

Delegation of decision rights and performance under the University Ownership and the Professors Privilege models

*A comparative study of two academic
technology transfer settings with country
specific examples*

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Abstract

With the enactment of the Bayh-Dole act in the US in 1980, universities, small-businesses and non-profit institutions are permitted to keep the ownership and decision rights over any publicly funded research result or invention. Due to their prestige and good performance, US universities and the models under which they function, are used as role models for many universities around the world. European countries such as the German speaking ones and the majority of Sandinavia are some of the various countries that followed the US example and switched their systems to the University Ownership model. The predecesing system of these countries was the Professors Privilege, under which the ownerhip and rights over inventions belong to the inventor. One of the few european countries that retained the Professors Privilege setting and didn't follow the example of the rest was Sweden.

The effects of the University Ownership model on academic inovation has been a subject of controversy among scholars with many of them claiming that comparison of European with US examples can be misleading and that more country specific research is required.

The aim of this study is to compare the University Ownership model with the Professors Privilege one, using Norway and Sweden as examples. Focus is set on how the delegation of decision rights under these two models, affects performance. To measure performance, parametres such as potential revenues, benefit for society as well as satisfaction and implications among the technlogy transfer actors that can lead to sub-optimal results were taken into consideration.

Although choosing one system over the other as far as performance is concerned is rather difficult since both have their pros and cons, it seems that the Professors Privilege setting has a slight advantage over the University Ownership one. This is because inventors are more satisfied since they can freely choose the commercialization path that fits their goals and aspirations. Furthermore, the chances of disputes and interest conflicts between the commercialization actors which can lead to sub-optimal results are lower.

Acknowledgements

The following master thesis was the result of an effort put from between January and May 2018. During this time interval I investigated how the delegation of decision rights, the kind of decisions made and related to these decisions knowledge, under the University Ownership and Professors Privilege academic technology transfer models, affect performance.

Writing this master thesis was rather challenging especially under such a time limitation and I would first like to thank Matthew Good for his priceless assistance and guidance through this project. The contribution of Truls Erikson was also extremely valuable as it was him who proposed this thesis topic and brought me in touch with the appropriate interview candidates. I also want to thank all the interviewees who were willing to spend some of their time participating to this project despite their hectic schedules.

Finally, I would like to thank my friend Victoria Thomas for revising and providing me with her comments on the thesis.

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1 Introduction and Research Question

In recent years, initiatives supporting technology-based economic growth have increased with a focus on stimulating academic innovation with an emphasis on patenting, licensing, start-up creation and university-industry partnership. This activity is referred to as “academic technology transfer” since we’re talking about inventions developed by academic researchers. The value of promoting academic entrepreneurship is widely agreed upon (Grimaldi, Kenney, Siegel, & Wright, 2011). The transfer of academic inventions to the private sector is increasingly believed to play a role in the initiation of new businesses, the growth of existing ones and in providing new job opportunities. Furthermore, promoting new technologies has a direct positive effect on social wealth.

One of the most important and influential pieces of legislation in the field of academic entrepreneurship is the Bayh-Dole enactment in the US which transferred the control and ownership of innovations from the government to the institutions where they were invented. This means that universities, small-businesses and non-profit institutions using federal research funding would now own their research results and be responsible for their commercialization. This led to an increase in patenting and licensing of academic research results coming out of US universities increasing in this way the institute’s revenues which can be used for reinvesting in further research.

While these changes were taking place in the American system of innovation, commercialization in Europe, particularly in the German speaking countries and Scandinavia, was carried out under a different model called “The Professors Privilege”. Under this model, university professors are allowed to retain ownership and the intellectual property rights over their research results and can decide the way these results will be used (Thomas Åstebro, 2015).

World renowned and prestigious American universities have always worked as role models for universities around the world due to their successful status. With Denmark taking the first step in replacing the “Professors Privilege” model with institutional ownership, Germany Norway and Finland did the same in hope that they would see results similar to those of the American institutions. Sweden was the only Scandinavian country to retain the “Professor’s Privilege” model (Geuna & Rossi, 2011).

By switching to the University Ownership, universities in the above countries were now the owners of all the inventions coming out of their institute. Technology Transfer Offices to whom the decision rights over the inventions are transferred, were established. Their responsibility is the successful commercialization of university-based findings.

The effects of the Bayh-Dole Act on societal benefits and the dynamics that are formed amongst the technology transfer actors in the US are rather controversial and inconclusive (Mowery, 2001; Rhines, 2005). Research carried out by various scholars in an effort to chart the effects such a change in the academic commercialization system could have had in European countries, concluded that it is a rather complex task to do and that parallels with the US example could be misleading. European University IPR systems remain highly differentiated and a one-to-one comparison with the US system is very difficult. There are different forces and factors in effect in each region that make the comparison of the different systems rather challenging. In order to understand the effects that the adoption of an institutional ownership approach has in each case, more country-specific research has to be carried out (Geuna & Rossi, 2011).

1.1 Problem Statement and RQ

With the belief that more country specific research needs to be carried out to better understand the effects institutional ownership has in each case, this study will be comparing the University Ownership model with the Professors Privilege one by using Norway and Sweden as proxies. Focus is set on how decision rights are delegated under these two models as well as on the decisions that have to be made, on the kind of knowledge the decision makers have related to those decisions and on how these three focus points affect the technology transfer performance. Hence the research question is:

How does the delegation of decision rights under the University Ownership and Professors Privilege models affect the processes performance?

1.2 The importance of this research project

After carrying out an extensive literature review, little information was found on how the delegation of decision rights under the model of University Ownership affects the performance of the technology transfer process. I therefore decided to answer the call for

more country specific research by carrying out an exploratory study on these effects in the Norwegian context. By carrying out an exploratory research, the aim is to enhance our understanding on the matter and contribute to the creation of foundations on which future researchers can build upon. Knowledge generated from this and similar researches could also provide policy makers with a better insight on the matter and aid them in coming up with more successful policies.

1.3 Layout of the project

Following is a literature review where basic theory and concepts that are used through the paper are introduced together with a presentation of what scholars have done related to the topic researched. Next is the presentation of the project design. After that, I present my results from the field, discuss them and then reach some conclusions. Finally, I give some suggestions for further research that could help future researchers interested in the same or related topics.

2 Theoretical Framework

2.1 Technology Transfer Approaches

The term academic technology transfer refers to the transfer of knowledge from its creator to another person or organization for some purpose or for the benefit of the public (Young, 2005).

There are two different approaches to transferring technology from the academia to the market. The first one, widely used around the world, is the University Ownership model where the university holds all the rights to research results of their employees if they have used university equipment and funds to achieve those results. The second one is the Professors Privilege model, which gives the right to the inventor to decide if and how will the invention be commercialized, even if their research was supported by public funds (Dirk Czarnitzki, 2015).

Transferring technologies from the academia to the private sector plays a significant role in entrepreneurship, in growing existing businesses and new job creation (Harmon Brian, 1997). Transferring knowledge from university laboratories to the private sector also plays a crucial role for the technological and financial growth of a country (Rhines, 2005). That is why an increased focus and interest has been observed by policy makers about this process.

Arguably the most influential enactment concerning the academic technology transfer process is the Bayh-Dole Act. For the greater part of the 20th century in the US, the government held ownership of all patents granted with government money. Furthermore, the government also held the right to license those inventions to the private sector. However, the technology transfer process was impeded by government policies on technology licensing. The U.S. government would license non-exclusively to the private sector and companies would not invest in technologies they did not have exclusive rights to (Rhines, 2005). For this reason, many good technologies that could be used to create value and wealth were left unused. In an effort to increase the number of university technologies reaching the market, the US congress enacted the Bayh-Dole act, which permits any type of institution or small business using federal funding to develop an invention, to retain ownership over that invention. This means that in a university context, the university now owns any invention spanning from the

research activities of its employees. In order to control and manage the legal aspects of invention disclosures, the licensing of IP and the overall commercialization process, universities established the so-called Technology Transfer Offices or TTO's. In this model, it is typically the TTO who has the decision rights over deciding whether to commercialize a technology or not.

Although the Bayh-Dole act is considered to have been rather successful in providing a general framework to promote the utilization of publicly funded R&D and as one of the main factors that led to the growth of patenting and licensing in American universities, a lot of controversy has arisen around it among researchers and policy makers (Mowery, 2001).

