team is not able to understand the customers' needs to address the research to the market b. The team does not have the necessary communication with the market to understand the real needs of the customers	Come avviene il processo di "marketing" della tecnologia? a. Trovate delle difficoltà? b. Per quale motivo credete vi siano queste difficoltà?	TEAM 1
9. The research team does not have the capability to build a network of stakeholders interested in the technology a. The research team does not able to explain to investors the potential of the project therefore the investors do not want to invest on the research b. The research team is not able to talk with all stakeholders	Quanto è sviluppata la vostra rete di contatti con investitori/ stakeholders interessati nella tecnologia?	TEAM 2
17. The research team fears competition for resource acquisition from other research groups a. The team is afraid of opportunistic behaviour from other research groups and lose important team members.	Con riferimento agli altri gruppi di ricerca, intravede la presenza di dinamiche competitive nell'acquisizione di risorse?	TEAM 3

Market Application and Environment Application		
Inhibitors	**Questions**	**Question code**
4. The research team's supply of a technology is misaligned with the industry demand a. The team's technology is different from market needs b. Usually the technology is disruptive and is difficult to insert inside the existing technology	La sua ricerca parte da bisogni del mercato o potenziali scoperte effettuate da lei o dal suo gruppo di ricerca?	MKT APPLIC 1
10. The research team is not protected from opportunistic behaviours by third parties a. The research team does not have the knowledge to protect itself from opportunistic behaviours b. The research team is not able to select the right shareholder c. The research team does not develop projects with other companies or project teams because it is afraid to be fooled, for this reason the outcomes of research are not driven from industry needs	Teme comportamenti opportunistici in relazione al contenuto della tecnologia/ricerca da parte del mondo extra-accademico (es. partners)? a. E da colleghi del mondo accademico interni o esterni all'ateneo? b. Eventualmente come si protegge da tali comportamenti?	MKT APPLIC 2
11. The research team is not working in proximity of companies interested in the exploitation of the technology a. The geographic localization of the team is not the best place to develop the project	Dove sono localizzati geograficamente di solito i potenziali sfruttatori delle tecnologie da voi sviluppate? (nella regione, estero ecc) a. Come fate ad approcciarli?	MKT APPLIC 3
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology a. The research team does not have the ability to "sell" the research	Quali sono i canali attraverso cui entrate in contatto con i potenziali utilizzatori/partner della vostra tecnologia?	MKT APPLIC 4
14. The research team does not fully understand the technological needs of the industry a. The research team does not know the best application of its research b. The research of inventors is not driven by market's needs, but rather from the possibility of publishing	Avete una chiara overview di quelli che sono i bisogni del mercato? Quanto lo sviluppo della sua tecnologia è stato guidato dai bisogni del mercato?	MKT APPLIC 5

Attachment 4

Protocollo intervista PoC

INIZIO REGISTRAZIONE

Grazie per averci ricevuto. L'incontro di oggi ha come scopo un'intervista che servirà a me ed al mio gruppo di ricerca ad ottenere informazioni utili per lo svolgimento di una ricerca scientifica.

La nostra ricerca ha un duplice obiettivo, in primis, comprendere le problematiche con cui i gruppi di ricerca si scontrano durante lo sviluppo di un progetto di ricerca, quindi la comprensione da parte nostra di quali sono gli "inibitori" che vi si presentano durante le fasi di sviluppo. In seguito a questo, capire se e come questi "inibitori" sono, almeno in parte, risolti dal "Proof of Concept".

Visto il duplice obiettivo questa intervista sarà svolta in due fasi, nella prima fase le chiediamo di fare riferimento a progetti che ha sviluppato senza l'utilizzo del PoC, se preferisci per evitare confusione può far riferimento ai progetti che ha sviluppato prima del PoC del 2016, a cui ha partecipato con il progetto di cui era referente. Nella seconda parte, invece, faremo riferimento solo al progetto che ha partecipato al PoC e se e come il PoC ha evitato/alleviato alcune delle problematiche che ci ha riferito durante la prima parte dell'intervista.

L'intervista ha scopo puramente di ricerca ed ha come output la creazione da parte nostra di un report e l'estrazione di dati qualitativi sulle problematiche evidenziate che confluiranno in un lavoro di ricerca. I dati proveniente da questa e da altre interviste ad altri partecipanti del PoC saranno raggruppati per la creazione di statistiche utili per la ricerca scientifica. Ovviamente i risultati ottenuti saranno presentati in maniera completamente anonima.

Ci autorizza a registrare l'intervista in modo da essere sicuri di non perdere informazioni importanti per la nostra ricerca? Le registrazioni verranno utilizzate solo da noi e per fini di questa ricerca e le registrazioni saranno mantenute dal team di ricerca.

Domande parte 1: Inhibitors

I: Incominciamo la nostra intervista facendo riferimento alla sua esperienza in progetti di ricerca e nello sviluppo di tecnologie che non hanno previsto il sostegno dei progetti PoC. Per semplificare, nel rispondere alle domande può far riferimento ai progetti di ricerca/tecnologici sviluppati prima di due anni fa.

Domande:

I: Le prime domande dell'intervista saranno relative a come conducete I progetti di ricerca e di sviluppo tecnologico

5. La vostra ricerca privilegia maggiormente la dimensione teorica (es. sviluppare nuovi modelli) o applicata (es. sviluppare nuove tecnologie)? [CULT 2]
6. Fatto 100, quanto pesa nella vostra attività di ricerca la pubblicazione e quanto lo sviluppo/commercializzazione della tecnologia?
    a. Perché predilige una attività all'altra?
    b. Quale ruolo hanno gli incentivi e la valutazione delle carriere ambiente accademico? [CULT 3]

7. La sua ricerca parte da bisogni del mercato o potenziali scoperte effettuate da lei o dal suo gruppo di ricerca? [MKT APPLIC 1]
8. Fatto 100, come divide il suo tempo tra le varie attività che le vengono richieste all'interno dell'incarico che ricopre? (ricerca, didattica, impegni istituzionali, ecc…)
    a. Trova il tempo adeguato per dedicarsi alle sue ricerche? [CULT 5]
9. Avete una chiara overview di quelli che sono i bisogni del mercato?
    a. Quanto lo sviluppo della sua tecnologia è stato guidato dai bisogni del mercato? [MKT APPLIC 5]

