Managing Commercialization of Academic Research:
A Case Study of Umeå University, Sweden

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ABSTRACT

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Background and Research Problem: Universities are complex and diversified institutions playing an active role in society. Besides education and research universities are now assigned a new role of commercialization of academic research. There is pressure on universities to act as a bridge for transfer of knowledge to industries and generate resources. As this role of commercialization is comparatively new for the universities so they face challenges and difficulties in managing commercialization along with education and research. In order to overcome these challenges some support structures has been introduced in the form of Technology Transfer Office (TTO) or Industry Liaison Office (ILO). As the role and support structures are new, so there is a need to develop such a managerial system which can better integrate the activities related to commercialization of academic research.

Research Purpose: This is a case study of Umeå University conducted to understand and evaluate the commercialization activities and functioning of support structures. The specific purpose is to investigate and suggest that, how universities having support structures but lacking success stories and track records, should manage its commercialization activities.

Method: Qualitative research methods are used and semi-structured interviews have been conducted from eight respondents. Umeå University has been used as a case study.

Concluding Comments: On the basis of this study we would like to comment that, Umeå University is committed to perform its third role of contribution towards society and there is adequate infrastructure available in terms of support structures. But still as this role is new for the university and carrying on commercialization activities while insuring freedom of research is a challenging task. So, a detailed evaluation of existing support structures and reorganization of their existing activities is required. It may also require better understanding and communication of the concept of commercialization, generation of new ideas and a greater attention, both from the support structures and central management of the university.

Keywords: Commercialization of academic research, managing commercialization, university-industry collaboration, organizational support structures.
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1. INTRODUCTION

This chapter is about the introduction of our research problem which is related to managing commercialization activities at universities. The chapter also covers the problem background and the overall purpose of the study. Furthermore we will discuss the scope, and limitations of our research.

1.1 Problem Background

Universities are complex and diversified institutions playing an active role in society. They act as institutions with primary objective of education and research. Besides education and research universities are now assigned a new role of commercialization of academic research. Universities are given considerable responsibility to interact with businesses and contribute towards economic growth and development (Braunerhjelm, 2007, p. 619). This new role of commercialization and knowledge transfer is different from the traditional role of teaching and educating.

In the world of globalization, universities are required to get involved in activities to commercialize university research and innovations to industries. Universities are involved in commercialization in order to attract more sponsored research funding, protect and license university-owned intellectual property, generate income by licensing, facilitate the creation of new or start-up businesses, regional economic growth and to develop science parks and incubators (Farsi & Talebi, 2009, p. 452). There is a pressure on university to act as a bridge to transfer the knowledge to industries and generate resources. According to Power & McDougall (2005, p. 291-292), pressure on universities for commercialization of academic research is due to finding new sources of income, other than the government funds, university fees and research grants. The university needs support from the local companies investing in research activities, because they cannot sustain without funding and support, and through quality research they can gain support from the firms (Mintrom, 2008, p. 235). These pressures from the government and society enforce universities to consider commercialization along with other core activities.

If we see the history, commercialization of academic research has grown rapidly over the world since the approval of Bayh-Dole Act in 1980. The Bayh-Dole Act was designed to facilitate the universities to claim the title of ownership for the inventions and research which are federally funded (Kenny & Patton, 2009, p 1407). The changes in legislation give flexibility to university in licensing agreements with companies and managing intellectual property (IP) which accelerate commercialization of research at university (Siegel, Waldman, Atwater and Link, 2003, p. 112). Bayh-Dole Act is not only implemented in US, but rest of the world also uses it as a model to improve
commercialization. This model provides more rights to government funded academic institutions for commercialization and patenting of their inventions (Vartak & Saurastri, 2009, p. 62).

The role of commercialization is comparatively new for university as they face several different challenges (Braunerhjelm, 2007, p. 619). According to Rasmussen at al. (2003), the challenges regarding commercialization of academic research are threefold from the university’s perspective: to increase the level of commercialization, to visualize the contribution to economic development, and to manage the relationship between commercialization and other core activities (Rasmussen, Moen, & Gulbrandsen, 2006, p. 518). In order to meet these challenges the universities are now changing to entrepreneurship universities (Etzkowitz, 2003, p. 112) and their goal is extending from teaching and research to further regional economic and social development. These entrepreneurship universities have special feature of having human capital in the form of students and teachers and act as a natural incubator which provides support structures to initiate new ventures. Jacob et al. (2003), has defined entrepreneurial university as “a university that has developed a comprehensive internal system for the commercialization and commodification of its knowledge. It includes not just structure such as liaison or technology transfer offices which bridge the gap between industry and the academy but also provides incentives for adjusting lines of study and the allocation of research budgets to the demand in private and public sectors (Jacob, Lundqvist, and Hellsmark, 2003, p. 1556)”.

To act as Entrepreneurship University they need integrated system for commercialization which includes elements ranging from motivation and education for initiatives to support specific commercialization projects; such as innovation centers, incubators, patenting offices, and seed capital funds. The challenge is to make a system where all these actors and elements cooperate and contribute towards the overall goal of successful commercialization (Rasmussen at al., 2006, p. 521). This integrated system for commercialization in most universities is in the form of Technology Transfer Office (TTO) or Industry Liaison Office (ILO). According to Ambos at al., TTO is the most well established dual structure in research oriented university (Ambos, Mäkelä, Birkinshaw, & D’Este, 2008, p. 1429). Its role is to facilitate transfer of knowledge and management of licensing agreements to protect intellectual property (Siegel at al., pp. 115-116). The formation of infrastructure at university for technology transfer is not only important for the integration of marketing arm, but also for its ability to enhance marketability of academic research (Etzkowitz, 2001, p. 118). Apart from TTO, business incubators, start-ups companies and science parks are also included in support structure of universities. The presence of these support structures increase the chances of successful commercialization and thereby the output of inventions (Powers & McDougall, 2005, p. 307).

University faces difficulties regarding commercialization efforts due to organizational arrangements and their commitment to benefit the social interest of society (Argyres & Liebeskind, 2007, pp. 428, 452). According to Martin, the university culture has its own
tradition of academic freedom and there is no restriction on subject matter explored and research results reported and this is very different from business community. Universities are naturally decentralized and their organizational units are the academic departments which are on equal basis and it is difficult for a university to define core competencies (Martin, 2007, p. 13). On the other hand some authors like Zgaga (2007, p. 9) also argue that entrepreneurial activity in university can be helpful for administration and service but this is not good for the quality of education because the features of education are different from the ordinary profitable services and it should be treated differently.

It is important that all activities and organizational structures related to commercialization of academic research should be managed in a way which should increase commercialization with minimum negative effect on education and research. Moreover it is also desirable that it should also improve university’s overall capacity to perform different functions. The above mentioned facts make commercialization of academic research a big challenge for a university. As in most cases the educational system of each country is different from the other while each university also has its own specific environment, organization and support structures. So a separate study conducted within the specific context of an individual university, with a purpose to investigate and manage the commercialization challenges face by that university will be more useful. Umeå University has an excellent status and is one of the most reputable universities in the Northern part of Sweden. University has support structures available for commercialization, in the form of Business Incubator, Science Park and Society Relation Office. But According to the Peer review report Umeå (2006) the Umeå University suffers and lacks an overall vision to ensure the third role of commercialization. In this Peer review report they identified the weaknesses of university regarding commercialization and knowledge transfer. According to the report there is inadequacy in the management of support structures in university and they have lack of track record and success stories in commercialization efforts (Bergstrom, Hersey, Jaspers, Odenö & Johannesson 2006, pp. 5, 11). Keeping in view the dearth of the kind of study, which can investigate that how universities can manage the challenges of commercialization where support structures are established but still lacking the success stories and track records. We have conducted this study particularly in the context of Umeå University and generally with the context of Swedish educational environment. In Swedish educational environment these support structures and commercialization activities are not been properly integrated with traditional functioning of university (Braunerhjelm, 2007, p. 619).

1.2 Purpose of the study

This is a case study of Umeå University conducted to understand and evaluate the commercialization activities and functioning of support structures. The specific purpose is to investigate and suggest that, how universities having support structures but lacking success stories and track records, should manage its commercialization activities.
1.3 Scope and Limitations

As this research is being done in a specific context of Umeå University and educational system of Sweden so generally output will be more applicable to Swedish universities and particularly Umeå University. But in our opinion some part of this study will also have some application for the other universities having the similar educational environment and problems. Such as, presence of similar support structures but slow commercialization process and lack of track records.

As the subject of commercialization of academic research is very broad and have several stakeholders involved like government, society, industry, researchers and universities. So it can be studied from different dimensions and perspectives. In this report we have narrowed it down to university’s perspective only and to be more precisely, it will address the common managerial issues of commercialization. The element of visualization of commercialization output to industry and economic development issues will not be discussed.

This research is based upon existing managerial practices, policies and information provided by support structures of Umeå University i.e. ENS and Uminova. The role of University management, board of directors, and head of departments will not be discussed in depth.

The respondents in the category of university researcher were from one department of Umeå University. Due to departmental differences in commercialization environment at different departments of the university, the implication of this study could have certain limits.

As the interviews were conducted in English which is not the native language of respondents, so there is a possibility that element of language barrier could have some effect on the results of the study.

1.4 Disposition

Chapter Two (Theoretical Methodology): This chapter will explain the theoretical research methodology. The choice of subject, preconception and perspective of the study will be discussed along with research philosophy and scientific approach of study.

Chapter Three (Literature Review): In this chapter we will explain the theories and concepts that will be used to build the literature review. In this theoretical framework we will explain in detail research that has already been done on commercialization of academic research.

Chapter Four (Practical Methodology): This Chapter will explain the practical methods used for data collection to build the empirical section. We will discuss in detail about the methods used for interviews, data processing and analyzing.
Chapter Five (Empirical Findings): In this chapter we will discuss the empirical findings based on the data being collected from respondents through semi-structured interviews. Later on the basis of these empirical finding’s analysis, discussions and conclusions will be drawn.

Chapter Six (Data Analysis and Interpretation): In this chapter we will build the connection between theory and our empirical data. From the empirical results we will go for the analysis and recommendations.