The implementation of the Bayh-Dole act may lead to increased conflicts of interest between the inventor, the university and the licensee, missing in this way it's original goal to improve the ties among these three actors. It can furthermore lead to the redirection of research, less incentives for scientific disclosure and a greater emphasis in applied rather than basic research (Schacht, 2009). In addition, the technology transfer office's (TTO) function is seen as unnecessary in some cases and may even impede the commercialization process since it is the least knowledgeable actor in the licensing relationship, which can lead to ineffective decision-making and poor negotiations (Kenney & Patton, 2009). Another issue is that TTO income has become of greater importance for many universities than the dissemination of research knowledge working in the interest of the society and that in the university ownership model, inventors are tightly dependent on the university's TTO regardless of its competence (Kenney & Patton, 2009).

It was only within the past decade that countries such as Denmark, Germany, Finland, Norway and many more changed to policies similar to the US Bayh-Dole Act (Erika Farnstrand Damsgaard, 2013). US universities are considered as highly successful and therefore their methods and policies act as role models and are copied by a great number of universities around the world.

An alternative to the University Ownership model and its predecessor in the European countries mentioned in the previous paragraph, is the Professors Privilege model, seen nowadays only in a few countries such as Sweden and Italy. Under the Professors Privilege system, it is the faculty and more specifically the inventors that own their inventions rather than the university (Erika Farnstrand Damsgaard, 2013). Researchers can disseminate new

knowledge and technologies successfully through firm ties that they usually hold with the industry, via science and technology conferences where they meet industry representatives and their peers, or by approaching bodies such as Innovation Offices to get aid for the commercialization of their inventions. Because of the fundamental difference between the University Ownership model and the Professors Privilege model, the decisions that have to be taken during the commercialization process and the rights for those decisions, differ as well. As this study focuses on the decisions that are taken during the commercialization process of the above two models, on who has the rights over those decisions and on the related to the decisions knowledge held by decision makers, some theory about decision rights is presented in the next section followed by a more in-depth description of the University Ownership and Professors Privilege models.

2.2 Decisions and Decision Rights

Since this paper deals with decisions and decision rights, it would be useful to first define what decision and decision-making means. A decision is the selection of the best option from a choice set containing two or more options (Beach, 1993). As a conclusion “decision making” can be described as the process and logic through which individuals arrive to a decision.

Jensen and Meckling (1992) wrote a paper on the delegation of decision rights within an organization that worked as an inspiration and as part of the theoretical backbone of this paper. They claim that when the rights over a decision are with the one that holds the most relevant knowledge, the performance of an organization increases. Knowledge over a subject is a necessity if decisions are to be made over it. Two types of knowledge are defined, the specific knowledge that is costly to transfer among agents within an organization and the general knowledge which is rather inexpensive to transfer. The limited capacity of the human brain and the cost of producing and transferring this specific knowledge means that the knowledge needed for every decision making can never lie with a single individual or body of experts. In order for an organization’s CEO to benefit from the knowledge and proximity the employees have over certain areas or activities, sharing of control via the delegation of decision rights down the organization’s ladder should take place (Graham, Harvey, & Puri, 2015; Meckling, 1992). There should be thus a system for delegating decision rights to individuals who have the required knowledge and abilities or who can acquire or produce

them at low cost. Control systems are also required to motivate individuals to use their specific knowledge and decision rights for the interests of the organization and not for their own. In many organizations, all decision rights sit with the executive directors and it is them that decide how and to whom those rights will be assigned to in order to achieve a maximum value gain. To avoid self-interest driven behavior from agents now holding decision rights, as mentioned in the previous paragraph, the CEO and board of directors should set a control system that will foster desirable behavior. This control system should, according to Jensen and Meckling (1992), specify the performance measurement and evaluation system for each decision agent, as well as the reward and punishment system related to the agent's performance.

As mentioned earlier, the above theory can be used as a guide and a theoretical backbone, as this study is looking into the decisions, decision rights and related knowledge, in the academic technology transfer process. In the academic technology transfer, there are various decisions to be made and different actors with the rights over those decisions and with different knowledge. The process of academic technology transfer therefore, resembles the processes in the type of organization Jensen and Meckling (1992) were studying, where various actors with different decision rights and knowledge have to make the best possible decisions. Since the delegation of the decision rights over a decision to the actor with the most related knowledge leads to an increase in organizational performance, my aim is to see if the same conclusion would apply in the commercialization of university inventions.

2.3 Tech. Transfer Process

2.3.1 University Ownership

Before starting to count and describe the various types of decisions that are made during a technology transfer process and who is responsible for them, it would be useful to first present the processes in order to get a good overview and understanding of them.

Recent research looking into the academic technology transfer process under the UO setting, claims that it is a more complex path and less straightforward than what it was believed to be before. Scholars believe that the linear system that was used to depict the commercialization process before, does not fully describe the whole event as it fails to consider various informal

mechanisms (Samantha R Bradley, 2013). My focus in this study though, are the formal steps of the transfer process and thus no informal mechanisms were included. Therefore, I decided to use a more linear model, that of figure 1.



Figure 1. Technology Transfer Process under the University Ownership Model (Everett M. Rogers, 2001; Samantha R Bradley, 2013).

Once inventors come up with an invention, they must first decide if they want to disclose their invention to the university’s TTO. They do that by filling out a disclosure form. Then the university TTO assesses the invention and decides if they are going to accept it and move forward in pursuing a patent with the help of the inventor or reject it. For this assessment, the

TTO must consider the commercial potential of the invention as well as the perspective interest from the private sector (W. a. L. Siegel, 2003). Once a patent is achieved, the TTO together with the inventor has to decide the commercialization path of the invention and the source. They will try to market the invention and target mainly already established firms or organizations, but also entrepreneurs that would like to start a new venture with the offered technology. The goal of the TTO is to match the invention with a firm, organization or entrepreneur that can utilize the technology and achieve revenues for the university (Samantha R Bradley, 2013). Once the TTO has found and decided on the appropriate candidate, both parties work over a licence agreement that usually includes compensations such as royalties for the university or equity in case a spin-off firm is established. The inventor is many times involved in the licensing process as a technical consultant or as an entrepreneur if a spin-off is to be established (D. S. Siegel, Veugelers, & Wright, 2007). Once an agreement is reached, the technology is officially licenced. If the technology is licenced to an already established firm, any royalties gained from the licence agreement are divided among the University, the TTO and the inventor. After it is licenced, a technology usually undergoes through extensive adaptation during its commercialization and the university and sometimes the inventing scientist, might continue to be involved with the firm/organization or entrepreneur to assist that process. (Thursby, 2001).

2.3.2 Professors Privilege

At the same time, the Professors Privilege model, indicates that the rights over an invention belong exclusively to their inventors and it is them that decide what to do with their results. The university has no right to ownership stakes as far as the IP is concerned (Bourellos, Magnusson, & McKelvey, 2012; T.Åstebro, 2016).

In contrast to the University Ownership model, the Professors Privilege model resembles less a linear process. It is in this case the inventor who holds the intellectual property rights and decides how the invention will be commercialized (Erika Farnstrand Damsgaard, 2013).