I: Uno degli aspetti cruciali nei progetti di ricerca/sviluppo tecnologico è rappresentato dai partner tecnologici e dagli investitori. Concentrandoci su questi le chiedo:

10. Come è percepita la sua/vostra ricerca al di fuori del mondo accademico? [COMP. Est.]
    b. E all'interno (colleghi, anche altri dipartimenti etc)? [COMP. Interna] [DEVELOP 3]
11. Quanto spesso siete contattati dalle imprese/associazioni per sviluppare nuovi progetti di ricerca? [DEVELOP 2]
12. Quanto è sviluppata la vostra rete di contatti con investitori/ stakeholders interessati nella tecnologia? [TEAM 2]
13. Come e dove ricercate tecnologie/competenze complementari allo sviluppo della sua tecnologia?
    a. Quali difficoltà trova nell'accesso a partner/tecnologie complementari? [CULT 1]
14. Quali sono le principali barriere legate alla collaborazione con altri partner? [CULT 4]
15. Teme comportamenti opportunistici in relazione al contenuto della tecnologia/ricerca da parte del mondo extra-accademico (es. partners)?
    a. E da colleghi del mondo accademico interni o esterni all'ateneo?
    b. Eventualmente come si protegge da tali comportamenti? [MKT APPLIC 2]
16. Esiste volontà nei vostri partner commerciali di condividere il rischio legato allo sviluppo di una nuova tecnologia? [DEVELOP 4]
17. Come fate a segnalare il vostro committment a potenziali investitori/partners?
    a. Intravede degli ostacoli? [DEVELOP 5]

I: Focalizziamoci ora sul finanziamento dei progetti di ricerca

18. Come finanziate i vostri progetti di ricerca (es. residui)?
    a. Fatto 100, quanto peso ha il Politecnico (escluso il PoC) e quanto le fonti di finanziamento esterne?
    b. Quali fonti esterne? [DEVELOP 1]
19. Con riferimento agli altri gruppi di ricerca, intravede la presenza di dinamiche competitive nell'acquisizione di risorse? [TEAM 3]

I: Un altro aspetto cruciale della ricerca di tipo tecnologico è, infine, la commercializzazione della tecnologia. In merito a questo:

20. Come avviene il processo di "marketing" della tecnologia?
    c. Trovate delle difficoltà?
    d. Per quale motivo credete vi siano queste difficoltà? [TEAM 1]
21. Dove sono localizzati geograficamente di solito i potenziali sfruttatori delle tecnologie da voi sviluppate? (nella regione, estero ecc)
    a. Come fate ad approcciarli? [MKT APPLIC 3]
22. Quali sono i canali attraverso cui entrate in contatto con i potenziali utilizzatori/partner della vostra tecnologia? [MKT APPLIC 4]

Vuole aggiungere qualcosa di rilevante su questa prima fase di intervista relativa alle problematiche che si possono verificare durante le fasi di sviluppo di un progetto?

Domande parte 2: PoC

I: In quest'ultima parte dell'intervista le chiediamo di pensare al PoC che è stato finanziato con il suo team di ricerca.

13. Alla luce delle difficoltà che abbiamo evidenziato prima, quali problemi ha risolto il PoC? *[temi da toccare sono: conoscenza mercato, network & partners, risorse finanziarie, università e processi interni, team di ricerca]*
14. Su quali dimensioni pensa che sia stato particolarmente efficace?
15. Con il PoC ha raggiunto gli obiettivi che si era prefissato? In che misura?
    a. Pensa che il progetto sia cresciuto realmente di valore?
    b. Che TRL ha raggiunto?
    c. Era quello prefissato?
16. Il progetto ha generato interesse da parte di aziende dopo il PoC? In che misura?
    a. Si sono conclusi accordi? Di che tipo?
17. Qual è lo stato attuale del progetto (progetto abbandonato, start-up, licenziato, accordi, ecc ecc)?
    a. Ci sono progetti futuri per la tecnologia sviluppata?
18. Qual è il ruolo, ad oggi, dei membri del team di progetto?
    a. Che ruolo ricoprono i giovani ricercatori del team?
    b. E i senior?
19. Pensa che un percorso di formazione imprenditoriale per i giovani ricercatori del team avrebbe aiuta ad aumentare le possibilità commerciali della sua tecnologia?
20. Ci vuole dire qualche altra cosa che pensa sia rilevante in relazione a come il PoC ha agito sulla sua ricerca?

I: Grazie per il tempo, l'intervista si può concludere qui. Possiamo ricontattarla nei prossimi mesi nel caso in cui avessimo qualche rapido dubbio da risolvere?

CHIUDERE REGISTRAZIONE

Attachment 5

Development Environment /Structural		
Inhibitors	**Questions**	**Question code**
1. The research team does not have access to external sources of financing a. The team does not know the people or the right people to receive the financing b. The team does not have the necessary fame to receive external fund	Come finanziate i vostri progetti di ricerca (es. residui)? a. Fatto 100, quanto peso ha il Politecnico (escluso il PoC) e quanto le fonti di finanziamento esterne? b. Quali fonti esterne??	DEVELOP 1
5. The research team does not have the right visibility outside the academia a. The world does not know the team's research b. The team is not able to open a communication bridge with the external world	Quanto spesso siete contattati dalle imprese/associazioni per sviluppare nuovi progetti di ricerca?	DEVELOP 2
3. The research team does not find legitimacy of its scientific value outside the academic setting a. The industry does not understand the potential of this new technology b. The team does not have the scientific knowledge to entry in the industry c. The team does not have the reputation/fame to entry in the industry	Come è percepita la sua/vostra ricerca al di fuori del mondo accademico? [COMP. Est.] a. E all'interno (colleghi, anche altri dipartimenti etc)? [COMP. Interna]	DEVELOP 3
7. The research team strives to find third parties willing to share the technological risk a. The research team does not find the investors to share the technological risk	Esiste volontà nei vostri partner commerciali di condividere il rischio legato allo sviluppo di una nuova tecnologia?	DEVELOP 4
8. The research team does not have any instrument to signal its own commitment on the development of the technology a. The external world does not know the research and the commitment of the research team	Come fate a segnalare il vostro committment a potenziali investitori/partners? a. Intravede degli ostacoli?	DEVELOP 5