Chapter Seven (Conclusion and End Notes): In this chapter we will look back at the problem statement and the purpose which were stated at the beginning of the research and concluding comments will be presented. We conclude our thesis with contribution of the study and suggestions for the future study.
2. THEORETICAL RESEARCH METHODOLOGY

In this chapter theoretical research methodology for study will be explained. Along with research philosophy and scientific approach of study, the choice of subject, preconception and perspective of the study will also be discussed.

2.1 Choice of Subject

Before coming to Sweden we were having an observation and opinion that the knowledge which is given at university lacks practical application in the society. We were also concerned about the economic contribution of university towards individuals and society. Till that time the concept of commercialization of academic research was not much familiar to us but after starting our master programs in the field of Management and Business Development in a new Swedish educational environment, we came to know more about it. Commercialization of Academic research is one of the issues that are being discussed heavily all over the world. Basic reason behind this; is the recognition of its contribution towards a country’s economy and society. Universities are one of the basic elements of this commercialization process. Besides education and research their expected role is extending further towards regional economic and social development (Braunerhjelm, 2007, p. 619). But managing commercial activities at university along with other core activities is a challenge for universities.

During our masters program we studied the concepts of entrepreneurship and ideas of commercialization which build our interest in this subject. After studying literature regarding commercialization of academic research and being involved in several practical activities, we decided to study this subject in more detail.

2.2 Preconceptions

If we talk about our involvement, previous experiences and capability towards the topic we will say that they are highly influenced by the commercialization environment of our university and the courses we studied. Being students of Management and Business development, we think we have enough practical skills and experience to study this topic. There are several support structures in our university which are working for the commercialization of university research and developing innovative ideas. ENS (Business and Society relations unit) in Umeå University is working as technology transfer office to commercialize the university research. Uminova (University incubator) is working to help university researchers and students to develop and commercialize their ideas and research. One of the authors was connected to a project related to ENS and the other participated in the courses of Venture-Cup and Academic Business Challenge, in which he worked with university researchers to develop the business idea under the supervision of Uminova. These activities during studies developed our interest in the topic of commercialization and we also gained some practical experiences and skills for
this study. It was our general observation and feeling that lots of efforts are being put in by these support structures but the output is not that much, like we didn’t found any successful examples being highlighted as the result of these activities. We saw some gaps in managing these commercialization activities for example, lack of collaboration in support structure and effective communication. These preconception and experiences at university built our interest to study the subject and try to come up with some recommendations.

During the course of Research Methodology in Business Administration, we have written a research report on a topic of “Increasing Commercialization of academic Research through University-Industry Collaboration“. This study further developed our interest in the subject. It gave us enough confidence and knowledge to study it in further detail and with a different perspective.

2.3 Perspective

Commercialization of academic research is a complex and diverse topic and it involves different elements and stakeholders like industry, university, researchers, legislation, society and economy. The research on commercialization topic can be conducted in different ways and will generate different results when executed from any of the above mentioned perspective. We are conducting this study from university’s perspective and we have narrowed down our focus for managing commercialization at universities along with other core activities.

2.4 Research Philosophy

The first part of research philosophy is about researcher’s view of reality and how he sees the existence of things in reality. If the researcher thinks that the reality exits independently without the influence of any other actors then his view of reality is objectivist. On the other hand, if the researcher thinks the subject does not exist independently, rather it is constructed by other social actors or it has some interaction and influence with other existing things then the researcher has a constructionist point of view. While in general the view of reality is called Ontology (Bryman & Bell, 2007). Our ontological view of reality is constructionist because in order to investigate the issue of managing commercialization at university we need to know about several other factors which are related to this subject e.g. Umeå University, its policies, support structures available for commercialization and Swedish rules and regulations towards commercialization of academic research. All these elements have an influence on the subject and without knowledge of these elements we cannot find the true picture of reality. So we can say that the reality is socially constructed and the view of reality is not without influence of other social actors. Although the complete study of these social actors is not possible but we have tried to get enough information about them.
The second part of research philosophy is about the knowledge of existence and the ways in which the researcher acquires this knowledge and is called Epistemology. This is further divided into positivism and interpretivism. Positivism is a study of social reality in which social world can be analyzed as natural science. While, interpretivism is the study in which elements such as values, norms and subjective position of researcher and research community are important for interpretation of reality (Bryman & Bell, 2007). Now if we look on the knowledge and the study of our research, it cannot be studied out of social context. Our study is being conducted in a specific environment of Umeå University and Swedish educational system. It has several perspectives and stakeholders like industry, university, government and society. We are the students of Umeå University and our knowledge of reality is also specific and limited, and further this study is conducted from university’s perspective so one must see this study in that specific context. As we think the mere scientific methods will not be able to portray the whole real picture so we have tried to build our knowledge on the basis of empirical observation gathered from semi structured interviews. Although we have tried our best to produce accurate and true information but still it can be influenced by personal interpretations and experiences. So knowledge produced in this study cannot be called fully objective and can be interpreted differently by different readers.

2.5 Research Method – Case Study

There are five different types of research methods; experimental, cross-sectional, longitudinal, case study and comparative method (Bryman & Bell, 2007, p. 39). We will use case study method for our study because in social science research, case studies are used for investigating issues in specific settings (Bryman & Bell, 2007) and we are conducting this study in the setting of Umeå University. According to Creswell (2006, p. 73), case study research is qualitative approach in which the study is investigated for an issue by using one or more cases within the bounded system (i.e., a setting, a context). For this approach of study data can be collected from multiple sources of information like interviews, documents, reports and observations. We used Umeå University (one of the big research universities in Sweden) as bounded system or setting for investigating our research problem. Because of single case study, our research is instrumental case study (Stake, 1995) to investigate the issue of managing commercialization at universities (as cited in Creswell, 2006, p. 74).

Case study research is also suitable to understand the complex issues and add value to research already been done on the issue. It usually answers one or more research questions which begin with ‘how’ or ‘why’ (Soy, 1997). By using the case study research, our aim is to investigate the issues of managing commercialization at university with the help of empirical observation, existing research and theories. The term case study refers to specific situation, location or subject of study and this research method is used for analyzing single organization, any single location, and person or an event (Robson 2002, cited in Saunders et al., 2009, p. 145). For investigating our research problem, we will collect information and experiences from Umeå University’s support
structures working for commercialization, university researchers and companies attached with University.

2.5.1 Case Presentation – Umeå University

Umeå University is one of the big research universities in Sweden which offers a broad range of academic disciplines. According to Goldfrab & Henrekson (2003, p. 655), Sweden is a country which has highest R&D spending in the world for more than a decade. The Swedish government has invested a lot to increase commercialization at universities and it has a good worldwide position for publication rates in academic journals.

According to the information on home page, Umeå University has almost 2000 researchers/teachers and spans many disciplines and branches of science. It has wide range of research areas which are: humanities, medicine, natural science, technology, social sciences and several interdisciplinary areas. It has twelve areas of ‘scientific excellence’ and some of which are best in the world. According to National Agency of Higher Education, Umeå University is one of the leading seats of learning in the field of cooperation with industry and the community. At present Umeå University have two main support structures to facilitate commercialization.

- ENS (Business and Society relations unit)
- Uminova Innovation and Science park

Further information about these support structures is provided in empirical section. According to the Peer review report Umeå (2006) the university suffers and lacks an overall vision to ensure the third role of commercialization. In this Peer review report they identified the weaknesses of University regarding commercialization and knowledge transfer. According to the report there is inadequacy in the management of support structures in University and they have lack of track record and success stories in commercialization efforts (Bergstrom, Hersey, Jaspers, Odenö & Johannesson 2006, pp. 5, 11). All the characteristics which are described above make Umeå University a good choice to investigate our research question. For further information see Appendix 2

2.6 Scientific Approach and Choice of Methods

There are two main strategies available for the research studies; qualitative and quantitative, and basically the selection of research strategy is the basis for the selection of different methods that will be used for data collection (Kekâle and Borelli, 2009). We have chosen qualitative strategy for our study and we will use semi-structure interviews as data collection method.

There are some reasons for choosing qualitative strategy for our research. The first reason behind this selection is the nature of the study and the requirement of complete
comprehension and details about the subject. Our research question is related to managing commercialization of academic research which involve stakeholders like university administration, industry and researchers, in order to get a true understanding of the problem and to have each stakeholder’s perspective a detailed description is required from them. In our opinion this detailed understanding can only be possible by conducting in depth interviews with them. The second major reason is the subjective nature of the research. We are conducting this research in a social context and the description of that social context is also important; which makes us more concerned about the words and opinions rather than numbers and figures. We believe that qualitative research strategy is suitable for our purpose of the study so we choose qualitative research strategy.

We will start our study with the theories and literature available on commercialization of academic research and will build literature review. On the basis of this literature, we will construct interview guide for interviews. Later, on the basis of our empirical observation and its analyses in the light of existing theories we will try to find out some measures and suggestions for better management of commercialization of academic research. As the existing knowledge and theories are being used to generate new knowledge so we can say that our research; mainly has a deductive approach.

2.7 Collection of Literature

Literature selection for this paper is according to the relevance of information with the nature of study. After reading different scientific articles and books which seems relevant, we selected the literature for this paper. We used internet, databases of libraries and books of different authors. For the selection of scientific articles to build the literature we used Umeå university library’s database. We also used http://scholar.google.com/ which is Google’s search engine for articles. Some of the information about Swedish educational system and commercialization activities in Sweden was gathered from VINOVA’s (Swedish Government Agency for Innovation System) website http://www.vinnova.se/en/ and the publications available there. The information related to Umeå University and its support structures was gathered from its website, www.umu.se and the documents provided by the respondents from Uminova and ENS.

2.8 Choice of Theories

We started by searching articles related to keywords like commercialization of academic research, university-industry collaboration and managing commercialization of academic research and get a reasonable amount of articles. Some of them were not relevant to our perspective while some were more general about the concept of commercialization of academic research. First we started reading the general article related to commercialization of academic research. This reading helped to increase our understanding of the concept and to find out the key elements. It helped us to find out a logical sequence of those elements more specifically related to our topic. To gain more
thorough information related to commercialization and its management at universities, we also used books of different authors. Later based on our prior understanding we started reading more specific articles. Further information about these articles is provided in next chapter.
3. LITERATURE REVIEW

This chapter is constructed with literature related to commercialization of academic research, produced by different authors. The chapter describes literature and theories related to university’s role, management of commercial activities and the support structures at universities to facilitate commercialization.