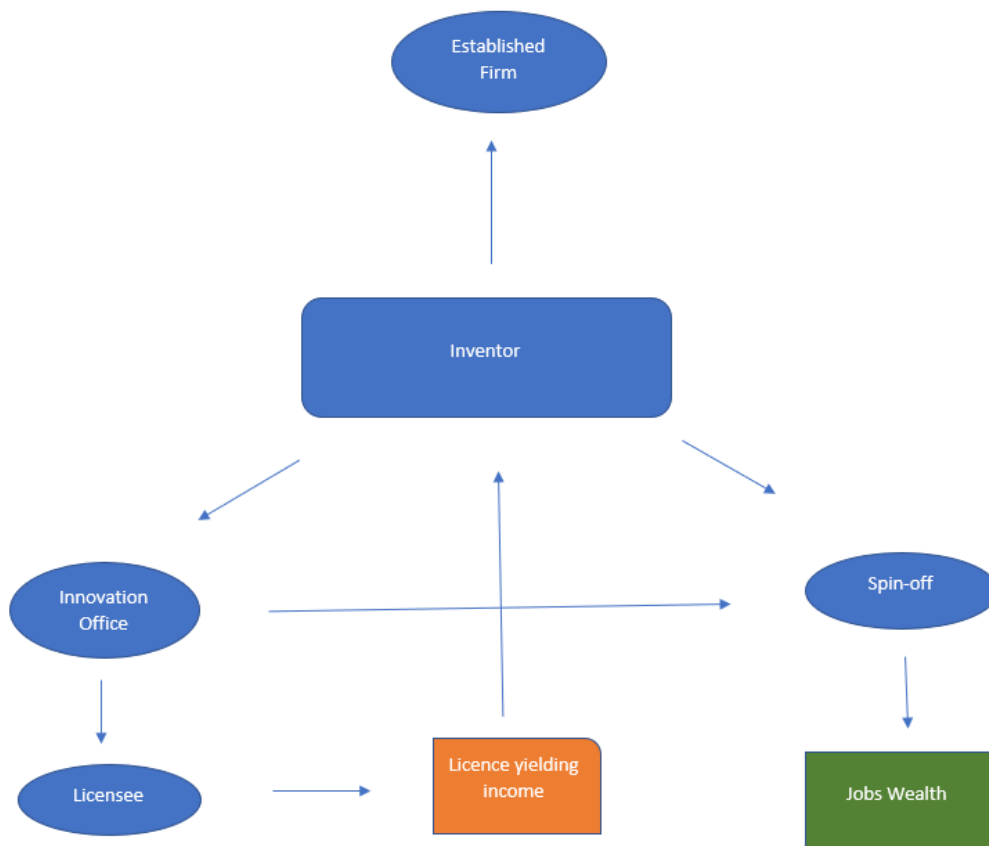


Figure 2. Technology Transfer Process under the Professors Privilege model.

Since the inventor has now full control of the invention, it is up to him/her to choose the path of commercialization. Thus, the first key decision is the path to be followed. There are three distinct alternatives. Scientist have usually, to a greater or lesser extent ties with the industry, the first choice for the scientist is therefore to sell the invention straight to an established firm in exchange of a generous compensation. A second option is to commercialize the invention on his/her own by following all the steps that a new venture has to follow such as searching for funding, the appropriate team, location, customers etc. Lastly, the inventor can choose to seek help from Innovation Offices. The role of Innovation offices is to guide and help inventors in the commercialization process without claiming any equity or rights over their inventions (Erika Farnstrand Damsgaard, 2013). We can see that in this process there is one key decision, that of which commercialization path will be followed. After the commercialization path is chosen, further sub-decisions could follow. Examples would be the

decision of inventors to follow or not the advices of Innovation Offices or deciding if a deal with potential partners is good enough or not.

2.4 TT decision rights set-up

Even though the US and the majority of European countries have similar IPR systems that allow institutional ownership, there can be substantial differences among them when it comes to national laws dictating how this system is going to be implemented and function. One such difference can be in the way rights are vested in universities. In Norway, under the “pre-emption rights” principle, the researcher is the first owner of the invention, but the university has the right to claim the invention within a specified amount of time otherwise it remains with the inventor (Geuna & Rossi, 2011). It should be mentioned here that according to the University and College law in Norway, researchers are expected to inform TTOs for any patentable invention. After the researcher decides to fill a form of disclosure for his/her invention, all the IPR over that invention are transferred to the university TTO. That means that the TTO has the right now to decide whether to go forward with the invention or reject it -in which case the rights return to the inventor- and the right to choose the source of investment in order to move the project forward. Furthermore, it is the TTO that has the right to decide to whom the technology will be licensed to though the opinion of the researcher is taken into consideration on the matter. Once the technology is licensed, the rights over it lie with the licensee.

Under the Professors Privilege model in Sweden, unless agreed otherwise, all the rights over an invention sit with the inventor. That means researchers have the right to decide if they want to commercialize their invention and the right to choose to whom. These rights are transferred or split with second parties when the inventor decides to sell, license or seek funding for the commercialization of his/her invention (Baraldi, Ingemansson, & Launberg, 2014).

2.5 TT Performance

Measuring the technology transfer performance of universities, can help the institutes identify their weaknesses on the matter and take actions that will improve their effectiveness and efficiency. The performance of the TT process has been measured in multiple different ways.

One way, and the most prevalent, was to measure the revenue generated from the licensing of technologies. Technology offices with higher income were considered more successful. This type of approach though, fails to take into consideration the core missions of academic institutions such as education, research and community service. To follow their mission and provide a positive impact in local and larger communities, many universities would continue various of their activities even if they lead to a financial loss (Fraser, 2010).

Various researchers but also managers and entrepreneurs, propose that different metrics and a wider range of criteria should be taken into consideration. Such criteria include amongst other the technology transfer budget of the institution, the number of licensing deals signed, the number of eventual products in the marketplace, the number of companies and jobs created as a result of a license and last but not least the public value created. Various institutes look more broadly to their measurements suggesting that instead of using only inputs and outputs such as the number of disclosures and licensing agreement, the outcomes/impacts of a technology in the marketplace and society, is of higher significance (Fraser, 2010). Finally, different metrics and expectations should apply to different institutes and their TTOs since some of them are older and more experienced than the rest.

In this paper performance will be measured by considering aspects such as satisfaction of the inventor and the TTO, implications among the TT actors leading to sub-optimal results, as well as benefits to society and the potential for revenue creation.

In the previous section, the technology transfer process under the University Ownership model and under the Professors Privilege one was presented with a focus on the decisions that are made in each case and the way the rights over them are delegated. In the next section, the methods used in this research will be described.

3 Methodology

3.1 Research Design

Since this research “Investigates a contemporary phenomenon in depth and within its real-world context especially when the boundaries between phenomenon and context may not be clearly evident” (Yin, 2014) a case study design was chosen.

The design found most appropriate for this research was that of an exploratory case study, since there was very little literature touching upon the relationship between the knowledge the various actors of the technology transfer process hold, the decisions they make based on this knowledge, the ways decision rights are delegated and the performance of the commercialization. The goal of this study is to explore how the delegation of decision rights to individuals with specific knowledge and the decision they make based on that knowledge, effect the performance of the commercialization process of university born inventions. As a theoretical backbone for this research the article of (Meckling, 1992) was used suggesting that when the decision rights over a decision lay with the one holding most of the knowledge needed for the decision to be made, then the performance of the organization increases.

3.2 Case description

According to (Yin, 2014) this study is a multiple-case embedded one, since it investigates two different cases with multiple units of analysis. The first case was a Norwegian scientist who has commercialized his/her inventions before and after the University Ownership enactment, with the before commercialization being the first unit and the after commercialization the second unit. The second case was the commercialization offices that I chose to interview in Norway and in Sweden. The Norwegian commercialization office was the first unit and represents the after-University Ownership era and the Swedish commercialization office was the second unit representing the pre-University Ownership era. To further support the data from the initial interviews, additional interviews were carried out. For the Norwegian model which represents the after-University Ownership enactment era, an additional scientist with a long history of successful invention commercialization was interviewed while for the Swedish system which represents the pre-University Ownership era, an additional professor and expert in entrepreneurship was interviewed.

3.3 Reliability and Validity

To ensure reliability, I interviewed the main actors of the technology transfer process so that the perspective of each is taken into consideration. In this way I could avoid as much as possible to draw conclusions based on biased opinions that presented only half of the story.

The research is looking into two contexts, that of the University Ownership model represented by the Norwegian TT system and that of the Professors Privilege model represented by one Norwegian case and by the Swedish TT system. In the University Ownership model, the two core actors and decision makers in the commercialization process are the inventor and the Technology Transfer Office that acquires the rights over the inventor's invention by law. It is the TTO then that is responsible for the commercialization of the invention. As this is the case, I decided that both parties should be interviewed in order to secure a satisfying degree of reliability.

Now as far as the Professors Privilege model is concerned, all the weight for the initiation of the commercialization falls on the inventor as there are not TTOs that lawfully take over the intellectual property of academic inventions. Researchers can freely choose to transfer their invention straight to industry partners, license their invention or establish spin-offs by collaborating usually with so called Innovation Offices that assist the inventor with the business aspect of things. Both an inventor and an innovation office were interviewed but unfortunately no industrial representatives due to a limited available time for this study to be complete. Hence, a spherical image on the matter was not achieved which might have a slight effect on reliability, though the two other parties interviewed had lots of experience and well-rounded knowledge about how the Professors Privilege model works and the dynamics formed among the three mentioned actors.