Cultural		
Inhibitors	**Questions**	**Question code**
6. The research team scarcely interacts with other technology providers a. The team does not collaborate with other teams or firms to have access on complementary technology b. The research team thinks to have all the competences inside the research group c. The research team does not want to collaborate with other groups, because it does not want to lose the control of the project	Come e dove ricercate tecnologie/competenze complementari allo sviluppo della sua tecnologia? a. Quali difficoltà trova nell'accesso a partner/tecnologie complementari?	CULT 1
13. The research team has a high focus on theoretical contents rather than applied ones a. The research of team is theoretical driven rather than market driven	La vostra ricerca privilegia maggiormente la dimensione teorica (es. sviluppare nuovi modelli) o applicata (es. sviluppare nuove tecnologie)?	CULT 2
15. The research team's academic career incentives privilege basic research over applied research a. The research's team is driven by the need to publish, to improve the academic career	Fatto 100, quanto pesa nella vostra attività di ricerca la pubblicazione e quanto lo sviluppo/commercializzazione della tecnologia? a. Perché predilige una attività all'altra? b. Quale ruolo hanno gli incentivi e la valutazione delle carriere ambiente accademico?	CULT 3
16. The research team worries about potential for stealing ideas a. The team thinks that collaborating is dangerous to maintain control on the project	Quali sono le principali barriere legate alla collaborazione con altri partner?	CULT 4
18. NEW The research teams do not have enough time to dedicate to the research a. NEW The researchers are very busy in the university life, among teaching, research and administrative obligations	Fatto 100, come divide il suo tempo tra le varie attività che le vengono richieste all'interno dell'incarico che ricopre? (ricerca, didattica, impegni istituzionali, ecc…) a. Trova il tempo adeguato per dedicarsi alle sue ricerche?	CULT 5

Team Knowledge		
Inhibitors	**Questions**	**Question code**
2. The research team does not have managerial skills to "sell" the technology a. The team is not able to understand the customers' needs to address the research to the market b. The team does not have the necessary communication with the market to understand the real needs of the customers	Come avviene il processo di "marketing" della tecnologia? a. Trovate delle difficoltà? b. Per quale motivo credete vi siano queste difficoltà?	TEAM 1
9. The research team does not have the capability to build a network of stakeholders interested in the technology a. The research team does not able to explain to investors the potential of the project therefore the investors do not want to invest on the research b. The research team is not able to talk with all stakeholders	Quanto è sviluppata la vostra rete di contatti con investitori/ stakeholders interessati nella tecnologia?	TEAM 2
17. The research team fears competition for resource acquisition from other research groups a. The team is afraid of opportunistic behaviour from other research groups and lose important team members.	Con riferimento agli altri gruppi di ricerca, intravede la presenza di dinamiche competitive nell'acquisizione di risorse?	TEAM 3

Market Application and Environment Application		
Inhibitors	**Questions**	**Question code**
4. The research team's supply of a technology is misaligned with the industry demand a. The team's technology is different from market needs b. Usually the technology is disruptive and is difficult to insert inside the existing technology	La sua ricerca parte da bisogni del mercato o potenziali scoperte effettuate da lei o dal suo gruppo di ricerca?	MKT APPLIC 1
10. The research team is not protected from opportunistic behaviours by third parties a. The research team does not have the knowledge to protect itself from opportunistic behaviours b. The research team is not able to select the right shareholder c. The research team does not develop projects with other companies or project teams because it is afraid to be fooled, for this reason the outcomes of research are not driven from industry needs	Teme comportamenti opportunistici in relazione al contenuto della tecnologia/ricerca da parte del mondo extra-accademico (es. partners)? a. E da colleghi del mondo accademico interni o esterni all'ateneo? b. Eventualmente come si protegge da tali comportamenti?	MKT APPLIC 2
11. The research team is not working in proximity of companies interested in the exploitation of the technology a. The geographic localization of the team is not the best place to develop the project	Dove sono localizzati geograficamente di solito i potenziali sfruttatori delle tecnologie da voi sviluppate? (nella regione, estero ecc) a. Come fate ad approcciarli?	MKT APPLIC 3
12. The research team does not have direct channels to approach companies interested in the exploitation of the technology a. The research team does not have the ability to "sell" the research	Quali sono i canali attraverso cui entrate in contatto con i potenziali utilizzatori/partner della vostra tecnologia?	MKT APPLIC 4
14. The research team develops projects without knowing the possible application a. The research team does not know the best application of its research b. The research of inventors is not driven by market's needs, but rather from the possibility of publishing	Avete una chiara overview di quelli che sono i bisogni del mercato? Quanto lo sviluppo della sua tecnologia è stato guidato dai bisogni del mercato?	MKT APPLIC 5

Attachment 6

Domande parte 1: Inhibitors

Le prime domande dell'intervista saranno relative a come conduceva i progetti di ricerca e di sviluppo tecnologico PRECEDENTI al PoC.

1

Quanto pesa la parte teorica, fare i nuovi modelli, rispetto all'applicare o fare cose concrete? Qual è il peso di quello che fai tu e il tuo gruppo di ricerca?

Le attività del gruppo di ricerca si fondono su due pillars, su due colonne: la prima è fondamentalmente sperimentale. In questa linea di ricerca, quello che facciamo è sostanzialmente affrontare, posso sintetizzare così l'uso del calore per varie finalità. Una delle finalità è il trattamento dell'acqua, per esempio, quindi si va dalla dissalazione, quindi la rimozione di sali o altri inquinanti dell'acqua utilizzando come sorgente energetica il calore, possibilmente un calore a bassa temperatura e quindi un calore che ha tipicamente uno scarso valore economico, uno scarso interesse, praticamente è un calore che viene rigettato in ambiente senza ulteriore utilizzo. Quello che vogliamo e uno degli scopi è quello di utilizzare lo scarto, in questo caso energetico. Ci siamo occupati tra l'altro sempre in un mio progetto di ricerca Smat sempre del trattamento delle acque ma in quel caso l'utilizzo di energia solare per la rimozione della carica batterica tramite l'utilizzo di materiali micrometrici attivati da una parte dello spettro solare. Quindi l'obiettivo lì era cercare di capire se era possibile utilizzare questa fonte energetica rinnovabile in alternativa all'utilizzo del cloro tanto per farvi capire.