3.1 Chapter background

The purpose of this chapter is to present and discuss the current literature, theories and models about commercialization of academic research. This chapter also describes the research that has already been done on the topic. We have categorized this chapter into three sections on the basis of research question and purpose of the study. In the first section we will discuss the literature about changing role and difficulties faced by universities to incorporate commercial activities. In the second section we will discuss about the general managerial issues faced by universities for commercialization of academic research. In the last section of literature review we will discuss the organizational structure present in universities to facilitate commercialization.

3.2 Role of Universities in Commercialization

3.2.1 Background of Commercialization

Bok Derek (2003, p. 3), in his book ‘Universities in the Marketplace’ explained about commercialization at universities with wide range of behaviors and trends. The economic forces which demand universities to incorporate commercialization include; increase in number of majors in computer science, the influence of business corporate culture in universities, and the use of business strategies in universities. In this book the author used commercialization as the efforts within university to make profits from teaching, research and other university activities.

According to Seigel at al. (2003) commercialization of academic research grows after 1980’s, when US congress approved Bayh-Dole Act. The Bayh-Dole Act is a model for universities to design the patent policy for commercialization of academic research. In this act restrictions are removed on licensing which allows university and research institutions to own their patents. This also facilitates university to be more flexible to own their patents by collaborating with companies (Seigel et al., 2003, p. 112). After the Bayh-Dole Act, commercialization process has become easier for universities in US because it makes the way clear to claim legal rights for their innovations using federal funding. Most of the universities in US focus on the creation of centralized Technology
Transfer Offices (TTO) rather than broad commercialization strategies (Latin, Mitchell & Reedy, 2007, p. 3).

The interaction with society is the third mission in addition to teaching and research for Swedish universities. According to the law, since 1997 the Swedish universities have to fulfill these three tasks and sometimes universities face conflicts in prioritizing these goals. The reason identified by Sellenthin (2009, p. 604-613) for these conflicting priorities for universities is the academic reward system. According to his findings 98.8% and 96.4% researchers in Sweden and Germany respectively regard publications to be important for their academic career. European Commission (2001) reports that transfer of knowledge is largely influenced by the features of national innovation system and there is need to maintain the balance between technology transfer and other main goals i.e. education and research. Sweden has also law of “Professor’s Privilege” which gives benefit to researchers to have full rights of their research. This privilege to researchers makes it difficult for university management to commercialize research because the agreement has to be made directly with the researchers (Johannesson, 2008, p. 9).

### 3.2.2 Changing Role of Universities

According to Rasmussen at al. (2006), university role of teaching and research has changed due to emergence of disciplines like biotechnology, increased globalization, reduced basic funding, and new perspective on the role of the university in the system of knowledge production. The universities experience a different funding structure and new expectations from the society, as they have more interest in starting new firms and other commercial activities (Rasmussen at al., 2006, p. 519). The university and public research institutions have pressures to contribute to society and to avail their own benefits, but the challenge is how university–industry interactions in fact shape processes and outcomes related to research and technology commercialization (Markman, Siegel, & Wright, 2008, p. 1402).

Due to these pressures some of the research universities are now extending to entrepreneurial universities which have expanded from an organizational growth regime into regional economic and social development strategy. This regional and economic social development is the third mission of universities extending from the mission of teaching and research (Etzkowitz, 2001, p. 110).

### Expansion of University Mission

<table>
<thead>
<tr>
<th>Teaching</th>
<th>Research</th>
<th>Entrepreneurial</th>
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<tr>
<td>Preservation and dissemination of knowledge</td>
<td>First academic revolution</td>
<td>Second academic revolution</td>
</tr>
<tr>
<td>New missions generate conflicts of interest controversies</td>
<td>Two missions: Teaching and research</td>
<td>Third mission: Economic and social development, old mission continued</td>
</tr>
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</table>

The rise of academic entrepreneurship requires a re-examination of university’s organizational structures and practices (Siegel, Wright and Lockett, 2007, p. 490). The historical role of university researcher is to concentrate on the basic research or applied science, but this role is now changing to bring the knowledge or innovation to market for the improvement of the human conditions (Latin at al., 2007, p. 3).

3.2.3 Cultural Clash between Academia and Industries

Universities are facing difficulties for managing commercialization due to cultural difference in academia and industries. The industries which are being benefited from university research and innovations have very different culture from the one that prevails in academic. In university-industry collaboration, both parties have their own goals and motives, universities have their own complex bureaucracies, culture and incentive structures. Moreover they have objectives of societal benefits but on the other hand firms have simply profit motives (Bercovitz & Feldmann, 2006, p. 176). According to Berman, bureaucracy in university is one of the barriers in commercialization of research. Due to cultural differences there are conflicting demands between university researchers and the industry managers whereas the management of university is tied with its own internal bureaucracies. These bureaucracies discourage companies to collaborate with university for commercialization purposes (Berman, 2008, p. 168).

According to Wright at al. (2004, pp. 289-290), academic scientists work in a non-commercially oriented culture and it’s difficult for them to know which applications are more useful in the market. The academic scientists lack the knowledge of transferring technology into the marketable products or services and these skills can only be built by entrepreneurial experiences and by working in industry. The academic scientists are also reluctant for commercializing their research due to lack of personal motivation and inherent university culture which discourages commercial behavior. The cultural gap between university and the industry is due to differences in objectives. The university especially the management of technology transfer office has to address these differences by giving awareness to researcher to commercialize his commercially viable research (WIPO, 2002).

3.3 Organizational Structure to Facilitate Commercialization

According to Kenney and Patton (2009, p. 1408), the organizational infrastructure of university includes technology transfer offices (TTO), business incubators, start-up companies and science parks. These are the evolutionary outcomes influenced by economic, legal and political decisions by different actors locally and internationally. These new organizational infrastructures have to manage the relationship between the university and the commercial sector. For example the issue of protecting intellectual property (IP) of researchers and dealing of licensing agreements with companies requires...
institutionalize formal organizational and normative structures, so that these licensing and patenting issues can be resolved without undue effort or attention by university (Berman, 2002, p. 836).

Different authors (Tushman, Anderson & O’reily, 1997; Ambos at al. 2008; Birkinshaw & Gibson, 2004) explain the ambidextrous nature of organizational structure of university to support commercialization and fulfill the dual demands i.e. academic and commercialization. *Ambidextrous organizations* (Tushman, Anderson & O’reily, 1997) are the organizations which have multiple organization architectures co-existing in a single organization. By nature these organizations are unstable and the management of these inconsistent organizations must provide clear roles and responsibilities to complementary departments and need to be balanced in their contrasting demands. Ambidextrous organizations have important components of dual structure where the conflicting demands are resolved at the level of individual employee. The universities which had earlier invested in the formation of technology transfer offices have good record in achieving the objective of commercialization (Ambos at al. 2008, pp. 1428-1430). The structural differentiation can help ambidextrous organizations to maintain different competencies that address inconsistent demands (Gilbert, 2005). An ambidextrous organizational context can be achieved through a variety of means, but they all share one thing in common -- they enable individuals in organizations to exhibit initiative, cooperation, brokering, and multi-tasking (Birkinshaw & Gibson, 2004).

According to Ambos at al. (2008, p. 1428), university have limited experience in managing commercial demands. Changes in organizational structure, establishing TTO’s, the incorporation of supportive policies, commercial activities and incentives for researchers are the responses of university for managing commercialization. These attempts to manage commercial demands with traditional academic ones supports the concept of *ambidexterity*, because it provides some guidance for university for creating structures and systems for managing conflicting demands of academic and commercial activities.

For managing demands of academia and commercialization there are some support structures which are both internal and external. The effective coordination between these structures is helpful for managing commercialization at university. These internal and external support structures are briefly explained here.

### 3.3.1 Internal Structure to Support Commercialization

**Technology Transfer Office:** For managing the commercial activities in university, technology transfer offices are working in most of the universities. They are called Industry Liaison Office (ILO) or Technology Transfer Office (TTO) responsible for transferring technology to industries and managing complex commercial activities. These offices in university are acting as an intermediary between universities and industries to facilitate commercial knowledge transfers, and their role is to resolve the issues of patents and licensing (Seigel at al., 2003, p. 112). Universities which invested in establishing
TTO to commercialize the academic research are more successful in their goals. The more experience TTO gains the more successfully the projects is commercialized (Ambos et al., 2008, p. 1430).

These technology transfer offices also focus on academic excellence in the traditional organizational setup with the commercial goal for commercialization of academic research (Ambos et al. 2008). Industrial Liaison Office (ILO) has developed different organizational forms, policies, and practices to fulfill the goal of commercialization by utilizing their professional staff, and their aim is to drive university into the market (Fisher & Grosjean, 2002). The role of these offices is to manage their university research results for the benefit of faculty and researchers by providing patenting and licensing facilities. Nowadays the managers of TTO have not enough reliable tools for decision making to identify which research is commercializeable. For this reason these technology transfer offices need to adopt business tools and techniques for effective marketing and transferring university research (Price, Huston & Meyers, 2007, p. 102).

**Business Incubator:** Business incubator is the key facilitator for technology commercialization which is university owned organization with four main objectives: economic development, technology commercialization, real estate development and entrepreneurship (Markman et al., 2008, p. 1407). Our focus in this paper is on the technology commercialization objective of business incubator. According to the American National Business Incubation Association (www.nbia.org) Business incubator means “an economic development tool designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services.” Business incubators role is to provide business environment for startup firms. Business incubator facilitate them in different prospective such as; financing, giving them recourses and guidance to stay in market. The new business ventures have lack of funds and technological advancement, but have entrepreneurial skill and Business incubator can play a role to commercialize their idea (Bøllingtoft & Ulhøi, 2005, p. 269).