Triangulation of the data to ensure validity, was achieved by using multiple sources of evidence since additional interviews were carried out with inventors and experts on the commercialization systems of Norway and Sweden in addition to the interviews from each case. Furthermore, the different perspective of different sources concerning the same theory, is an additional fact that adds further validity to this study

3.4 Data Collection Process

The first step in the data collection process was to find relevant -to the research topic- literature. The first article “Specific and General Knowledge, and organizational structure” (Meckling, 1992) which I used as a theoretical backbone, was introduced by my supervisor. Then a literature research on the Bayh-Dole followed, mainly by writing “Bayh-Dole” in the search engines Google Scholar and Oria. Following that, I searched for “Professors privilege” in the same search engines to find literature about that model. My following literature researches were on the academic commercialization process under the University Ownership model using search words such as “academic commercialization”, “university ownership model” and “technology transfer”. Next, I searched for literature on the allocation of decision rights for which mostly the citations from the article of Jensen and Meckling were used, and on performance measurement for TTOs for which the words “TTO performance” were used. In addition to my literature research, additional literature was provided by my supervisor.

I tried to select articles similar to the research topic of my project. That included articles describing how the University Ownership and Professors Privilege models work, articles that compared the two models and articles that debated on the pros and cons of the Bayh-Dole enactment and suggested alternative hybrid models.

The second step included finding the appropriate candidates for the collection of qualitative data. The majority of the ones I chose to interview were introduced to me by my supervisor. The initial candidate criterion when looking into the Norwegian context was as mentioned earlier, inventors that had commercialized their inventions before and after the change of law concerning such commercialisations. Later, after seeing that it was a bit more challenging than expected to find such inventors, I decided to also include inventors that had commercialized their inventions only after the enactment of the new law concerning academic technology transfer. As far as Sweden is concerned, proper candidates were inventors that had commercialized their inventions, ideally more than once. Below is a table presenting a bit of the background of the five interviewees included in this research.

| | |
|---------------|---|
| Interviewee 1 | Academic researcher and entrepreneur. Started a firm under the Professors Privilege model and a couple of firms after the University Ownership model came into effect |
| Interviewee 2 | Academic researcher with a long track of invention disclosures and patenting -under the University Ownership model many of which became big successes. |

| | |
|---------------|--|
| Interviewee 3 | A technology and strategy manager from a Norwegian TTO. |
| Interviewee 4 | Innovation and Entrepreneurship professors of a Swedish university with extended experience and knowledge in both the Professors Privilege and the University Ownership model. |
| Interviewee 5 | Technology and strategy manager from a Swedish innovation office |

Table 1. Interviewees Background

3.5 Identity Protection

The interviewees were informed that the interviews would be confidential and that no names would be used in the paper since some of them have close collaboration with each other, a potential leak of identity could cause problems on their relationship. For this reason, alphabetical letters are used instead of the name of the interviewees. In addition, I intend to send a copy to each interviewee before the final presentation of my paper, so that I have their consent about the content.

3.6 Results Analysis

The first step of the data analysis process was to transcribe the interviews I carried out, with the help of the Nvivo software. I then used two cycles of analysis for my transcribed data. In the first cycle, I used “piori” codes to condense and summarize my data in accordance to the codes “decisions”, “decision rights” and “knowledge”. In the second round a narrative approach was adopted for presenting the summarized data.

4 Findings

In this section the findings from analyzing the primary data will be presented. I found that a good way to categorize the findings would be by the decision they described. Thus, the decisions made during the process of commercialization and their related findings, are presented in a timeline-like manner below.

4.1 Decisions under the UO and PP systems

4.1.1 Disclosure Decision

Both processes, the University Ownership and the Professors Privilege, followed the processes shown in Figure 1 and 2, respectively. Every interviewee confirmed that the first step in the commercialization process, is the decision of the inventor to disclose their invention. While under the PP model inventors have the right for this decision, under the UO model inventors are expected by law to disclose any research result with commercial potential, though it was found that Norwegian universities are not so strict and don't push inventors so much on the matter.

“we have something called the Professors Privilege in Sweden which means that, unless you've agreed otherwise for instance in a research agreement, the researchers at the universities own the rights to their own results and can do whatever they want with it, not whatever they want with it but the idea is that it's theirs to use compared to if you're going to be an employee in an industrial company or compared to universities in Norway or Denmark for instance. “(Interviewee 5)

In Norway, it is the TTO that takes over the ownership of an invention as soon as a disclosure is made. From the interviews, I found that in the case of dissatisfaction with the services of the TTO, researchers could even consider bypassing the TTO and disclose their work to third parties or commercialize it on their own, even though they don't have the right to do so and such an action would not be in accordance with what the law dictates on the matter.

“With my next ideas I want to do it differently, I don't want to follow the rules, I want to let's say start a company” (interviewee 1).

Instead, in Sweden under the PP model, inventors are free to choose the way they want to disclose their inventions. Their choice depends to some degree on their interests, drive and aspirations and on if they see themselves as entrepreneurs ready to create a new venture. In some cases, researchers have already close established ties with industry players and are used to transferring the rights over their inventions directly to them for a fee.

“I think it depends on... I think to some extent it depends on their own interest and their own drive. There are certain researchers that see themselves as entrepreneurs, there is not a lot of them, but some of them do and they want to do venture creation and then they kind of seek out the resources available. There are researchers that have extensive networks already in the industry or used to working with the industry and used to transferring their rights to the industry for a fee or... and then it is convenient for them to just jump straight to that.”

(Interviewee 5)

4.1.2 Acceptance or rejection of invention

The second step in the process for both the TTO in Norway and the Innovation Office in Sweden, is to sit and have a quick internal evaluation of the disclosed invention and based on their knowledge, decide if revenues can be generated from it. They do that by assessing the patentability of the invention, the size of the targeted market and its market potential, if the invention is a product or method and if the disclosure form accurately describes the invention. They try to understand and describe the invention at hand as well as possible.

Norway:

“... usually we receive a written disclosure of invention, and then we take a quick internal evaluation of it and sort of, just based on experience, do we think it possible to earn money from this? And then of course asking this question we ask, "Will it be possible to protect the invention? Can we make a patent application and hopefully get patent?" so that is the IPR part and second is " do we think there is a market? Is there a need for such a product?" and "is the dofi (disclosure of invention) at all describing a product? Or is it the process or a method?"(Interviewee 3).

Sweden:

“We have a meeting we have a discussion, we try to figure out what is it that they have, and sort do the verification around that, who owns it like I said and everything like that... or who controls it or who has rights to it. User rights or whatever. And then we try to figure out what would be the best way to take this forward to realize this. And that is not always clear, so in many cases we say, ok let's make into a verification project, let's apply for funding”(Interviewee 5).

During the assessment of the invention, the TTO and Innovation Office teams work a lot with reviewing related literature and carrying out an extensive research on the web. It is often that the novelty of the invention is questioned after finding out that someone has already done the same or something similar to the disclosed invention.

“Then we go back to the office and then we start working with literature and that is often a bit depressing because you have a meeting with a very enthusiastic inventor and they usually claim that their inventions are special, unique, best in the world and nobody has ever done anything like this before, but when we start digging into literature we usually find that somebody has been doing something similar” (Interviewee 3)

The assessment of the invention is a very knowledge-based process. Both business knowledge and a more than basic technical knowledge is required. Most of the employees working at the TTO and innovation office have some technical background in different sciences and a good part of them has even completed PhD studies in their field.

“Haven't got a PhD but I would say that half of our staff have a PhD and then we have a variation within different technological backgrounds because we're working in tech university so it's a good thing to have a tech background of some sort” (Interviewee 5)

The team will then meet again after their initial research, to address further issues and inquiries about the invention at hand.

“do we still think it's worth pursuing this or not?” and then very often we have new meetings to discuss «is it new? Is it better? Do we still think it has a market?” you could typically say” (interviewee 3)

After the initial assessments are over, the TTO or Innovation office team will decide if they accept the invention and are willing to move forward with it or, if in their opinion the

invention is not ready or mature enough, reject it and ask the inventor to work further on it. It is not only the TTO or Innovation Office employees that have some knowledge in both the business and scientific world but the scientists as well. Researchers have various ties with the industry from which they can get updated about new trends, technologies and opportunities. So, in some cases researchers with their extensive scientific knowledge and industry insight, could end up making a sounder judgement about an invention than the mentioned offices.