Questi materiali venivano attivati e hanno un effetto antibatterico e vengono rigenerati dal sole.

Esatto, quindi che potessero agire da catalizzatori in qualche modo, quindi agenti che non si consumano sostanzialmente all'interno della vita dell'impianto. Altro argomento che tratto io in prima persona è l'accumulo del calore quindi tecnologie per lo stoccaggio del calore. Questo è un tema molto sentito ultimamente per l'utilizzo delle rinnovabili, se pensate che per esempio il 50% dell'energia primaria a livello europeo ma vale anche per gli U.S. è utilizzato per scaldare o raffreddare gli ambienti, includendo tutto l'elettricità il trasposto ecc., quindi metà di dell'energia che estraiamo come petrolio ecc. serve per riscaldare gli ambienti allora capite che sarebbe auspicabile avere delle tecnologie che consente,in zone benedette dal sole di stoccare il calore d'estate per poterlo utilizzare d'inverno senza utilizzare fonti fossili. Quindi altra questione, appunto, guardiamo, in realtà lo affrontiamo sia da un punto di vista sperimentale, abbiamo da poco per esempio fatto un contratto con GM partito da questo mese su questo argomento dello stoccaggio del calore, sia da un punto teorico nel senso che poi legate a queste questioni dell'accumulo. C'è sempre collegato il problema della scelta dei materiali più opportuni, oltre all'ingegnerizzazione dei dispositivi, delle batterie termiche, ecc., l'utilizzo di materiali che possono stoccare quantità notevoli di energia di calore, in questo caso in piccoli spazi. Quindi seguiamo queste attività dal punto di vista sperimentale con dei dispositivi che progettiamo e sia da un punto di vista diciamo numerico per la simulazione delle prestazioni attese tramite previsioni al computer. Queste sono sostanzialmente le attività. Un tratto abbastanza comune, se posso aggiungere, delle tecnologie a cui lavoriamo è sempre il fatto di cercare di avere delle tecnologie performanti ma a basso costo. Ci poniamo sempre il problema economico, nel senso che a volte anche sfidando il mainstream in letteratura, molto spesso si vede sulle pubblicazioni scientifiche l'ultimo ritrovato tecnologico, materiali nano strutturati in un certo modo all'ultimo grido. La nostra visione è un po' più quella di dire ok ma qual è l'obiettivo:

l'obiettivo è stoccare il calore, l'obiettivo è, non lo so, dissalare l'acqua con una certa produttività dato un certo input energetico. La questione è qual è il modo più economico, meno impattante da un punto di vista, è veramente vero che utilizzando questo materiale insomma state-of-the-art posso avere delle performance significativamente superiori rispetto a quando utilizzo dei materiali più comuni? Viene fuori una roba interessante che a volte il materiale l'ultimo ritrovato è interessante per quanto riguarda la performance descritta e altre volte non è strettamente necessario.

Quindi voi partite da una base teorica, cioè tante volte provate anche a testare quella che è la base teorica, per poi applicarlo.

Certo, nei nostri studi cerchiamo sempre di avere un modello numerico o teorico che possa descrivere i fenomeni, se io sto analizzando un dispositivo per la dissalazione dell'acqua cerco di avere un modello che predica al computer le prestazioni e in parallelo il test per cercare di avere sinergia tra due le attività. – [13.a]

Quindi fatto 100 possiamo dire 50% e 50% oppure è un po' più sbilanciata?

Dipende dalle attività. Le attività che ho descritto finora le ho descritte nella categoria sperimentali perché cerchiamo di dare una priorità, diciamo così, all'aspetto sperimentale quindi il modello è a supporto. Ci sono poi, l'altro pilastro di cui vi parlavo, delle attività che sono prevalentemente di tipo numerico, teorico fondamentale, chiamatelo come volete, dove gli esperimenti sono necessariamente per loro natura molto complessi da fare o comunque non alla nostra portata per le facility che abbiamo qui a disposizione e allora a quel punto privilegiamo l'aspetto più teorico. Per esempio, la simulazione di nano sospensioni per capire che tipo di impatto possono avere. – [New 13.c]

Esisterebbero le facilities sperimentali, fisiche, che funzionano? Se avessi budget illimitato potresti invece fare simulazione?

In alcuni casi sì. Faccio l'esempio di uno studio che ha fatto Annalisa Cardellini. Lei si è occupata della simulazione di queste nano sospensioni in acqua e quindi immaginate delle nanoparticelle disperse in acqua, che rimangono in sospensione e c'è stato negli ultimi vent'anni nell'energia termica un hype, un grande entusiasmo intorno a questi sistemi perché il primo che le aveva osservati negli U.S. aveva descritto delle proprietà di questo fluido rispetto al fluido base l'acqua fantastici. Quindi per lo scambio termico, per l'electron cooling sarebbe stato insomma la panacea. Ci sono stati migliaia di paper e alla fine poi si è scoperto che in realtà le misure che erano state fatte nel corso degli anni, si è notato un certo scattering, c'era chi otteneva più o meno quello, chi otteneva meno e chi diceva che non succedeva nulla quindi non si riusciva a capire che cosa accadeva. Fino a qualche anno fa dove poi si è capito che in realtà qualche prestazione migliore si riusciva ottenere ma se le particelle aggregavano in un certo modo ed erano aggregati non stabili quindi a volte le potevi osservare altre volte no. Nessuno poi ha mai studiato nel dettaglio questo tipo di applicazione. Annalisa nell'anno al MIT in un gruppo prestigioso, ha fatto questo modello botton-up, nel senso che hanno costruito il modello, è partita dalle particelle poi mettendo l'acqua e simulando nel dettaglio sta roba qui, a quel punto c'era il problema di validare i dati sperimentali, le proprietà simulate al computer e quello non è stato possibile perché il MIT non aveva la facility sperimentale e non funzionava. Quindi nemmeno il MIT aveva quella facility adatta, nel senso che tu dovresti avere una facility che ti serve una volta e non è giustificata. Quindi in alcuni casi privilegiamo le simulazioni perché almeno le simulazioni riesci a farle e riesci ad impostarle. – [New 13.c]

Fatto 100 il teorico e sperimentale, voi siete a metà e metà.