### 3.3.2 External Structures to Support Commercialization

**University Owned and Joint Ventures:** University-owned ventures are another organizational mechanism for transferring university research to industry. This type of organizational mechanism is formed by investment of university in start-up firms to facilitate commercialization and the ownership is sometimes shared between the researchers and investors (Argyres & Liebeskind, 1997). Joint ventures are form of organizational structure to support the commercialization activities, they are the organizations jointly owned by the university and outer industry. Such joint venture with the industry partnership facilitates university to access those resources which are required to commercialize the research and were not available before. The resources like organizational routines, managerial talent and vibrant ecosystem of trading partners facilitate commercialization activities at university (Markman et al., 2008, p. 1410).
Spin-offs and Start-ups: According to Markman et al. (2008, p. 1408), “Strictly defined, spinoffs are new ventures that are dependent upon licensing or assignment of university or corporation’s intellectual property (IP) for initiation.” These spin-off and startups need to be initiated by university to improve commercialization. The joint venture spinoffs are the ventures in which the university scientists have the equity shares and the university utilizes the resources of the venture to accelerate the commercialization of academic research (Markman et al., 2008, p. 1408). The creation of start-ups is required to transfer knowledge from university to industry and to promote the regional economic development (Breznitz et al., 2008, p. 130).

Science Parks: The Science Parks and Business Incubators facilitate commercialization between the university and R&D of industries. The aim of Research parks is to bridge the gap between industry and researchers and to increase the efficiency of the firms (Squicciarini, 2007, p. 170). Research Park are large scale projects that house a spectrum of entities including corporate units, government labs, medium and small firms, which are closely related to research intensive universities to facilitate commercialization (Markman et al., 2008, p. 1408). These research parks are taking active role in creating entrepreneurship culture, developing innovative ideas and encouraging researchers.

3.4 Managing Commercial Activities at Universities

For managing commercial activities at university, the management needs to consider the intellectual property issues, the incentives for university researchers, satisfying other stakeholders of commercialization and its far-reaching efforts to attract more companies for commercializing the university research.

3.4.1 Managing Intellectual Property (IP)

Protecting intellectual property is one of the major issues for university regarding commercialization. When the researcher in university discloses his findings for commercialization, the first thing that comes in his mind is to protect his research or innovation from stealing. The university’s Technology transfer office can play its role for protecting researcher’s intellectual property. According to Thursby and Kemp (2002, p. 112) this process starts with the disclosure of results to Technology Transfer Office (TTO), when the researcher feels the research is commercializeable. In the next step TTO evaluates and finds some private firms to commercialize the innovation or research. In the end, agreement of licensing takes place with the firm and university gets royalty for the research or innovation. These researches by university faculty and students can be commercialized by patenting the intellectual property to entrepreneurs, faculty members themselves and established companies (Litan et al., 2007, p. 11).
Markman at al. (2005, p. 142) identified three main licensing strategies for commercializing research and technology: (a) licensing for sponsored research (b) licensing for equity in a company (c) licensing for cash. These three strategies of licensing depend upon the research type and the university’s polices for licensing agreements. The TTO in university which are structured for profit making from licensing, transfer the technology via new venture formation. On the other hand traditional TTO’s which are structured as nonprofit support structures, transfer technology through university business incubators.

Making money through licensing is not the objective of every university. Mostly public universities aim licensing for diffusion of knowledge rather than profit. The royalties, sponsored research, number of patents and licenses are the output of commercialization activities for many universities (Thursby & Kemp, 2002, p. 112). Currently many universities establish technology transfer offices for managing patenting and licensing, but some of these are succeeded in making significant income. Some of the universities in US which have good reputation in research are able to make money from licensing (Rasmussen at al., 2006, p. 520). According to the Chronicle of Higher education, at least two dozen universities earned more than $10 million in fiscal year 2005 from research and innovation’s licensing (Blumenstyk, 2007 cited in Wood, 2009, p. 930).

### 3.4.2 Researcher’s Incentives

The incentives for university researchers to actively participate in commercialization of their research are highlighted by different authors. According to Seigel at al. (2007, p. 497), appropriate incentives are necessary to design for university researchers, In order to encourage them in entrepreneurship activities. The traditional reward system and the modern technology transfer rewards system have conflicts of interest, because the traditional reward system for researchers is based on publications of basic research and on the other hand technology transfer reward system is on the basis of revenue generation from research. This issue can be resolved by higher management of university because it is the decision taken by level of priorities.

The academic researchers in process of commercialization act as technology champions; because they are the ones needed to be motivated for applying patents and transferring technology by participating in equity ownership. The close partnership with companies and informed awareness of market opportunities to researchers can improve the performance in patenting and licensing (Chang, Yang & Chen, 2009, p. 945). By patenting and licensing, universities are contributing to the economic growth, and by owning intellectual property rights and starting their own businesses, academic scientists seems more like businessmen. Proper incentives need to be implemented for university researchers and they should also be trained and educated to work with companies or to start their own businesses. The university should clearly communicate the strategies and ambitions regarding researcher’s incentives for commercialization (Magnusson, McKelvey & Versiglioni, 2003, p. 27).
Some of the authors like (Glodfarb & Henrekson, 2002; Magnusson et al., 2003) believes that the US model of incentives for academic researchers is better than Swedish model. In US, royalties of research are given to university and researchers have more encouragement for commercializing their research. On the other hand the Swedish system has involvement of government to create mechanisms for facilitating commercialization. Due to top down nature of Swedish policies and unfavorable incentives, there is less positive attitude towards commercialization of academic research as compared to US.

3.4.3 Collaboration with Companies

Universities and industries have their own interests and motives for university-industry collaboration. University has interest in collaborative research in order to gain access to sources of research funding, equipments of research and chemicals, and to get feedback of its research outputs (Dooley & Kirk, 2007). Interviewing different university and industry researchers, Berman (2008, p. 167) identified that the companies have their own motives for the sponsored research partnership with universities. The first main motive is the research outcomes and recent findings in universities which would be very helpful for companies to solve their problems by collaborating with university research centers. Secondly companies could be benefited by fresh ideas from graduates to look at their problems with external eyes and different aspects which may not be come up with the company’s R&D personals. The other motive explained by Berman (2008) is to collaborate with university, for hiring the competitive graduates or PhD students in an effective and economical way. These interests and motives of university and industry are sometimes conflicting and it becomes challenge for university to collaborate with companies. Innovative ideas and scientific breakthroughs in university can be successfully commercialized, if university can facilitate the companies to interact with university researchers (Markman et al., 2008, p. 1403). For transferring these ideas there is a need of cooperative efforts from both university and private sector (Seigal at al., 2003, p. 129).

According to Cyert and Goodman (1997, p. 49), university-industry collaboration has inherent obstacles for making alliances between them. He identified that the university researchers have lack of motivation and skills to move further from the basic research to practical implementation. On the other hand the companies have difficulty to understand the explicit and tacit knowledge in the research. The issues of intellectual property rights, long time span and the nature of complexities in applied research are the barriers for university industry relationships. The university management responsible for the commercialization needs to consider these challenges and initiate steps to bridge the gap between university and industry.

3.4.4 Satisfying Stakeholders of Commercialization

To achieve commercialization goal as third mission, university has to consider key stakeholders of this commercialization process. Seigal at al. (2003, p. 115) identified
three key stakeholders for technology transfer from university to industries and their motives for the commercialization process. These three main stakeholders are university scientists, technology transfer office and firms. The actions, motives and their perspective are briefly explained in the following table.

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

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Actions</th>
<th>Primary motive(s)</th>
<th>Secondary motive(s)</th>
<th>Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Scientist</td>
<td>Discovery of new knowledge</td>
<td>Recognition within the scientific community-publications, grants</td>
<td>Financial gain and a desire to secure additional research funding</td>
<td>Scientific</td>
</tr>
<tr>
<td>Technology Transfer Office</td>
<td>Works with faculty members and firms/entrepreneurs to structure deals</td>
<td>Protect and market the university’s Intellectual property</td>
<td>Facilitate technological diffusion and secure additional research funding</td>
<td>Bureaucratic</td>
</tr>
<tr>
<td>Firms/entrepreneur</td>
<td>Commercialize new technology</td>
<td>Financial gains</td>
<td>Maintain control of proprietary technologies</td>
<td>Organic/entrepreneurial</td>
</tr>
</tbody>
</table>

Source: Seigel at al., 2003, p. 115, Journal of Higher Technology Management Research

University faces challenges to satisfy the above mentioned conflicting motives of stakeholders. It is important to consider the culture and incentives of key stakeholders in commercialization process. Firms main motive is making profit by utilizing university research and innovation and university administrator’s like TTO’s aim is to safeguard the researchers and research environment. The researchers are more interested in the pecuniary incentives like research grants, publication of their research in scholarly journals (Seigel at al., 2007, p. 642). The incentives and rewards to key stakeholders within university are according to the existing culture, policies and procedures. There is need to modify procedures to enhance commercialization considering the motives of key stakeholders (Lockett & Wright, 2005, p. 1048). According to Allen (2001, p. 66) there is need for establishing effective tools and communication systems like conducting educational seminars, training sessions for inventors and staff for managing all stakeholder’s expectations.
4. PRACTICAL METHODOLOGY

The Chapter contains practical methods used for data collection to build the empirical section. We will discuss in detail about the methods used for interviews data processing and analysis.

4.1 Interviews

As it is mentioned earlier that our research is qualitative and we conducted semi structured interviews for empirical results. Face to face interview allows respondents to understand the questions more easily and feels confident to answer the question in more detail and comprehensively. It is also suitable for interviewers to understand the nonverbal gestures and expressions and he/she can add or reduce questions according to respondent’s knowledge. The greater concern for interviewer should be to gain maximum possible information from respondents according to research purpose (Bryman and Bell, 2007). Due to above listed factors and in order to get related data and deeper comprehension face to face interviews was a good choice for us. So all the interviews were face to face discussion in a good environment and the objective was to give good understanding of questions to respondents and gather relevant data from them.