“Yeah, so I am consulting for biotechnology companies. So, I can see from the questions they are giving me you know from the problems they are working with, about where they are. And it's the world, your looking into a world, so you know how that world is moving. And also, when you go to conferences you can see what others are struggling with and what kind of questions others are asking. You sort of know where it is going” (Interviewee 2)

“...they said we are not interested in this. And I knew it was the wrong decision. So we went to another TTO and they were really interested and so they found some early investors, and then the university became interested and claimed their 15%. They can claim 15% even if they have said no in the first place, but ok.” (Interviewee 2)

The above statement is a nice example of how the lack of specific knowledge can lead to suboptimal decisions and how decision rights are transferred from the TTO back to the inventor when the first rejects the invention. Then the inventor has the right to pursue the commercialization of his/her invention through other means such as contacting other TTO's or commercialization actors.

The researchers/developers many times don't want to have the decision rights over their inventions and be involved in the commercialization process and rather have someone take over their inventions and further develop them without their involvement so that they can focus on new research ideas. Commercializing an invention without the help of the inventor though can prove challenging since the specific technical and scientific knowledge an inventor holds is crucial for the success of the process.

“Yeah, they tried, and this board member tried to do that and said, ‘you need to have a plan for the cash plan...’ and we all said we don't care, it's too boring (...) what I don't like is that nothing happens. It is very nice, everyone is very nice to each other, ‘that's a really great idea they say for everything I send in, but maybe the idea is not perfect and you know it never is, so

they say 'maybe you would like to work on it a bit more, work a bit more on it to make it more perfect' and I say 'yes probably I should do that'. But that's not how it should be because I don't have time to do that, what it should be is that they say 'this is a great idea, we will now go to a patent office, they will write a patent and we'll put this guy or woman on this and we'll drive the process. We'll contact you when we need your help' and then they start it." (Interviewee 1).

4.1.3 Patent application timing

To my surprise, many similarities were also found, between the two models, when an Invention gets accepted by a TTO or Innovation Office. The main difference was that, as mentioned earlier, the rights over the decisions made under the UO model were with the TTO while under the PP model they were still with the inventor.

Once a TTO has decided to move forward with an idea, their next decision is the timing of filing for a patent for the invention, since patenting in different times can lead to different losses or gains and that is a piece of knowledge held by the experienced employees of the TTO. A researcher deciding to file a patent on his or her own, without having this specific knowledge, might end up paying much higher amounts of money for the patenting than otherwise.

"then the first step is to write a patent application or at least prepare for a patent application because it is wise to postpone the actual filing of the patent as long as your dare, but you have to be early enough to really protect your idea. But if you file as quickly as you can, you end up having huge expenses in patent." (Interviewee 3)

Under the Professors Privilege model, the Innovation Office does not have the right to file for a patent without the inventor's permission. It is only when the inventor agrees that the office can move forward with the patenting process. The role of the Innovation office in this case is merely to guide and advise inventors through the commercialization process. Inventors can stop using the Innovation Offices services whenever they feel so, can decide or not to follow the advice offered and can also decide the degree of involvement of the office. Innovation offices are paid by the Swedish government to support researchers, teachers and students with anything related to innovative ideas and their commercialization. Even though inventors have

such a freedom of choice, they usually stick to the innovation office's advice due to the specific knowledge they hold when it comes to commercialization.

“The innovation office, there are several of them. It's an assignment (...) ministry of education. The ministry of education has decided that ... university should have a so called Innovation Office and they pay for that, to help and support researchers and teachers but also students at the university in all aspects (...) It means that we are a unit within the university, we're not an external unit (...) We never take ownership in the innovation office and none of the innovations offices in Sweden take ownership (...) If the researchers want us to be part of that discussion, we're happy to be but we don't have to be cause we don't own, so we can't demand to be part of it, but a lot of researchers want to sort of support them. ” (Interviewee 5).

4.1.4 Funding

After a patent has been filed, the next step is to apply for funding and it is the TTO again under the University Ownership model that decides how and from whom this funding will be acquired. The design, establishment and financing of the project is done in cooperation with the inventor.

“So, we work with the researchers to plan a project and finance a project” (Interviewee 3)

It is worth to mention here that as a rule it is the TTO that is managing the projects established but in some cases such as Biotech inventions, it is the inventor that usually acts as the project manager.

“And then if it's the Biotech program then usually it is the inventor that is the project manager with support from the TTO” (interviewee 3)

That means that the inventor is given the right to make more decisions concerning the development of the project such as where does money needs to be spent. The TTO is still the decision rights holder.

There are a couple of governmental bodies that are responsible and can fund new research inventions in Norway such as the Norwegian Research Council through funding schemes such as FORNY.

Similar is the situation in Sweden, under the PP model, where the Swedish Innovation Association (Vinnova) offers funding support to Innovation Offices, called “verification funding”, for verification purposes. This fund is meant to help projects by financing a market research, by paying for consultants in order to get experts advice concerning the new invention and for resolving any issues concerning patentability and IPR. This fund is meant for helping with the technical verification of the new invention and is not nearly enough for bringing it to the market and that is one of the main reasons Innovation Offices do not take any ownership over inventions.

“We have an assignment from them to help projects with funding, we call it verification funding. Basically, when they come to us and say "you know what, I need to know if this patentable or not because I'm going... I'm going to license or I'm going to a research agreement with this company and I'm trying to understand what's going on". So we can pay with the verification money, we have a budget of around 300k SEK max. for a project, we seldom use this much, normally we use around 100k so we can look into things such as is this novel or not, is this patentable? So knowledge research even ... we can fund bringing in consultants to look at how does this fit into the value chain, what do customers need to see in order of it to be of interest for them, is it something that you would license out as a patent or does it need some technical verifications tied to it, sort of market verification, we can enable that and we can also enable to some extent technical verification.”(Interviewee 5).

4.1.5 Licensing or New venture creation

The next milestone in the transfer process under the University Ownership model, after a thorough market research, is to find potential partners where the invention could be licensed to or who could help in the establishment of a spin-off firm.

“So, then we have been evaluating, we have been securing IPR and then we have been securing financing. Then I would very much like to say that the TTO is then working heavily to go into the market place to evaluate the market and work heavily towards finding partners” (Interviewee 3)

It is in this phase important, that the responsible TTO for the commercialization of the invention, has a wide network and knowledge of the industry and the market related to the invention at hand, as well as a connection with different investors, in order to be able to

recognize various possibilities and find the most suitable partner for their project. Even though TTO employees have a good scientific and technical background, necessary in communicating and better understanding the inventor, at the end of the day the researcher is the one with the scientific expertise and the TTO employees are supposed to be the commercialization experts. So, they are expected to be good and have the above-mentioned traits, which can sometimes prove challenging.

“when we are discussing with the scientist, you need to understand the science and that can be quite difficult so when I meet with a scientist they sort of expect me to understand what they are talking about, so most of us do have PhD but then on the other hand... we of course look at the scientist as the expert, so we are not sort of evaluating the science, we are trying to evaluate the value of the invention and in doing so, the scientists do expect that we know sort of industrial figures, we know revenues, we know sort of who is doing what , know which company is doing what, I mean which companies are big in these and these areas, who do we contact and that is a huge task because the number of companies out there in the world is huge and really to find the company that is interested in your invention, to really understand the market place they are fighting in, to really understand the competition in that market place... this is difficult. ” (Interviewee 3)

As invention rights holders, it is the TTO again that leads the negotiations with potential partners and takes the final decision about the type of agreement that is going to take place and to whom will the invention be eventually licensed to. Although the “power” of the TTO over decision making in the commercialization process might seem at a first glance rather absolute, that is not the case. The employees of the TTO try to cooperate and work with the scientist/inventor along the way of the commercialization process and take decisions jointly since the inventors themselves have many times a strong opinion as far as some decisions are concerned such as where will the invention be licensed to. This strong opinion of theirs though can sometimes hinder or even contradict the work or the decisions the TTO takes. Such conflicts between the inventor and the TTO can lead to sub-optimal commercialization results or in the degradation of their relationship if the TTO insists on seeing through a decision the scientist disagrees with.