Attualmente direi che siamo 50 e 50, nel senso che ci dedichiamo il 50% del tempo allo sperimentale e 50% al teorico. – [13.a]

2

La pubblicazione è un pezzo di questa storia, nel 50 e 50 ci sono pubblicazioni?

Abbiamo sia pubblicazioni puramente numeriche, teoriche rispetto al caso sperimentale. – [15.a]

Di commercializzazione avete esempi di cose che sono state applicate da imprese con cui avete lavorato?

Abbiamo fatto qualche lavoro con Denso di ottimizzazione degli scambiatori di calore, piccole attività, non progetti finanziati. Per esempio, è entrata questa piccola consulenza con GM, ci hanno commissionato lo studio di alcuni materiali per fare lo stoccaggio di calore bordo auto e l'obiettivo è proprio quello di andare al prodotto.

Quale ruolo hanno gli incentivi e la valutazione delle carriere in ambiente accademico?

Devo dire che i ricercatori guardano quello che viene valutato per l'avanzamento della carriera. Guardi i bandi e cosa viene valutato. Allo stato attuale se devo dire guardo cosa viene pesato nei bandi per la progressione della carriera e l'ASN, le pubblicazioni. Ora tendenzialmente ho visto che un po' la didattica sta prendendo più piede perché ci si è resi conto è un pezzo molto importante. – [15.a]

3

La sua ricerca parte da bisogni del mercato o potenziali scoperte effettuate da lei o dal suo gruppo di ricerca?

Diverse cose, molto spesso da un'idea che ci solletica pubblicata su un giornale, per esempio. L'esempio del PoC è un caso emblematico, rientra un po' nel discorso che facevo prima del fatto di dire ma abbiamo veramente bisogno di un mega materiale nano strutturato per avere una certa performance o possiamo raggiungere lo stesso obiettivo ma con cose di più basso livello che magari durano di più, che si conoscono di più, hanno un impatto ambientale minore e quindi la performance che ti dico è uno dei parametri. – [4.a]

Quindi problema reale, dibattito scientifico e avanzamento radicale.

Cambio di visione se è possibile. Altre volte, l'azienda ci chiede e ci commissiona un lavoro e quello è fatto su commissione.

Ma questo vi genera idee per il futuro o questi lavori sono tipicamente sono cose più limitate?

Sono cose più limitate perché l'azienda vuole risolvere quel problema lì.

Quello che fanno loro è una tecnologia che è conosciuta, nel senso che sta dentro la fisica tecnica per cui quando hai dei fenomeni di trasporto di massa di energia, lo scambiatore di calore è uno di questi fenomeni, è chiaro che hai bisogno di calcoli specifici, hai nuovi materiali, nuove condizioni al contorno, vai all'università a farti risolvere il problema. Compri l'expertise del docente. Sì.

4

Ti chiedo la suddivisione del tuo tempo, fatto 100 il tuo tempo convenzionale, ricerca, didattica, applicazione sperimentale, contratti con l'esterno.

Ho un semestre in cui ci sono tutti i corsi, quindi mi faccio tutto il carico didattico in un semestre e poi mi lascio l'altro semestre libero per la ricerca. Sì, è una buona stima 40% didattica e 60% ricerca.

Trova il tempo per dedicarsi alle sue ricerche?

Me ne manca un po' rispetto a quello che vorrei fare. Ovviamente, abbiamo un gruppo fortunatamente esteso, quindi se ti viene un'idea da provare hai sempre la persona da chiamare per dire di provare questa cosa per vedere se può funzionare. – [New 18.a]

Quanti siete nel gruppo?

Siamo circa 15.

Rapporto con partner tecnologici e investitori, con chi avete rapporti stabilmente verso l'esterno? Con qualche industria, l'Unione europea prevale.

Abbiamo avuto sia enti pubblici come Smat, molti progetti europei e poi aziende private come GM, Denso per consulenze.

A livello europeo sono più progetti?

Sono progetti sostanzialmente focalizzati sulla parte di modellazione dei materiali.

Però sono progetti europei come H2020? Sì, sono progetti H2020 per la maggior parte, quindi se devo dire 70% H2020 e il 30% da suddividere tra aziende.

Quelle delle aziende sono più di basso livello, per esempio una consulenza fissate su quelle che sono le loro esigenze.

Sì, senz'altro. L'azienda va subito dritto al punto, non vuole understanding scientifico, vuole la soluzione di un problema. La chiamerei più sviluppo che non ricerca.

6

Come è percepita la sua ricerca ad di fuori del mondo accademico?

Credo che per la mia esperienza, insomma, per quanto riguarda i progetti con le aziende quello che c'è stato chiesto era un expertise che loro non avevano. Quindi, GM viene qui per chiedermi i materiali per l'accumulo termico perché ovviamente io ho avuto modo di approfondire la conoscenza, avendo anche io il corso di accumulo termico, non hanno quella persona che ha quell'expertise così diciamo verticale su quel topic da un lato e dall'altro cercano ovviamente anche una competenza di tipo più ingegneristico spinto, nel senso che è un fatto di sensibilità rispetto a quell'argomento, secondo me. Abbiamo avuto interazione con ENI e ci chiedevano degli studi di fattibilità. Sono tutte le competenze che all'interno gli mancano e quando gli manca quella competenza si rivolgono al mondo dell'accademia. È una roba che si colloca tra il fondamentale a ridosso dell'applicativo che secondo me è la parte che loro manca. – [3.b]

Invece le vostre ricerche del mondo accademico che può essere il Politecnico o altre università, come sono viste dai colleghi, magari questa ricerca che avete fatto voi, nel caso del PoC, altri hanno visto questa cosa e loro hanno provato a copiare qualcosa di simile. C'è questo interesse a cercare di capire come funziona e magari riadattare il modello?

Molto spesso accade, quando riesci a fare qualcosa che supera le aspettative. – [NEW 16.b] Ci è capitato recentemente con un progetto sul dissalatore che utilizza calore a bassa temperatura. Tutto era nato da un paper del MIT di Boston, dove abbiamo fatto varie esperienze noi, quindi ci siamo messi in coda rispetto a questa iniziativa della produzione del vapore solare, quindi l'utilizzo della radiazione solare per produrre vapore a più o meno alta temperatura e con più o meno efficienza. Dopodiché abbiamo tirato fuori un dispositivo che aveva 3 volte le prestazioni di quello che avevano trovato loro. Poi abbiamo presentato e sono rimasti molto colpiti e abbiamo visto che nella letteratura ha avuto un buon seguito, quindi in qualche modo quando tiri fuori una cosa che vale te la seguono.