4.1.1 Selection

The selection of respondents for the interviews was decided according to three key stakeholders in commercialization of academic research identified by Seigal at al. (2003). These key stakeholders are as follows:

- University administrators (Responsible for Commercialization)
- University researchers
- Company managers/Entrepreneurs

In order to get knowledge of practical experiences and challenges for managing commercialization activities; university representatives were interviewed. The managers of technology transfer offices, managers in science parks and officials of business incubators are usually directly related to commercial activities, so these respondents were thought enough to investigate. As Umeå University is our case study for this research, so for the selection of respondents in the category of university representatives we contacted ENS Umeå University (Business and Society relations unit) and Uminova (University incubator). We selected two respondents from ENS and two business coaches from Uminova. In order to get student’s point of view, we also interviewed university Phd. researchers who are technology champions and without their researches and innovations the commercialization is not possible.
Although we are conducting this research from university’s perspective but still industry is an important element of commercialization process. So we decided that it will be better to include company managers/entrepreneurs in the respondent’s list. The respondents that we choose as entrepreneurs are involved and attached with commercialization activities of Umeå University and their companies have links with university incubators. It is important for our study because they already have the basic idea about commercialization, so they properly answered our questions. It helped us to understand the problems faced by companies while collaborating with university.

So in total we selected eight respondents for the collection of primary data for our research. Although we feel these eight interviews are enough to answer our research question through empirical data but still if we would have had more time to conduct interviews, university’s central management could have been the next best possible choice for us.

4.1.2 - Choice of Interview Structure

For the interviews of our qualitative research, we decided to go for the semi-structured interviews. In semi-structured interviews, the researcher prepares the set of open ended questions which needs to be asked in same sequence from the respondents. But according to Kvale & Brinkman (2009), it is up to the researcher to strictly follow the sequential arrangements of questions or change in sequence according to situation. To answer our research question, the study needs clear clarification of issues in commercialization at university and require detailed explanation from each respondent according to his experiences so an interview guide was formed in which different questions were prepared for the categories of researcher, entrepreneur and University representatives. These questions were prepared according to the literature we used in literature review. The general theme of the question was based on issues like, university’s role in commercialization, support structure, issues of intellectual property, industry university collaboration, stake holders, their perspectives and suggestions towards commercialization of academic research. The questions were open ended to give room to the respondents to answer in detail. Semi structured interview also allowed us a flexibility to change the sequence of the questions depending upon respondent’s answers and understanding.

According to Patel and Davidsson (2003, pp. 78) semi-structured interviews has lower degree of standardization then questionnaire technique because the questions are open and allow respondents for wider explanations. But with the help of follow up questions and interpretations we tried to get best possible relevant data. According to Bryman & Bell, 2007 Semi-structure interview gave us flexibility to add more questions that arises from the respondent answers which we didn’t think earlier. Open ended questions in semi-structure interviews also benefited us in getting new ideas and new perspective of any issue from the respondents in which we have limited knowledge. In open ended questions the respondent answers in his terms and sometimes researchers get unusual and
interesting answers (Bryman & Bell, 2007, p. 259). But in our case we didn’t find a very high level of difficulty and the data we got through questions was thorough and related.

4.1.3 Interview Guide

The interview guide was prepared for semi-structured interviews and it is shown in the appendix A of the thesis. The interview guide is constructed according to the classification of key stakeholders of commercialization. It is divided into three main sections containing questions related to university administrators, university scientists and entrepreneurs. The questions are designed to consider our research problem and according to the main themes of commercialization discussed in the literature review of the study.

The open ended questions are constructed according to specific rules defined by Bryman & Bell (2007, pp. 266-271). The first rule of thumb that we consider for designing questions is to bear in mind the research questions. The other specific rules that we followed are: avoiding long and double-barreled questions, avoid general and leading questions, avoid questions that include negatives, avoid questions that actually ask two questions and avoid technical term which respondent don’t know.

4.1.4 Choice of Respondents and Collection of Empirical Data

Being the students of Umeå University, we didn’t face any difficulty to access the respondents for interviews. One of the authors has contacts with the Uminova (University incubator) and has been working on several projects with them, so he arranged meetings for interviews with the Uminova business coaches. These respondents are responsible for different commercialization activities at Uminova and also take part in strategic and administrative matters. For conducting interviews with the ENS representatives, we visited them and booked an appointment for the meeting. The respondents of Uminova and ENS appreciated our topic and they seem to be very interested in our study. Their cooperation was very enthusiastic and they assured us for any kind of help during our thesis. We have been working with some researchers on different projects so with the help of them we find contacts of university researchers and booked time for interviews. During the master program there were couples of Entrepreneurs who were visiting us as guest lecturers. So we have maintained contacts with them. As they are already attached with university and has an idea of the concept of commercialization of academic research, we decided to interview them because in our opinion they were more suitable for answering the questions related to our subject. We have already booked meetings with them during their visits to the campus and the problem of access was not that much.

The following interviews were conducted:
Semi structured interviews were conducted with two respondents of External Relations Umeå university. The interviews were conducted on 21st May, 2010 at 8.00 am. Prior time was booked and ENS building was chosen as a place for interviews. Both respondents were interviewed at the same time.

Semi Structured Interviews were conducted with two business coaches working at Uminova. Business coach X was interviewed on 19th May, 2010 at 2.00 pm, while the Business coach Y was interviewed next day 20th May, 2010 at 1.00 pm. The place of interview was Uminova Innovation’s Main Building.

Semi structured interviews were conducted with two PhD researchers from the Department of Applied research and Electronics, Umeå University. The interviews were conducted on 20th may 3.00 pm. Both respondents were interviewed together at the same place. The location of these interviews was Teknik Huset, Umeå University.

Semi structured interviews were conducted with two entrepreneurs. The respondent 1 was interviewed on 23rd May, 2010 at 1.00 pm. The place of interview was Corona restaurant. While the other entrepreneur (respondent 2) was interviewed 7.00 pm 17th May, 2010. Prior time was booked with him and he was interviewed after a guest-lecture at university.

4.2 Data Processing and Analysis

According to Gillham (2000), analysis of case studies should be according to the chronology, coherent and the theory built-up for the issue which is investigated through case study. After conducting each interview, we transcribed the data from voice recorder in the same day and identified the relevant and important data which was required for our study. Some of the respondents were talkative and they explained more than the required information, so we looked at the data and filter the important points. After choosing the relevant information from the raw data, we analyzed data according to themes that we used in literature review. By processing the interviews general impression was depicted from the data that what major managerial issues are being faced by universities and how they can be solved to establish a better management system for commercialization of academic research. The data from the respondents is presented systematically in the empirical chapter and then afterwards, we will go for analysis and conclusion.

4.3 Quality of Research

Although we have tried our best to produce true knowledge and maintain the quality throughout the research but still as our research is qualitative and due to subjective nature of the topic, semi structured interviews has been used for data collection, So there is always a possibility that it could be influenced by personal interpretations. Secondly as this study is being done in a specific environment of Umeå University and Swedish educational environment so its generalization will be limited. To attain the quality...
criteria of the research, it is important to consider validity and reliability of the research results. Validity refers to the issue of whether or not an indicator developed to measure a concept; really means that concept (Bryman & Bell, 2007, p. 165). For the research results to be valid, the control of methods and data needs to be regular and legitimate (Bryman, 2000, p. 43). In our opinion semi-structured interviews from different respondents allowed them to freely answer the questions according to their experiences and produced relevant data. During conducting interviews we affirm and clarify the answers by asking “Do you mean by this” to assure the correct understanding of respondent’s answers. For internal validity we compared the interview guide with conceptual model of themes of commercialization discussed in literature review. External validity evaluates the extent to which the results of a study can take a broad view of setting, place, and time (Bryman & Bell, 2007). Our research is weak in this criteria of external validity because our research is instrument case study (Stake, 1995) in which we have single case for investigating an issue. Due to time and resource constraints it is not possible for us to go for multiple case studies by picking more universities. As we already mentioned in our limitations that due to time constraints the university researchers interviewed were from the same department so this affects the quality of research as well. Depending on the specific environment and nature of each department, the activities performed to facilitate commercialization are different at different departments. So there could be a difference of exposure and motivation among the students belonging to these different departments. It can raise question on the sample being true representative of the whole university researchers.

The other main criterion for the quality of research is reliability of the research findings. Reliability of the research findings are concerned with the question that whether the results of a study are consistent over time and if the study conducted again the results will be repeatable or not (Bryman & Bell, 2007, p. 163). Our research is based on the specific context of Umeå University and the results depict the circumstances of the situation. As we have chosen limited respondents, whose answers to different questions can be different in different occasions. Moreover theses answers can be analyzed differently by different researchers so we can say that even if the study will be conducted again in the similar condition still the results may differ in certain aspects.

Trustworthiness and Authenticity are the two criteria that are mainly used for qualitative research. Further the criterion of Trustworthiness is divided into sub criteria of credibility, transferability, dependability, and conformability (Lincoln & Guba, 1994, cited in Bryman & Bell, 2007, p. 411).

All the methods used for conducting this research were consulted from the basic rules and principals of research methodology explained in different books. As it was not possible to reach all the respondents after the research, so copies of this research were sent to some of them to have their opinion about our understanding of their responses. Proper procedures were followed under the supervision of our supervisor and the whole record of the research was made available so we think it is enough to prove truthfulness of our research.
The trustworthiness of the respondent’s answers in our case may be weak due to the sensitivity and nature of the topic. The respondent from Uminova and ENS were also having some secrecy agreement and the information about patenting and licensing was not made fully available to us. Due to direct relationship of some respondents with commercialization activities and in order to insure their answers to be trustworthy we gave an option to the respondents to remain partially anonymous and their names were not mentioned. The direct transferability of this research to other universities is weak but as a general understanding, some part of our recommendations and suggestions are transferable.

Ensuring authenticity of the respondent’s answers is also important because qualitative research has the issue of authenticity that respondents may answer wrong or forget to identify any important things. To ensure this we conducted more than one interviews from each set of key stakeholders of commercialization. The same questions from more than one respondent ensure our research authenticity.
5. EMPIRICAL RESULTS

This chapter presents the information collected from the respondents through semi-structured interviews. The purpose is to render what was given account for in the interviews and to capture the views of the respondents as per their experiences on commercialization of academic research.

The chapter is divided in three sections. First section presents the information gathered from university administrators responsible for commercialization of academic research i.e. Uminova and ENS respondents. The second section contains the information provided by PhD research students of applied physics and electronics and third section includes the information from entrepreneurs and industry representatives.