“We try to work along with the scientists/inventors all the way, so that the decisions are joint, but from a legal point of view the rights to the invention are transferred to the TTO. So, we decide who we want to partner with and when. But it will be very unwise not to discuss it the

professor or the inventor because they have usually very strong opinion on this and they sometimes even have strong opinion on the negotiations and that might be a bit difficult because some of the people here are skilled negotiators and when you bring a university professor to the table that is not a good idea...” (Interviewee 3)

The process is rather similar under the PP model, where after the technical verification of an invention, the Innovation Office helps the inventor enter a second funding stage by finding appropriate investors that will take the project further. The next stage could also be the establishment of a spin-off firm or the license of the invention. The possibilities are various, and the Innovation Office helps the inventor to make the best possible choice. It is usually at this stage that the inventor might start losing parts or all of the ownership over the invention, since professional investors and venture capitalists usually require some equity in order to invest their money and time.

“we always try to help them find a second stage actor that they can go to, we never sort of just leave them and say you know what roam with it we're not going to help you anymore. (...) we're very clear on the fact that we are going to do what's best for the project and the researcher. If there is a fit with the offers that they have at a certain office, perfect we'll push for that, if not, we'll take them to other incubators or we'll find private investors or try help them to find private investors or find companies that are likely to take it forward.”
(Interviewee5).

While it is the TTO that leads the negotiations with potential partners in Norway, under the University Ownership model, the role of the Innovation Office in Sweden, under the PP model, is again advisory. The Innovation Office takes part in the negotiations only if the inventor wishes so.

Once the licensing of the invention or the establishment of a spin-off that utilizes the invention takes place, the TTO considers its job fulfilled and a success, and the inventor might or might not, depending on initial agreement, continue to cooperate with the licensee for the further development and adaptation of the invention.

Although indirectly, the financier of the initial stages of the project exerts considerable influence under the UO model, which I had not considered or included earlier in this study. As mentioned earlier, once the TTO accepts the invention of a researcher, an invention project

is established for which the TTO then seeks funding. This funding is needed to further develop the research results from both a technical and business perspective, until it is in a mature enough stage to be licensed. The actor that finances the project, is usually a public organization such as the Norwegian Research Council. In order to get funding from such an organization, the TTO has to present their project to a board of experts coming from related industries and convince them that it is worth funding. These experts hold extended technical knowledge and experience in commercializing inventions. If this board is convinced, they will then agree and decide to finance the TTO's project. The financier has now some saying on the decisions and work done by the TTO since the organizations money is at stake. If the work and milestones agreed upon between the TTO and the financier are not met or carried differently in any way, the financier has the right and can decide to cut the funding. That can mean the delay or even the abortion of the commercialization process.

“And the Forny program in particular was established for TTOs to apply for money, so that is a specific tool for TTOs to apply for money and that means the panel that is evaluating the applications within the Forny program... they are, in this panel the Research Council uses external experts, so they typically have people from the industry and from universities... So I would say that the quality of the evaluation in the RC has been improving greatly over the last years (...) Yes, they have more decisions on the project, you have to write a progress report every sixth month and it is on a rather high level and the Research Council has also said that they want to have a midterm-evaluation. So we had the evaluation of five projects and they looked into them in detail, because you make the plan and decide which activities will be done on the first and second quarter of 2017 for example and if they are not done or postponed and their money has been used in another way they ask why and if there is a big deviation on what was agreed, they might even consider stop the funding” (interviewee 3)

No such thing was found in Sweden under the PP model, where Innovation Offices can get funded with the “verification fund” as mentioned earlier. No involvement of the funding governmental body (Vinnova) in the work of the Innovation Office was mentioned.

After the commercialization path of an invention has been decided upon, the appropriate for the project partners identified, negotiations taken place and the licensing or establishment of a firm carried out, the job of the TTO in Norway and that of the Innovation office in Sweden is done.

Bellow I present a summary of the decisions taken in each model and with whom do the related rights and knowledge lie.

| NORWAY | Decision Rights | Knowledge |
|---|-----------------|----------------|
| Decision | | |
| Invention Disclosure | University | Inventor |
| Accepting or rejecting the invention and patent application | TTO | TTO/Inventor |
| Funding | TTO | TTO |
| Commercialization path | TTO | TTO |
| Choice of partner and negotiations | TTO | TTO/Inventor |
| Financiers decision to continue funding or not a project | Financing Body | Financing Body |

Table 2. Summary of right holders, decisions and related knowledge under the UO model.

| SWEDEN | Decision Rights | Knowledge |
|---|--------------------------|---------------------|
| Decision | | |
| Invention Disclosure | Inventor | Inventor |
| Accepting or rejecting the invention and patent application | Commercialization Office | Com.Office/Inventor |
| Funding | Com.Office/Inventor | Com.Office |
| Commercialization path | Inventor | Com.Office |
| Choice of partner and negotiations | Inventor | Com.Office/Inventor |

Table 3. Summary of right holders, decisions and related knowledge under the PP model.

4.1.6 Perception of success

Finally, it was very interesting to find out that the perception of success, can differ significantly among the commercialization actors. What inventors often consider a success, a TTO may not and vice versa. For example, inventors might consider it a success, if their inventions are well known and widely used by the group they are targeting even though a very low if any profit is generated.

“So the idea was that maybe we can make it beautiful and functional and nice and sell it as a commercial product so that everyone in science can benefit from it and maybe we can even live from it (...) And today almost 20 years later, this name has become a standard in the scientific field, everyone knows what an X is, so that idea was successful. And we made the

first prototype at the workshop at the department for our research and as it was tested and it worked and then we made the next one after we got the first order. (...) Yes, I own now 75% of the company I think...I pay a lot for owning them and since we don't have much income basically the company is for me mostly an expense. (...) Yeah, but that was never my intention. My intention was to run this company” (interviewee 1)

On the other hand, TTOs in Norway, consider it a success when an invention is successfully licensed and a sufficient to their criteria profit was made.

5 Discussion

The research community is rather divided on the topic of the academic commercialization process, with most of the authors from the literature reviewed clearly taking a position on the matter, by either supporting or disapproving the university ownership model. Due to the controversy among scholars over the University Ownership model, researchers have stressed the need for further and more in-depth analysis of the process and its effects in the overall commercialization process. That is what this study is doing by comparing the University Ownership model with the Professors Privilege one based on the way decision rights are delegated, decision made and related to these decisions knowledge.

The model performance depends on the context they're in and the set goals. By carrying out this exploratory study, I managed to shed more light on the dynamics that are developed among the actors of the academic commercialization process and the impact that these dynamics have on the overall process performance. My findings suggest that both the University Ownership model and the Professors Privilege have their advantages and disadvantages and that no clear lines of one being the better over the other can easily be drawn.

As mentioned earlier, this study compares the University Ownership model using Norway as an example, with the Professors Privilege one that was the predecessor in Norway and today's standard in Sweden.

The way I decided to move ahead, is by presenting two cases of technology transfer before the enactment of the University Ownership model and after. On the first table below, I compare the before and after cases of a single scientist in Norway while on the second table, I compare a Technology Transfer Office in Norway with an Innovation Office in Sweden. The Innovation Office in Sweden and the way it works, was taken as an example for the before the University Ownership model enactment era.

| | |
|-------------------------|------------------------|
| Scientist Norway | |
| Case 1 Before | Case 2 After |

| | | | |
|--|--|--|--|
| <p>Positives Achieving scientists vision</p> <p>Alternative commercialization paths</p> | <p>Negatives Might not generate high revenues</p> | <p>Positives Generation of greater revenues</p> <p>More funding sources</p> | <p>Negatives Scientists vision might not be achieved</p> <p>Less commercialization choices for researchers</p> <p>Commercialization hinderance due to lack of knowledge from TTOs</p> |
|--|--|--|--|

Table 4. Inventor in Norway under the UO and PP models. Positives and negatives.

| Commercialization Offices | | | |
|--|--|---|--|
| Innovation Office Before | | TTO After | |
| <p>Positives Inventor guidance without the loss or rights or ownership</p> <p>Inventors can choose commercialization path that fits their aspirations/goals</p> | <p>Negatives Smaller verification funds</p> | <p>Positives Higher verification funds</p> | <p>Negatives Inventor's aspirations/goals might not be achieved or be hindered.</p> |

Table 5. Commercialization offices under the UO and PP models. Positives and negatives.

The above pros and cons together with the rest of the findings of this study are further discussed below. The discussion part will be presented like the findings part, divided in decision parts.

5.1.1 Disclosure Decision

While the Swedish system offers researchers/inventors the freedom to choose if, when and how to disclose their inventions, the Norwegian system doesn't. Researchers/inventors are

expected to disclose any research result with commercial potential and do not have the right to withhold it. Although the rules dictate so, it is many times that researchers don't follow them precisely and either withhold some invention or consider alternative methods of commercialization due to personal reasons such as being unsatisfied by the services provided by the TTO.