Qualcuno cerca di sviluppare in quello stesso filone per migliorare, capisce che c'è spazio per la pubblicazione.

Cerca di seguire quel filone, è sempre la qualità dell'idea che lanci. Ovviamente questa mania di pubblicare ecc., fa sì che il 95% dei paper che escono in letteratura scientifica oggigiorno sono semplicemente degli incrementi a quello che si sa. Quindi varia la condizione di prova, si varia lo spessore di un oggetto e magari si vede che cambia qualcosina quindi è un avanzamento incrementale.

– [NEW 13.b] Quella roba lì è difficile che ti seguono perché è un caso particolare. Poi, c'è quel 5% di paper che tutti noi cerchiamo di infilarci tra i vari paper che pubblichiamo dove c'è l'idea innovativa. Quelli sono quelli che riescono a fare un po' scuola, quelli che vengono seguiti, gli altri fanno un po' di noise. – [New 16.b]

7

Quanto spesso siete contattati dalle imprese per sviluppare nuovi progetti di ricerca?

Abbiamo 1-2 contatti all'anno, sono contratti 6-7 mesi. – [5.b]

8

Quanto è sviluppata la vostra rete di contatti con investitori/stakeholders interessati nella tecnologia?

Le aziende che ci contattano direttamente per le consulenze sono quelle che vi ho detto, GM, Denso, ENI. Molte delle aziende sono all'interno dei progetti europei, sono partner dei progetti europei. Per esempio, Bayer, Unilever, ecc. – [9.b]

Loro hanno un network di grandi imprese, praticamente tutti i rami di un certo tipo di settore quello dei materiali, a livello europeo ma nell'ambito di progetti europei.

Sì, sono tutti progetti più o meno legati all'uso energetico di materiali e all'interno di questi progetti come partner.

9

Come e dove ricerchi tecnologie/competenze complementari allo sviluppo della sua tecnologia?

Tantissime. Abbiamo già avuto modo nell'ambito di un progetto finanziato dal Miur, dove avevamo l'obiettivo del progetto di sviluppare delle superfici con delle proprietà di scambio termico avanzate rispetto alle superfici normali e ci siamo avvalsi della consulenza di DISAT ma anche INRIM perché dovevamo fare delle modifiche sul nostro progetto. Capita molto spesso. Altra questione sempre per il tema dell'accumulo del calore, stiamo facendo una tesi, quindi non è un progetto, in co-tutela con Pavesi che si occupa di cementi, è un materialista. Stiamo cercando di fare dei cementi che possano accumulare e rilasciare calore, quindi per l'edilizia. Lui ci ha fatto i provini, ora noi li abbiamo visti dal punto di vista termico. – [6.b]

10

Quali sono le principali barriere legate alla collaborazione con altri partner?

Molto spesso sì, perché anche tra colleghi ingegneri non ci capiamo e con l'esterno ancora di più. Io guardo l'aspetto termico e le performance e lui guarda la mescola. Il translator, la persona che faccia da interfaccia, nel senso che il traslator non è solo materials, modeling e anche molto spesso, ci sono tante interfacce nella pratica ingegneristica. Quelle figure che riescono a parlare o comunque la facilità di comunicazione tra ingegneri con diversi background non è mai una cosa scontata. – [New 20.b]

11

Teme comportamenti opportunistici in relazione al contenuto della tecnologia da parte del mondo extra-accademico?

Nella mia esperienza non è mai successo. Intravedo, questo è un mio pensiero, una possibilità di questo tipo qui non appena c'è qualcosa di brevettabile. Se c'è un risultato scientifico l'azienda è contenta ma non fa salti di gioia, se c'è qualcosa di brevettabile che interessa l'azienda, in quel caso, secondo me, inizia il conflitto che quasi sempre finisce ad appannaggio dell'azienda. – [New 10.d]

12

Esiste volontà nei vostri partner commerciali di condividere il rischio legato allo sviluppo di una nuova tecnologia?

Raramente. Dipende da qual è la motivazione dell'azienda, secondo me. L'azienda è interessata al prodotto, se intravedono delle possibilità in quel filone, ok cioè deve essere esattamente in linea con gli scopi e gli obiettivi dell'azienda. Questo è giusto perché l'azienda fa il suo mestiere. Se devia dal loro business, anche un po', il loro interesse scema ed è comprensibile, nel senso che l'azienda cerca di minimizzare anche le risorse da investire. – [7.a]

13

Come fate a segnalare il vostro commitment a potenziali investitori/partners?

È sempre una cosa ad obiettivo. Gli obiettivi si scrivono chiaramente nel contratto di consulenza e bisogna raggiungere quell'obiettivo e bisogna comunque dimostrare che si fanno tutti gli sforzi possibili per raggiungere quell'obiettivo. – [8.a]

14

Come finanziati i vostri progetti di ricerca?

Li finanziamo sui fondi liberi, nel senso che se ti viene una nuova idea e non hai i dati preliminari, è semplicemente un'idea nella tua testa e quindi anche scrivere una proposta di progetto su quell'argomento, quella proposta sarebbe debole perché non è suffragata da dati o da esperienze preliminari. Quindi devi formare in qualche modo degli elementi, dei dati o dei risultati parziali a supporto per poi cercare un finanziamento ad hoc. In questa prima fase cerchiamo di finanziare con i nostri fondi liberi, nel senso che ci sono dei fondi che accumuliamo facendo progetti europei, esatto i residui. Nel momento in cui il progetto è terminato e completato ci sono dei residui che accumuli e cerchiamo di reinvestire questi residui sulle idee che ci sembrano più promettenti, che non sono ancora finanziate ma che secondo noi sono promettenti. – [1.a]

Fatto 100 quanto peso hai il Politecnico e quanto le fonti di finanziamento esterne?