For better understanding and clear concise empirical presentation, we have shortened the transcribed data by including only the related information. For this purpose we have also paraphrased it in a systematic way. The data has been arranged into different heading based on its relevancy.

5.1 Uminova AB

Before information about respondents and empirical data, it is important to know about Uminova AB. Uminova is the business incubator of Umeå University works on commercialization of business ideas by providing personal support and environment. Their aim is to help the university researchers and students to develop their research into business ideas and companies. Uminova is further divided into: (a) Uminova Innovation, which contributes to the commercialization of business ideas. They offer a structured process as well as personal support, networking and a creative environment. The focus is on business ideas from scientists, staff and students at universities and hospitals in Umeå and the innovative ideas from companies in the region (Uminova, 2011). (b) Uminova Science Park, affords a high-tech business environment suited for research-related companies and organizations. It promotes local culture of innovation and competitiveness through its work for common economic development. The result is an inspiring technology park where good ideas become dynamic enterprises (Uminova, 2011). (c) Uminova Invests, works for future growth of companies and invest on people with good ideas and entrepreneurial spirit - especially at a stage when the injection of capital and expertise necessary to help a business grow. The idea, product or service must be unique with high market potential, and must be affiliated with Umeå University and other educational and research activities in the county of Vasterbotten (Uminova, 2011).
Respondent X:
Respondent is a PhD in analytical chemistry from Umeå University. She has experience of working in spin-off companies and of patenting research results. She has been employed by Merck SeQuant AB in Umeå, a former spin-off company that was acquired by the chemical and pharmaceutical company Merck KGaA (Darmstadt, Germany) in 2008. Since the autumn of 2009, she has been working as business coach for Uminova Innovation.

Researcher Y:
Respondent has a bachelor degree in Business administration from Umeå University. She has previously worked as an electrical engineer. She also has experience from the printing industry and an advertising agency. She is educated at PRV, The Swedish Patent and Registration Office, in Intellectual property rights. Since 1998 she is working as a business coach at Uminova Innovation. She is member of the national board for SISP (Swedish incubators and Science Parks). At Uminova Innovation she is project manager for the Innovation program IBIP (Innovationsbrons, Inkubatorprogram) financed by Innovationsbrons and the project Innova which is a Regional Structural Fund program.

5.1.1 Purpose Function Strategies and Managerial Practices of Uminova

According to respondent Y, Uminova arranges events and interactive counters on the campus and make available a lot of information both for the students and scientists. They also arrange some seminars to inspire the researchers towards commercialization. These seminars also educate students about the role of Uminova and available facilities. If students have any business idea they contact Uminova through their website, idea drop box or visit every Thursday 3 to 5 pm. There is always a business coach available to interact with students. If the idea is verified and seems to have potential it can be further developed in collaboration with Uminova. Uminova help the students and researchers to use business tools like “7D models” to develop their business ideas into real business plans.

Talking about the key elements of Uminova’s basic strategy the respondents expressed that, Uminova don’t have any organizational influences on the research. Uminova don’t force researchers to commercialize their research. Uminova thinks that the research or idea is owned by students or researchers and they have full authority to use their ideas. It is a student’s decision that if he wants to develop his own company from that idea or license it to another company.

5.1.2 Collaboration with Industry

Answering the questions about collaboration with industry, respondent Y told us that
“Uminova is the business incubator of Umeå University and we are not working on the collaboration with the companies. Our mission is to interact with the students and help them to commercialize their ideas by starting up their own companies. We are owned by the university and if we take scientist from the university and put them into industry the owner (University) will not appreciate this.”

According to respondents, Uminova, do not collaborate with companies but the researchers collaborate with company on their own. Uminova can only help them to develop their idea or research or to build a company out of it.

Talking about one of their program named **summer entrepreneurs** respondent Y said that “it’s a tradition here to hire students during the summers but in this program we want companies not to hire students instead just use their services. The purpose is to help students understand that how it works in a company and then help them to start their own company. Students can try it in the summers and see if they like it. If they like this way to live and work they can choose it as a career for them.”

### 5.1.3 Collaboration with Other Agencies Working for Commercialization

The respondent X told us that, Uminova only deals with the incubation of these companies and we don’t help these start-up companies to grow. When these companies want to grow they need investment and involvement of more people. At this stage Uminova Invest or some other investors like business angels or big companies can come in. Uminova has two other units as well, InfoTech Umea and Bio tech Umea. They deal with making clusters of the companies in the region and help them to internationalize but this is more about marketing and a very small part of our job.

According to respondent Y, there are many other agencies working to promote commercialization and entrepreneurship. Uminova also collaborate with the other existing agencies like Connects Nord, AlMI. This interaction with other commercializing agencies is not that organized and we have no schedule of formal meetings with them. The organizations are regulated individually but there is no authority or person who regulates their performance collectively. We are in a system in which we meet each other when we need but it is not scheduled or planned.

### 5.1.4 Evaluation of Uminova’s Performance

According to respondent X, Uminova has an evaluation report for one year but we don’t have a comprehensive report since the Uminova has started. She said that last year out of 170 just 30 companies have started and 10 got licensed. Some of these companies are working but they are physically not here. As she mentioned, that to measure and follow the companies they need resources and proper measurements. But they have the same information about the companies they started up with and give this information to Innovation Bridge, which is an agency to keep track of startup companies in the whole
Sweden. Innovation Bridge is in four places in Sweden measuring and providing information about whole Sweden. They also help Uminova to summarize and send report to the government.

5.1.5 Challenges for Uminova Regarding Commercialization of Academic Research

According to both respondents of Uminova, many researchers are not interested in commercializing their research so they don’t approach Uminova. According to Uminova’s surveys there are only 50 percent in favors of commercialization and then approximately 30 percent interested in starting their company. But Uminova is trying to reach as many as possible to encourage them to commercialize their ideas and researches. Talking about the motivation of researchers’ respondent Y said that, “Researchers don’t think a lot about money and it doesn’t trigger them but may be the Noble prize fame and publishing articles could be the trigger for them. But we cannot be sure about all the researchers because it differs person to person.”

Both respondents mentioned that the researcher’s attitude of not being interested in commercialization is a big hurdle for commercialization of university research. The respondent Y mentioned that, they can reach more researchers but the problem arises when the researchers don’t want to be reached. She said that Uminova only offer their service and they cannot force the researchers. They reach those who want to start their company.

According to respondent Y, this issue is a big problem because the university doesn’t own the research it’s only the researchers who owns the research and if they are not motivated there will be no commercialization at all. She further mentioned that, even if the university will owns the research still there will be need for some entrepreneurs and the students coming from business school who have such experiences.

5.1.6 Suggestions for Improving Commercialization of Academic Research

Respondent Y expressed her views that, a good way of getting practical experience is to work in the company and at the same time work with your research or studies. It may take a long time for a student to get his/her degree and it is costly and risky for the companies because they don’t know what they will be getting back. She said, may be there is a change required in the educational system. There should be some working experience required for master’s students before coming to university so that before starting their own company and advanced studies they should have a practical experience of working in industry.
As she gave us an example of the United States that, “In U.S., the researcher can start his own company with his research facilitated by university and this is not so common in Sweden. In Sweden, there is always somebody else who will look at how this research is going to be used and that somebody is not the researchers commonly. The motivation of scientists can be raised but it takes time to change the attitude and behavior to incorporate them to business world.” The respondents mentioned that the university management should work to raise the level of motivation of changing behaviors and attitudes of the researcher. They also referred this issue to ENS that they can play their role to bridge this gap between industry and academia.

5.1.7 Patenting and Licensing

According to respondent X, Uminova has a very good system to deal with the issues of Intellectual property. She said that, we have several law companies which provide help and support regarding legal issues. Uminova also help students in patenting their research ideas and research outcomes are protected by confidentiality agreements. Due to confidentiality issues, she didn’t give us the name of law companies. She further informed us that probably from the next year innovation offices will be set-up at Swedish universities with a task to deal with issues related to patenting and licensing.

5.2 ENS

External Relations (ENS) established in 2004 is Umeå University’s joint resource for improving and strengthening the cooperation between university, industry and society. According to the information from their home page, ENS was designed to work in close collaboration with Umeå University, with the aim of improving and strengthening the cooperation between university, industry and society at large for mutual benefit and success. ENS acts as an intermediary between industry and faculties, departments and centers of Umeå University.

Respondent 1
The respondent 1 is working as coordinator in the external relations of ENS and responsible for dealing external relations with the companies for collaboration.

Respondent 2
The respondent 2 is director of Industrial Graduate School which is the project of ENS for educating PhD students.

5.2.1 Purpose, Functions, Structure and Strategy for commercialization

According to respondent1, ENS is designed to work in close collaboration with Umeå University and cooperates with key outside businesses. The aim is to improve and strengthen the collaboration between university, private sector and society at large for mutual benefit. ENS acts as an intermediary between the faculties, departments and
centers of Umeå University (inside world) and industry and society (outside world). ENS works to identify and bring together partners from university, small and medium-sized companies and organizations at regional, national and international level. For its external projects it applies for funds to EU through its EU Project Office which is its contact point for international research cooperation with university and regional, national and international partners.

The local industries also get benefits by collaborating with university as they get the opportunity to solve their problems in a more modern scientific ways. For instance, ENS has an established and efficient network with different industries and society in which it operates and facilitates its cooperation and collaboration. Umeå University has an excellent status and is one of the most reputable universities in the Northern part of Sweden, which provides ENS with a competitive edge for university industry collaboration. ENS has highly experienced staffs who have been working in this field for a long time and their expertise in dealing with both the internal and external customers are very high. ENS also claims that it has a distinct way of performing its activities: personal and face to face meetings in companies are usually arranged in order to provide a more professional and specialized services.

ENS also collaborates with three universities; Luleå University of Technology, Linkoping University and the Swedish University of Agricultural Sciences. The aim of this collaboration is to learn new ways of efficient working. For instance, ENS collaborates with the Knowledge Transfer Office (KTO) of Linkoping University and Grants Office (GO) of Lulea University for exchange of new ideas to improve the working processes and to develop better quality control systems. In short, the formation of such networks has significantly improved the overall performance of ENS.