This dissatisfaction could result from the fact that TTO's have greater capabilities in certain areas and scientific fields than they do in others. That could again be because a TTO holds greater knowledge on specific scientific fields over others or that their commercialization system fits better to specific types of inventions. This can lead to various satisfaction degrees among researchers from different fields (Genet, Errabi, & Gauthier, 2012).

The university on the other hand, cannot be very strict and enforce the researchers to abide to the rules since they are the generator of new inventions and potential income for the institution. Creating a bad relationship with them can only lead to negative results. The TTO, under the UO system, is constantly trying to keep a balance and good relationship with the inventors, which sometimes means saying yes when they should have said no. It is not only the disclosure step where delicate maneuvers are required between the two parties in order to keep a good relationship, but also in later stages of the commercialization process.

Not surprisingly, no such issues were found under the Professors privilege model in Sweden. What was surprising, is that even though the inventors in Sweden are not obliged to disclose their invention to Innovation offices, they still do so to a great extent due the business knowledge these offices hold and the help they can provide. Amateur in the invention commercialization process scientists trying to transfer inventions on their own, can easily be tricked into sub-optimal deals due to their lack of knowledge in commercialization.

5.1.2 Acceptance or Rejection of Invention

As mentioned earlier, the decision of accepting an invention as a project or rejecting it, is a very knowledge-based process. The decision is made by the commercialization offices which try to assess the invention based on their insight and knowledge of the business world as well as the scientific knowledge some of the office members might hold. A sound judgment about the market potential of an invention can also be seen from the inventors/researchers who have a good industry insight, gained by having ties with various industry players, on top of their

extended scientific knowledge. Therefore, one cannot say that commercialization offices know always better which inventions have the greatest potential and which not. This can also be seen from the results of the second interview where the TTO in Norway had rejected an invention and the researcher immediately knew that it was a bad decision. Then the invention turned out to be a success story after the inventor contacted another TTO. While under the University Ownership model, the rights over an invention go to the university TTO, if an invention is rejected then the rights return to the inventor who can then find another such office to aid them in the commercialization process. One of the drawbacks here could be that even if the inventor finds another TTO and the invention is successfully commercialized, the university the researcher works for can still claim a certain percentage from the profits made even though the invention was initially turned down by the university TTO. This could potentially lead to the dissatisfaction of the inventor which is yet another aspect of the UO model that can lead to a conflict between the inventor and the university. Under the PP University setting, while researchers/inventors have the freedom to make their own choices, in the case of rejection, they might decide not to take into consideration the suggestions for improvement from Innovation Offices and follow other commercialization paths that entail a higher risk of failure. It is again their lack of knowledge of the commercialization world -that Innovation offices hold- that does not allow them to see those risks on their choices.

5.1.3 Patenting and Funding

The patenting process is a co-joint effort between the two actors, the inventor must present a very detailed and thorough presentation of the invention while the commercialization office takes responsibility of the filing process and the administrative tasks. It is in this phase that the cooperation of the inventor with the commercialization office grows further as it is together that they design, establish and finance a project even though under the UO model it is the TTO that holds all the decision rights. It was interesting to see, that in some cases, TTOs under the University Ownership system are willing to hand the project management over to the inventor if that means achieving better results. This could be another sign that what it appears at first to be a rather rigid linear-like system, is in reality a more allowing and dynamic one with the purpose of achieving the best possible results. This plasticity that the UO system exhibits in some cases, increases its similarity to the PP model. The importance of governmental support to the academic innovation system was also obvious, since both countries under the two different systems have governmental bodies funding and supervising

the projects of the commercialization offices (TTOs and Innovation Offices). Due to the greater flexibility of the PP system and the fact that Innovation Offices do not have any claims over inventions, the governmental fund offered for verification purposes is lesser than that of the UO setting.

5.1.4 Licensing or Spin-Off Establishment

Under the PP model, the inventor can decide what the commercialization path of the invention will be while being advised by an innovation office. On the other hand, under the UO model it is the TTO holding that right. Even though it is the TTO that has the final saying, it is often that inventors have a strong opinion on the matter. Will the invention be licensed and to whom or will a spin-off be established? Technology transfer offices take the inventors opinion into consideration since they want to keep a good relationship with them and since their knowledge is in most cases necessary for further developing the inventions once they have been licensed.

While Technology Transfer Offices try to collaborate as much as possible with inventors and take their opinion into consideration, conflicts between them still occur as the goals and intentions of each actor might differ. The main source of income for TTOs is licensing technologies and as fast as possible, that is considered a success. On the other hand, a researcher's goal might be the benefit of society and social wealth without being interested in making profits from the invention. This can lead to a conflict of interests and disagreement as a TTO may, for example, be negotiating a licensing agreement with potential partners while the inventor wants to see their invention used in another way.

As it was expected, the above issues were not seen under the PP setting since the inventor is still the responsible for making the decisions and the Innovation Office's role is still only advisory. While under the UO model there might be an increased emphasis in the licensing of technologies in pursuit of greater profits, under the PP setting there is the risk of things going astray if inventors decide to follow commercialization paths that fulfil their ambitions but don't generate enough profits or have a great risk of failure.

5.1.5 General Considerations

With the metrics chosen for measuring performance, presented in the theory section, it was difficult to choose one model over the other. Licensing technologies to established firms of the industry is a rather safe and straight forward way for creating revenues and it is the first choice of action for Technology Transfer Offices as the TTO employee interviewed claims. On the other hand, this commercialization path might sometimes contradict the vision and aspirations of the inventor and be less beneficial for the society, since as one of the experts' interviewed said, many companies to whom technologies are licensed to just place them on a shelf and never use them. Thus, if the vision and goal of a researcher under the UO system is to create value for society without thinking about profits as much, it could prove more of a challenge since the TTO, holding the rights, might have other plans or be less competent in that type of commercialization procedure.

It could be argued that the PP model performs better when it comes to achieving the researcher's goals and ambitions, since inventors can choose on their own the commercialization path with Innovation Offices guiding them without any claims over the technology. So, if an inventor's main goal is to create value for the society, then the appropriate commercialization path can be chosen, while if the main goal is profit generation then the inventor is free to contact industrial partners to whom the invention can be licensed. In the case of an inventor with an entrepreneurial spirit, venture capitalist can be contacted as well and start-up firms established. On the other hand, a more altruistic approach from the researcher's part and the establishment of new ventures, entail a greater risk of failure meaning less or no profits compared to the more set approach of TTOs under the UO model, whose primary focus till now has been technology licensing.

Furthermore, this misalignment of goals and interests that can occur between the inventor and the TTO offices under the UO model, can lead to obstacles in achieving the best possible results out of the commercialization of an invention. In addition, TTO's wanting to maintain a good relationship with inventors, refrain from opposing the inventor when they sometimes should. As the TTO employee interviewed claims, this can lead to accepting too many projects on which the TTO spends time and funds and that will eventually be shut down since from the beginning their market potential was not good enough. These facts give an additional performance bonus to the PP model since such obstacles created from interest conflicts and efforts to balance relationships between the commercialization actors were not found .

An additional fact this study pointed out about the commercialization process under the University Ownership system and the Professors Privilege, is the knowledge interdependence that exists between the inventor and the commercialization offices. In contrast to the organizations (Meckling, 1992) describe, where transferring the decision rights over a decision to the one holding the most related knowledge leads to greater performance, academic technology transfer needs both actors to achieve the desired performance. Even though TTOs hold all the decision rights over an invention in Norway, it doesn't mean they have all the related knowledge needed for these decisions. They are still very much dependent on the inventor's knowledge, a knowledge very difficult to acquire on their own since inventors have years of technical and scientific experience on specific fields. The same goes with the Professors Privilege system in Sweden. Even though inventors can hold all the decision rights over their inventions, they many times lack the business knowledge of an Innovation Office which is needed for a successful technology commercialization.