Devo dire che negli ultimi anni, non so se continuerà questa tendenza, sono stati dati dei fondi, tra cui anche l'iniziativa del PoC, sono stati aperti dei bandi competitivi a supporto, ma anche è stata un po' esteso il finanziamento quello ordinario, chiamiamolo così, per cui qualche fondo per alimentare questa fase delle nuove idee. Insomma, è stato molto utile, nel mio caso lo è. Noi abbiamo dei fondi dai progetti europei ma sono vincolati allo scopo, quindi se ti viene un'idea un po' off che magari c'entra in qualche modo, ma che non è perfettamente in linea con gli scopi dei progetti non li puoi spendere perché non sono pertinenti. Allora avere sia i fondi di ateneo un po' liberi sia i residui aiuta ad investire sul futuro. – [1.a]

15

Con riferimento agli altri gruppi di ricerca, intravede la presenza di dinamiche competitive nell'acquisizione di risorse?

Secondo me sì. Attualmente c'è una forte competizione, proprio per i dottorandi. Per esempio, il nostro dipartimento ha 3-4 borse ministeriali all'anno e quindi immagina su diverse decine di docenti. Inevitabilmente si innesca una competizione sia lato nostro e che lato studente. A quel punto, ci si inventano delle regole per la selezione, ovviamente sono regole legittime ma a volte sono anche discutibili. – [NEW 19.c]

16

Come avviene il processo di "marketing" della tecnologia? Trova delle difficoltà?

Vendere tecnologie no, non direttamente devo dire perché noi facciamo delle attività sperimentali ma sono sempre abbastanza fondamentali, non hanno un elevatissimo TRL tipicamente, siamo sempre su dimostratori tecnologici al più da laboratorio. La priorità per noi sono le riviste scientifiche, per noi quello è il main target, anche perché per portare a un livello tecnologico adeguato, quindi per innalzare il più possibile il TRL, poi spingere sul mercato una tecnologia, per quanto furba, innovativa, ecc., c'è bisogno di risorse giovani. Non posso essere solo io docente a spingere quella cosa lì. Se nel frangente in cui si verificano tutte queste condizioni, c'è anche un giovane studente tesista che ha voglia, allora a quel punto, secondo me, si creano le condizioni giuste, altrimenti è difficile e poi la risorsa, di cui vi parlo, deve essere molto giovane, deve poter rischiare nella sua prima fase perché se va male poi cosa fa? Quindi non puoi mettere una risorsa in là con gli anni precaria su una roba ad alto rischio di mercato. Questo, secondo me, è un aspetto importante da sottolineare. – [NEW 19.c]

17

Dove sono localizzati geograficamente di solito i potenziali sfruttatori delle tecnologie da voi sviluppate?

Sono aziende europee, multinazionali ovviamente. – [11.a]

18

Quali sono i canali attraverso cui entrate in contatto con i potenziali utilizzatori/partner della vostra tecnologia?

C'è un'idea progettuale quando fai il progetto e a quel punto ti cerchi dei partner ovunque. Gli accademici si conoscono un po' già tutti, almeno in quell'ambito di ricerca. -Ogni accademico conosce un'azienda e a quel punto si fa un giro di contatti, si vede chi è interessato a partecipare a quella call, si costruisce il cosiddetto consorzio e a quel punto tu inizi a conoscere anche le aziende degli altri. – [9.b]

Ti crei una rete dal passaparola.

Esatto. Poi finito il progetto tu hai conosciuto i contatti.

Domande parte 2: PoC

In quest'ultima parte dell'intervista le chiediamo di pensare al PoC che è stato finanziato con il suo team di ricerca.

1

Alla luce delle difficoltà che abbiamo evidenziato prima, quali problemi ha risolto il PoC?

Ho partecipato al PoC perché, nel momento del bando, avevamo quest'idea che non era supportata da progetti, da altri finanziamenti. Avevamo quest'idea e avevamo presentato anche delle domande di brevetto in merito a questa cella solare per la produzione di vapore solare, però era appunto una cosa più curiosity driven, era una roba che ci interessava e basta dal punto di vista scientifico. Siccome volevamo dare seguito, avevamo fatto qualche prova di laboratorio ma non avevamo il dispositivo, il dimostratore tecnologico e quello significava di investire dei fondi liberi. Il PoC dava esattamente quella quantità di soldi iniziale per costruire un primo dispositivo. Quindi ci sembrava l'ambito ideale per provare questa cosa qui.

2

Su quali dimensioni pensa che si astato particolarmente efficace?

Sul momento è stato una cosa perfetta, cucita addosso alle nostre esigenze del momento. Siamo poi riusciti effettivamente a implementare l'idea, realizzare il prototipo.

3

Con il PoC ha raggiunto gli obiettivi che si era prefissato?

Esattamente quello che avevamo preventivato è stato fatto. Quello senz'altro.

4

Il progetto ha generato interesse da parte di aziende dopo il PoC?

Esattamente il discorso che ti facevo all'inizio, nel senso che avevamo tra l'altro finito il PoC, ci aveva anche lavorato un nostro tesista appassionato che aveva dato un grosso contributo, oltre a qualche borsista, finanziato sul PoC stesso. Questa persona era giovane, molto motivata quindi per lui era anche una roba molto interessante, su cui avrebbe voluto investire. Abbiamo avuto qualche contatto con alcune aziende che si erano dette inizialmente interessate ma poi a queste dichiarazioni di intenzioni non è seguito granché. Poi la persona ha perso un po' di entusiasmo, è stato assunto da un'azienda ed è finita lì, perché ovviamente non poteva aspettare che si concretizzasse la cosa con delle promesse. Ci siamo trovati esattamente in quella condizione che vi descrivevo un attimo fa, in cui c'è l'idea, c'è il prototipo ma mancano le risorse umane, perché io non riesco tra didattica, progetti europei, insomma studenti, progetti didattici, ecc., non riesco portare avanti anche la parte commerciale. Non è il mio mestiere tra l'altro ma pur volendo e pur dedicandomi non ho il tempo materiale per fare quella roba lì.

Bisognava a quel punto creare una start up o una spin off.