ENS has different head offices located at Ornskoldsvik, Skelleftea, Lycksele, Kiruna and Umea. All these offices are geographically dispersed and indulged in several types of projects. They mentioned that their organizational structure works with respect to projects and regional study programs.

**Industrial Graduate School**

Respondent 2 told us that, a new project called “Industrial Graduate School” has been launched by ENS about two years ago. There are two basic objectives behind this project (1) strengthening the contacts with industry (2) preparation of graduate students not only for an academic career but also for a leadership career in industry. The project is running on the basis of a mutual collaboration between experienced researchers and companies in which they work together on a common research project. The research projects are of mutual interest for both researcher and companies. These projects are 50% percent funded by departments and 50% by the companies.
5.2.2 Intellectual Property and Licensing

In this regard the information we got about ENS shows that ENS role towards licensing and patenting is limited. ENS deals with licensing agreement with companies for commercializing the university researches. Their role is to safe guard the intellectual property of researchers and they have some collaborative research projects with companies in which they have licensing agreements.

5.2.3 Satisfying Stakeholders of Commercialization

According to ENS respondents, it is important to consider the expectations of key stakeholders who have a direct or indirect influence on its operation. Some of its major internal stakeholders consist of the various faculties and departments of the University (researchers), students and its employees, while, external stakeholders are the government, municipalities, public/private companies and the local citizen. Government is the most powerful stakeholder as the establishment of ENS itself is a result of government’s recognition of the requirement that Umeå University should cooperate with industry and society to boost up the economic growth of the country and especially the Northern region.

The municipalities also have a vital role to play as they help ENS in creating its network by providing information about the companies and sometimes visiting them with or on behalf of ENS. They are also concerned in promoting the regional growth in a direct way because they are also providing support to their local companies to grow with the help of Umeå University.

Researchers and students from the different faculties and departments of the university also play a key role as they can be considered both the suppliers and customers of the unit. They are the one who undertake research which can be used to fulfill the need of the enterprise, they are considered to be the provider of the necessary skills, knowledge and competences for the economic growth. While they are also customers of ENS, as the unit is responsible for undertaking all the necessary processes needed for them to receive funds from the external world, mainly from the EU Office. They will expect that ENS helps them in finding appropriate job placement and carrier opportunities.

The companies cannot be ignored as key stakeholders because without negotiating with them commercialization of university research is not possible. They are the ones who practically use the knowledge produced in the universities and in response they provide financial and economic benefits to the society.

5.2.4 Major Issues and Problems Faced by ENS

According to respondent 1, one of the major issues ENS faces regarding commercialization is the internal resistance from bureaucracy and head of departments.
There are people in the offices, professors and students who are of the view that commercialization will change the focus from pure research to applied research and this is bad for the society. The second main reason for their opposition is that the most of the research grants goes through the bureaucracy and Deans of the faculties, and they think that an increased involvement from industry they will be losing control of that money. So the project launched by ENS to increase commercialization of academic research faced a lot of resistance from inside.

According to respondent 2, the companies are not that open to fresh graduates especially who don’t have any experience of the industry and moreover companies want a greater and flexible interaction with students. The interest of the company is mostly towards their specific issues and they are always interested to own the research.

## 5.3 PhD Researchers

For the category of researchers we have chosen two Ph.ds. Both of these respondents are from the department of applied physics and Electronics. They have worked on projects like Free Space Algorithm, Unmanned Vehicle and have produced valuable outcomes having practical applications. One of them has also worked in industry as a researcher. As both of them are well familiar with the university environment and now they are working on different research projects as well, so we think this makes them a good choice in the category of researchers for our thesis.

**Respondent A**

One of the students (which we will call respondent A) has patented one of his research outcomes with an automobile company but it was his individual effort. He was also aware of Uminova and had worked with them in one of their activity called “Academic Business Challenge”. We think this makes him well aware of the obstacles, which a researcher can face to commercialize his research

**Respondent B**

The other student (which we will call respondent B) was not much aware of the concept of commercialization of academic research. We chose him as a respondent so that he can help us understand the reasons for a university researcher for not being interested in commercialization process.

## 5.3.1 Experiences with Commercialization of Academic Research

According to respondent a, most of the researchers are not interested in starting their own company after doing their PhDs. He mentioned that from his fellow PhDs just three are doing business out of thirty because it is difficult to run a business while doing the research. Respondent B expressed that, he has no idea for marketing of research or to implement it in industry.
According to both researchers, it is better to work with companies and it gives better understanding of market demands and practical problems. They said that scientific researches and innovations in university can play a key role in the development of economy and society. Working with industry scientists in professional environment of R&D departments can also be helpful for their individual research. But starting a company is different and a difficult thing. There is also a commercial risk attached with commercialization and the researchers may not want to take that risk and it also requires some capital to start a new company.

5.3.2 Difficulties and Obstacles Regarding Commercialization

Respondent B explained that researchers are usually more interested in publishing their paper rather than patenting and they think publishing of papers is more important than commercialization. Talking about the reason for this kind of motivation he said that through publications the researchers can earn good money and popularity in the academic world. The respondent A said that, the money is not the only motivation for them. Publishing the paper in academic journals, Noble prize fame and competition with other researcher can also be the main triggers for them. He further explained that the mentality of the researchers is to explore new things and making products out of it could be the job of other persons. Respondents B said that, you never know the potential of new ideas. It takes some time maybe ten years to publish something and then a decade more to find out its use. Sometime you don’t see the application at the moment but usually the researchers are always interested to leave the application and go ahead and move forward.

The respondent A mentioned that the researches should be more commercialized but sometimes the research is more complex so it can only be the researchers who know the application of their research and the researchers have very short time to see if it is applicable or not. He further said that if the researchers concentrate to find out the application of their research then they will have a less time to do new research and perhaps they will have less publication and this is not good for their academic carrier. According to respondent B, researchers think that it is difficult to contact with firms personally for commercializing the research and technological innovations. University should help the researchers for commercializing their researches. Sometimes it’s a problem for researchers to fulfill the demands of company and these demands can also reduce innovation.

5.3.3 Patenting and Licensing

Answering a question about the issues of Intellectual Property (IP), both researchers gave almost a similar reply that, patenting and licensing are complex issues and should be dealt by university they don’t like the paper work and it takes a lots of time. The
researchers expressed their views that most of the researchers don’t know about the patents and they don’t care about the patenting and licensing.

**ENS and Uminova**

According to researcher B, He is not much aware of the activities of Uminova and ENS regarding commercialization of university researches. He had seen them sometime in the department but he has not been approached personally.

Respondent A said that, there are quite a few, who are in contact with Uminova. But he thinks these are not the researchers who are going to interact with Uminova. The Uminova should go to the people and tell them about their functions and commercialization, may be in “Fika” meetings. He mentioned that, he hasn’t seen them in that way.

Respondent B said that, there must be a connection between researchers and companies and this role can be played by Uminova and ENS. Both argued that the Uminova and ENS should play their role for giving information and awareness among researchers regarding commercialization. They said that the ENS and Uminova should help them in finding applications and feasibility of their research for commercialization.

### 5.3.4 Suggestions to Improve Commercialization of Academic Research

Respondent A expressed that due to less motivated nature of the researchers a lots of ideas are wasted. It will be better if the university will own the research and then tell the researcher that now we are doing the commercialization of your research and you will get some benefit for it. They explained that it will be great if their researches will be applied to make a product for companies and they receive the patents for that.

According to him, US universities are better for patenting and licensing because they have more rights towards academic research. American universities have their websites where they show available patents. The universities show all the patents that are available to the companies for buying or licensing. According to respondent B, maybe this is the way it should also be here in Sweden, because then it will become a natural contact between university and industry. The strategic persons from industry can visit these websites and hunt for the patents. Similarly patents bought by one company can be sold by them to another interested company.

Both researchers were agreed that there should be some business courses during their PhD so that they can at least know some marketing terms.

### 5.3.5 Funding

Answering a question about funding and research grant the respondents replied that, they get most of the funds from local government, central government and sometime E.U. the funding will be more if they have more publications.
Getting funds from industry will be good in one aspect and bad in other. Some time the research equipments are costly and you always need more money for your research so it will be good. But on the other hand it could also be risky and biased, which is bad. The respondent B said that, there might also be some ethical problems in taking money from the companies. May be they will say take that money and prove that this is good. Respondent A suggested that, the research could be started with the help of government funding and may be at the end of the research there can be chance to find out its commercial uses and find funds from companies.

5.4 Entrepreneurs
Respondents

Semi structured interviews were conducted with two entrepreneurs. One of the entrepreneurs (respondent 1) is in touch with Uminova and has developed three different companies with the help of university incubator. The businesses are related to software development, recruitment and production of IT gadgets. The other entrepreneur (respondent 2) was also educated at Umeå University but now he is running a textile company in Bangladesh. Prior time was booked with him and he was interviewed after a guest lecture at university. We chose these respondents because we think their close contact with both university and industry makes them a better respondent for answering the question related to commercialization and they have the better understanding of the practical issues.

5.4.1 Ideas about Commercialization

According to Respondent 1, the researchers should do their research without thinking of commercialization. In this process researchers and entrepreneurs should be separated. He said that, “A researcher’s job is to produce the research and then it is the entrepreneur’s responsibility to take it to the market. So commercialization is good but it should not be forced. The researchers should look more beyond the coming few years and entrepreneurs should focus on what they can do now with the ideas. First do the research and later see if that research can fulfill any need or if it has any use. If it has any use then put it in a box and start selling it. If the research does not full fill any need then the researcher should put more effort into it and develop it into a product. When a researcher has done his research then the entrepreneur or the C.E.O of the company can start commercializing it. The researcher can work with his product as an advisory element or part of R&D and see if the company needs any help”

The respondent 2 was also having almost similar response. According to him,
The researchers should do their research without having any idea of commercialization. There should be a difference between a university researcher and a technician hired by a company. If you will not do so the radical innovations will be reduced. At the end of a student’s research he should be given a chance if he wants to continue his research or wants to join a R&D of a company. It is good to have some radical research without having a practical implementation in short run, but it will be more useful in long run.