Although both settings have their pros and cons and choosing one over the other is not an easy task. With the performance metrics chosen in this study, it could be argued that the PP model has a slight advantage as there are fewer arguments and disagreements between inventors and commercialization actors that could lead to sub-optimal results. Furthermore, it seems that through the PP system, it is easier for researchers to transfer their inventions to and create benefit for the society if they wish so, without anyone intervening with this ambition. It was interesting to see that the two systems have more similarities than expected, since it is many times that under the UO model more flexibility can be observed as far as the process is concerned with TTOs being more willing to do things a bit differently than the law dictates for achieving better results. This means that in some cases, it is the inventors that get to choose about how some things will be done even though the decision rights still lie with the TTO. Apparent was in both models the knowledge interdependence between inventors and commercialization offices with one holding vital technical knowledge and expertise and the other necessary commercialization and business knowledge.

In the theory part I presented Jensen's and Meckling's (1992) paper which was an inspiration and one of the theoretical backbones of this paper. On their paper the authors claim that when in an organization the decision rights over a decision lie with the one with the most related knowledge, the performance of the organization improves. Measures must be taken though to make sure the receivers of those rights won't act based on their own interests but for the

interests of the organization. We can see that in the case of academic TT, it is difficult for one actor to have all the related knowledge needed to achieve optimal results. There is a strong knowledge interdependency between researchers and commercialization offices even though it is just one of them that has the majority of the decision rights over the TT process.

Furthermore, adopting rules to ensure that the TT actors don't act based on their own interests can impede relationships and lead to less than optimal results. These thoughts apply mostly for the UO model where the relationship of the researcher and the TTO is pre-set and dictated by law, resembling in a way a pre-arranged marriage. Under the PP system, Innovation offices are meant to help and guide inventors without any claims over their inventions avoiding in this way any conflicts of interest.

It seems that the theory of (Meckling, 1992) would need some refinement to properly address the case of decision rights delegation in the academic technology transfer context.

Universities are rather large organizations divided in various faculties and sub-organizations each one having their own agendas and goals and each one agreeing or disagreeing in different degrees with the general university missions and policies. Furthermore, researchers are many times driven from their own interests such as profits, fame or benefit for the society which makes it more difficult to align them with the interests of the university.

5.1.6 Limitations

According to (Samantha R Bradley, 2013), linear models of technology transfer are no longer sufficient to describe commercialization processes since they fail to consider informal mechanisms of the technology transfer process. Although the law might dictate specific things, the process of commercialization is -in reality- more fluid with its various actors making allowances and exceptions on various occasions in order to maintain a good relationship between them or to achieve greater performance.

Due to complexity reasons, time limitations and the exploratory nature of this research, only the formal steps and mechanisms were focused upon. Nevertheless, various informal mechanisms made their appearance during the interviews and were hence mentioned in this research though not extensively.

This study focused mainly on what happens with an invention until it is licensed, or a spin-off is established and on the dynamics that are formed between the initial actors of the

commercialization process. An emphasis was put on the decisions made, the rights over those decisions and the knowledge included. To fully understand the commercialization processes under the two models and the fate of new inventions, the decisions of the licensees or the spin-offs taking advantage of the new technologies should be considered as well.

Unfortunately, due to time limitations this was not possible for this study.

In addition, all the information about the role and action of inventors under the Professors Privilege model in Sweden, were gathered through second party experts and not through direct interviews with the inventors. Directly interviewing the inventors could lead to more accurate or even unexpected results for the research.

6 Conclusions

The purpose of this study was to compare how decision rights are delegated under the University Ownership and Professors Privilege models and how this delegation affects their performance while taking into consideration the decisions that are made during these processes and the related to those decisions knowledge the ones holding the rights have.

The University Ownership model was a result of the US Bayh-Dole enactment under which the ownership and rights -over any publicly funded research result or invention- are transferred to the institution under which they were found. Thus, in an academic context, any invention or research results generated with university funds, belongs now to the university. Due to the prestige and success that many US universities have, they work as role models for various European countries that switched to the University Ownership model from their previous Professors Privilege one, following in this way the steps of those famous universities in an attempt probably to achieve similar results. Many scholars argue that an attempt to chart the effects of the University Ownership model in Europe is a rather complex task and comparisons with US examples can be misleading as there are different forces in effect in each country. Therefore, more country-specific research is required. In this research the Norwegian system was used to illustrate the University Ownership model while the Swedish system represents the Professors Privilege model.

This study's research question was:

How does the delegation of decision rights under the University Ownership and Professors Privilege models affect the processes performance?

This research question was inspired after reading (Meckling, 1992) supporting that when decision rights lie where the most relevant knowledge is, organization performance increases. To answer this question, a theoretical framework was developed by reviewing available literature and by acquiring additional primary data through interviews.

In this study, I managed to shed some more light on the dynamics created between inventors and commercialization offices under the University Ownership model and the Professors Privilege using Norway and Sweden as proxies.

After concluding the analysis of my data, there were no clear lines of one system being better than the other as both had their pros and cons. Nevertheless, with the performance metrics chosen for this study, there was a slight advantage of the Professors Privilege model as there is a higher probability of achieving societal benefits since TTO's under the UO model tend to license most of the inventions to industrial partners who many times do not commercialize these technologies. In addition, under the PP model, there were lower chances of inventor dissatisfaction and disagreement between the technology transfer actors which can lead to sub-optimal commercialization results.

Furthermore, it was interesting to see that under the University Ownership, although the TT process might at first seem as a rigid and linear one it is not always so. Many times, the University and more specifically the TTO's are more flexible with their decisions and more allowing towards inventors without necessarily doing things "by the book" if that means better results. An example is the fact that the TTO included in this study, when dealing with biotech inventions, allows the inventors to be the project managers giving them in this way the right to make various decisions themselves even though the rights over the inventions remain legally with the TTO. It can be thus argued that through this fluidity the UO setting exhibits sometimes, the two systems compared in this study are more similar than one would guess at first.

Finally, the theory of Jensen and Meckling (1992) doesn't seem to apply in the context of academic technology transfer as there are at least two actors interdependent to each other's knowledge for the achievement of the desired results. Under the UO model the fact that it is just one of these actors having the rights over the decision making without having all the related knowledge, causes many times disagreement and controversy that lead to sub-optimal results.

This study with its exploratory nature and results could act as an inspiration and guide for future research on the dynamics among the actors in the field of academic technology transfer and their effects on the processes' performance. In addition, the results should not be generalized as the results are based on a rather small selection of interviewees in the Norwegian and Swedish context. Different contexts can come with different factors that can lead to different results if a similar study was to be carried out.

7 Improvements and suggestions for further research

My study may serve as a basis for further research on academic technology transfer models and their performance. More specifically the way decision rights are delegated among the TT actors throughout the process and the way that affects performance can be more thoroughly explored. Furthermore, for a more rounded and complete understanding of the processes investigated in this study, the role the decisions of the licensees in the TT process should be included as well. This study focused on the official commercialization path of the UO and PP models. During the analysis it was found that quite a few times -under the UO model- unofficial commercialization paths are chosen if it means better results. It would be interesting for future researches to look more thoroughly into these unofficial decisions that do not go “by the book” and their effect on the commercialization process.

Another interesting thing would be investigating the reasons that lead to conflicts of interest and controversies among the commercialization actors especially under the UO model and how could these disagreements be avoided. This study touched upon the matter but a more in-depth analysis is required to gain a better understanding.

Finally, the ones interviewed in this study were middle aged or older individuals with families and various responsibilities. That means that getting hold of and arranging interviewees with them can be more time consuming than expected. Researchers planning, similar to this researches, should bear that in mind and plan their time accordingly.

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9 Appendix

9.1 Interview guide for inventors

Intro

Welcoming

Short presentation of myself and of the project

Possibility of recording and securing anonymity

Semi-constructed interview questions

- Could you tell me a bit about your background?
- I am aware that you are the inventor of X and Y. What made you work on this?
- I am aware that you were also involved in the commercialization process of X and Y. Could you describe the process?

Under the University Ownership model

- Have you ever considered unofficial commercialization paths?

Additional question for interviewee 1

- You have commercialized your inventions under both the University Ownership and the Professors Privilege models. What are your impressions, preference, comments? What did you like or dislike in each?

9.2 Interview guide for commercialization offices

Intro

Welcoming

Short presentation of myself and of the project

Possibility of recording and securing anonymity

Semi-constructed interview questions

- Could you tell me a bit about your background?
- What is the role of your commercialization office?
- Could you describe a usual invention commercialization process?
- Which rights stay with the inventor after choosing to work with you? Which rights do you gain?
- How and based on what do you make your decisions? The role of inventor in them?

Additional for Innovation Office in Sweden

- From your experience, how do usually inventors decide which path to follow for the commercialization of their inventions?