Però di nuovo la start up, si devono verificare una serie di condizioni che, dal punto probabilistico, la probabilità è molto bassa. Devi avere l'idea, il progetto che funziona, il prototipo che gira, l'interesse dell'azienda e le persone giovani che in quell'istante riescono ad assumersi quel rischio della spin off, che possono investire 2 anni della loro vita senza che gli capiti nulla di sconvolgente alla loro carriera perché magari quella roba lì, fallisce per diversi motivi. Nel momento in cui fallisce quella roba devi avere un piano b. Questo è il motivo per cui, secondo me, siamo ancora a quello stadio lì, nel senso che

ci vuole una risorsa giovane che creda nel progetto, veda potenzialità e sia disposto a mettere sul tavolo un anno o un anno e mezzo di duro lavoro.

In questo momento questa ricerca è rimasto un brevetto, un prototipo funzionante che però cerca partner.

Forse arriverà un paper, noi come docenti accademici siamo contenti però la parte commerciale è ferma perché io non ho le risorse, ho dei collaboratori ma non possono rischiare su quella roba lì. Non me la sento di farli rischiare su quella roba lì.

Per gli aspetti futuri si aspetta qualche azienda interessata per poterlo ceder? Sì.

6

Qual è il ruolo, ad oggi, dei membri del team?

C'ero io, il professore Asinari, c'era Matteo Morciano che è il dottorando e poi c'era Matteo Fasano che è il ricercatore e poi ho avuto dei borsisti e un tesista. Io ho, ovviamente, supervisionato, ho seguito la parte di progetto, di costruzione in officina, quello che potevo fare ovviamente, che era il mio ruolo di coordinatore. Il lavoro sporco di montaggio, prove, ecc., l'hanno fatto appunto i tesisti e i borsisti.

Chi è rimasto all'interno del suo gruppo di ricerca? C'è Morciano che ora finisce il dottorato.

Ci sono ancora loro e manca solo il ragazzo. Sì, che era la parte attiva perché appunto i dottorandi hanno poi, ovviamente, il loro progetto di dottorato, deve scrivere la tesi e quindi è tutto preso. I ricercatori sono valutati secondo i bandi quindi hanno bisogna di pubblicare come pazzi.

7

Pensa che un percorso di formazione imprenditoriale per i giovani ricercatori del team avrebbe aiutato ad aumentare le possibilità commerciali della sua tecnologia?

Secondo me, sì. Anche lui sarebbe stato adatto per questa cosa qui. Questo senz'altro. Il perché poi lui abbia abbandonato la cosa, ci sono poi motivi personali, la famiglia non riesce a mantenerlo per 6 mesi e quindi lui si deve trovare un'alternativa. Una persona senz'altro aperto a questo tipo di esperienze.

Magari una borsa da ricercatore per un anno.

Questo è esattamente quello che avevamo chiesto all'azienda che avevamo incontrato ma poi non si è fatta più sentire. Una borsa non per mettermi i soldi in tasca io, ma per dare i soldi a lui, dargli un minimo di tranquillità per fare questa roba qua.

8

Ci vuole dire qualche altra cosa che pensa sia rilevante in relazione a come il PoC ha agito sulla sua ricerca?

Più o meno le cose importanti sono queste. Secondo me, in Italia manca un po' la parte di investitori, tipo U.S. che ti danno un credito più agevolato con meno pretese, sembra che quando ti danno i soldi vogliono mille garanzie. Se devo dare le garanzie a te perché non ce le ho io, se avessi avuto le garanzie o i soldi rischiavo io. "Allora chi rischia io o tu?". Questa è una questione. L'altra questione è, appunto che mi sono accorto, che hai bisogno di tutto una serie di condizioni non facili da realizzare nell'accademia italiana. Hai bisogno delle persone, del borsista, che possa investire risorse e tempo su quella roba lì. Non ho una risposta o una soluzione su come si potrebbe fare per risolvere quella roba lì. È semplicemente quello di cui ho avuto esperienza. Il dottorando stesso si trova in una condizione, in

un bivio, cioè lui molto probabilmente sta perseguendo la carriera accademica, almeno ci proverà, allora ha bisogno di pubblicare come un pazzo per tenere il passo dei concorrenti e allora se si mette con la borsetta in mano a bussare le porte degli imprenditori, perde un sacco di tempo, cioè chiamarli, i meeting, convincerli, mettere su la spin off ecc., tu non pubblichi niente e quindi è una scelta di vita e allora a quel punto stai puntando tutto su quella roba lì senza avere il piano b. Il docente dal canto suo, non può giocare con la vita del dottorando. Quindi io vedo la possibilità solo per un neolaureato che può tranquillamente mettere sul tavolo un anno e mezzo della propria vita se la famiglia glielo consente perché non rischia molto. Se l'idea è valida magari lui trova il modo, spingendo, lavorandoci, impegnandosi di portarla avanti. Ci sono un sacco di condizioni da soddisfare.

Li finanziamo sui fondi liberi, nel senso che se ti viene una nuova idea e non hai i dati preliminari, è semplicemente un'idea nella tua testa e quindi anche scrivere una proposta di progetto su quell'argomento, quella proposta sarebbe debole perché non è suffragata da dati o da esperienze preliminari. Quindi devi formare in qualche modo degli elementi, dei dati o dei risultati parziali a supporto per poi cercare un finanziamento ad hoc. In questa prima fase cerchiamo di finanziare con i nostri fondi liberi, nel senso che ci sono dei fondi che accumuliamo facendo progetti europei, esatto i residui. Nel momento in cui il progetto è terminato e completato ci sono dei residui che accumuli e cerchiamo di reinvestire questi residui sulle idee che ci sembrano più promettenti, che non sono ancora finanziate ma che secondo noi sono promettenti.
OPPOSTO - Devo dire che negli ultimi anni, non so se continuerà questa tendenza, sono stati dati dei fondi, tra cui anche l'iniziativa del PoC, sono stati aperti dei bandi competitivi a supporto, ma anche è stata un po' esteso il finanziamento quello ordinario, chiamiamolo così, per cui qualche fondo per alimentare questa fase delle nuove idee. Insomma, è stato molto utile, nel mio caso lo è. Noi abbiamo dei fondi dai progetti europei ma sono vincolati allo scopo, quindi se ti viene un'idea un po' off che magari c'entra in qualche modo, ma che non è perfettamente in linea con gli scopi dei progetti non li puoi spendere perché non sono pertinenti. Allora avere sia i fondi di ateneo un po' liberi sia i residui aiuta ad investire sul futuro