5.4.2 Problems

Talking about the problems faced regarding commercialization the respondent 2, explained that, when researchers do their research without thinking of commercialization some problem arises. For example, there is a problem of time frame between researcher and companies, because companies want it quick while the researchers thinks in terms of five years or more. There are also some cultural and academic problems, researchers analyze too much and they lack practical knowledge.

Respondent 1 expressed that, after Uminova there is no support available for commercialization. Today they have incubation; acceleration and investment and the focus is more on the initial steps which leads the research to incubator but then there is nothing. There is no help for networking and there is no focus on growth. According to him, the spirit of growth and challenging the world wide international companies is missing and the vision is very local and not international.

According to respondent 1, there is a big difference between the academic and practical implementation. “The companies are more concerned about the outcomes of the researches and they want to commercialize the findings with respect to their specific problems, while university researchers are always more focused towards academics and their degrees.”

5.4.3 University Industry Collaboration

According to respondents, the existing structure provide a good collaboration but still there is need for some events which should provide opportunity to the students and researchers to stay at the company for one week and see how things goes on. Or the companies should be given some opportunity to stay with the students at the university. “It is not about university and industry; it is about people meeting people”. So the number and duration of informal contacts should be increased and the natural flow of contact should be maintained.

Respondent 1 has some contacts with researchers. He said that sometime he recruits students from university. He believes that guest lecturers in university can help the company representatives to interact with university students and researchers. While respondent 2 said that, “the researchers should be given a chance to interact with the
companies in the middle year of their research and the companies should also consider the issue of protecting the intellectual property of researchers”.

Respondent 2 also mentioned that he has been invited several times by university as a guest lecturer and he thinks that these kinds of activities can really reduce the gap between university and industry. He further explained that he has been participating in several activities arranged by student organizations like SIFE and AISEC and these kinds of interactions and organizations are really productive. He appreciated the role of student organizations and said that, the student’s participation in these activities also help to improve leadership abilities and interpersonal skills. In his opinion these student organizations should also participate in commercialization activities.

5.4.4 Expectations towards Researchers

Talking about the expectation of companies towards the university students, respondent 2 explained that, in order to better interact with researchers there is a need to educate them in terms of business courses. He said that the PhD students should know some business terms to commercialize their researches. He mentioned the terms like sales management and some marketing courses should be taught to them. He also discussed the problem of communication skills with some scientific researchers. He mentioned that it is important for the scientists to deliver his research properly and there is need for attitudes towards commercialization.

5.4.5 Suggestions to Improve Commercialization

According to respondent 1, there is lack of coordination of big companies with university and there are no such role model or success stories. The big companies should be kept close to university. According to respondent 2, some practical tasks are required for research students like, give them some products and tell them to go and sell it in the market. In this way they know some marketing skill and this help them to market their research. The slogans like “Stop thinking Start Doing” should be followed. There should also be some courses which make them more practical. He said that, the companies are sometime little scared from academics due to complexities of applied researches but they also know that the findings and fresh researches in university can make a difference in their businesses. So companies and universities both should take some daring steps based on mutual benefits.
6. ANALYSIS AND SUGGESTIONS

In this chapter an analysis of the empirical results will be done. Based on that analysis some recommendations will also be presented.

This analysis is based upon the empirical observation we have gathered through semi structured interviews and the theories used in literature review.

6.1 University's role of Commercialization

As explained in the theory that the role of a university is changing and most of the universities are now becoming entrepreneurial universities and their contribution towards society is also increasing (Etzkowitz, 2001; Markman at al., 2008.). Moreover, since 1997 the Swedish universities are bounded by law to fulfill all three functions of teaching, research and contribution towards society. Our empirical observation shows that Umeå University is also been equipped to be a modern entrepreneurial university. University has an ambidextrous organizational structure to balance the contrasting demands. But the university is also facing difficulties in managing its commercialization activities. In the first part we will analyze different organizational support structures and facilities that the university have, while in the second part we will focus on different obstacle, inefficiencies and problems towards commercialization processes.

6.2 Organizational Structure

As explained in theoretical section the internal and external support structures are required to facilitate commercialization activities at the university. These support structures Include: Technology Transfer Office (TTO), Business incubators, University owned joint ventures, Spin-off, start-ups and Science parks. ENS and Uminova are the support structures to act like, TTO, business incubator and science park. ENS work as the technology transfer office which act as an intermediary between university and industry, while Uminova Innovation and Uminova Science Park act as a business incubator and science park aimed to increase entrepreneurial activities in terms of Spin off and Joint Ventures. So we can say that adequate basic structure is available for the university to act as an entrepreneurial university and to perform the role of commercialization.

6.3 Managing Intellectual property

The university has a good infrastructure which can provide support for patenting and licensing, the secrecy is well maintained by having different legal contracts and there are several legal companies which provide their consultation. But infect all these facilities are valuable if the researchers are motivated and encouraged to contact the support structures like Uminova and ENS. As shown in the empirical observation, the individual knowledge
of researchers about patenting and licensing is not enough and they don’t seem to be motivated about it because they think it is a difficult job for them. This lack of information can result in a low level of patenting and licensing activity and ultimately the access of industry executives towards academic research and university researchers cannot be properly channelized. So the possibility of scientific disclosures and licensing university research for practical applications becomes limited. There should be some efforts and programs to create awareness about the patents and licensing among researchers and increase the ease of access.

On the other hand as mentioned by (Chang, Yang & Chen, 2009, p. 945), the close partnership with companies and informed awareness of market opportunities to researchers can improve the performance in patenting and licensing. By patenting and licensing, universities are contributing to the economic growth, and by owning intellectual property rights and starting their own businesses, academic scientists seem more like businessmen. This makes the management of intellectual property as one of the most important processes of Commercialization. In our opinion, the management of support structure should consider evaluating their performance in terms of numbers of licenses and patents.

6.4 Bureaucratic Issues

As explained in literature review, bureaucracy in university is one of the barriers in commercialization of research. As the cultural differences there are conflicting demands between university researchers and the industry managers whereas the management of university is tied with its own internal bureaucracies. These bureaucracies discourage companies to collaborate with university for commercialization purposes (Berman, 2008, p. 168). Almost the similar remarks were given by respondent 1 from ENS. He mentioned the bureaucratic resistance they have been facing due to different reasons. The bureaucracy of the university have concerns towards commercialization because they think, it can affect the quality of research. Secondly most of the university grants pass through the university bureaucracy so, external direct funding can decrease their control over university funding. As (Siegel, Wright and Lockett, 2007, p. 490) suggested that, the rise of academic entrepreneurship requires a re-examination of university’s organizational structures and practices. We are also of the opinion that the university should revise its organizational structure and processes to decrease this bureaucratic resistance. On the other hand, the moral concerns of bureaucracy should also be addressed. Better communication of the importance of commercialization will not only decrease bureaucratic resistance, but will also increase the overall moral support for it. Ultimately it will help to increase the university’s overall efficiency towards commercialization of Academic research.
6.5 Individual Researchers Motivation

If we take a look on our empirical observation, the lower level of individual researcher’s motivation seems to be a big hurdle in the process of commercialization. As mentioned by Uminova’s respondents, according to their own surveys there are only 50 percent in favors of commercialization and then approximately 30 percent interested in starting their company. As per the comments of researchers, they actually acknowledge the importance of commercialization, for the society their research and their personal developments. But still there are some elements which are reducing their motivation towards commercialization efforts. Some of these elements are described below.

Researcher’s Perception towards Commercialization

The researchers acknowledge the importance of commercialization but they perceive that working in the industry and starting up a business as a difficult activity. As researchers think that working with industry scientists in professional environment of R&D departments can also be helpful for their individual research. But they think starting a company is different and a difficult thing. In their opinion there is a commercial risk attached with commercialization and most of the researchers may not want to take that risk and further more it also requires some capital to start a new company. They also showed their concerns towards, radical innovations, ethical issues and the element of biasness in the research.

Incentive and academic reward system

As in the literature Seigel at al. (2007, p. 497) mentioned that, appropriate incentives are necessary to design for university researchers, and the traditional reward system and the modern technology transfer rewards system have conflicts of interest. Mainly because the traditional reward system focus on publications of basic research, while technology transfer reward system is more focused towards revenue generation from research. As the researchers expressed that, at the moment the publishing of research papers in scientific journals and using the government funds for their research are considered as the best available options for researchers. So at the moment we can say that, either the existing reward system of the university is more focused towards publications or it may have not been properly communicated (Magnusson, Mc Kelv eye & Versig lioni, 2003, p. 27). The university should clearly communicate the strategies and ambitions regarding researcher’s incentives for commercialization.

6.6 Cultural Clash between Academic and Industries

As explained in literature review there is a big cultural difference between university and industry and both have different goals and motives for commercialization. Our empirical observation also depicts similar kind of picture which shows clash between the academic and commercial interests. The entrepreneurs attached with university do acknowledge the importance of pure research but on the other hand they want to commercialize their technologies and research on their own terms and conditions as well. They are interested
in informal contacts with the university researchers and wider exposure towards innovation and research. At the same time they are concerned with, researcher’s knowledge of practical business issues, communication skills and theoretical nature. So they want researchers to be introduced to the business world, during the course of their research as well. On the other hand academic researchers are more involved in their basic research and interested in publishing their papers in scientific journals. Their motivation towards commercialization and business world is not so high, which increases this gap further. So, one of the respondents mentioned that, there is strong need of showing flexibility from both sides to bridge this gap between university and industry. As explained in literature review, if the researchers and students will be given opportunity to work with companies, it will help them to better understand the practical implementation of their knowledge and research. These activities will also be helpful for companies to get an insight of academic world and new ideas.

The respondents of university incubator (Uminova) also expressed their views that the lack of industry experience greatly affects the performance of students in the startup companies. The environment outside academic life requires knowledge of market demands and practical experiences. As per their views, this kind of issues may require some changes in the university’s academic programs and their structure. Practical experience of the industry can be made compulsory for getting admission to some of masters programs at the university or these programs can be structured to include few months compulsory work experience. ENS respondents also expressed that, the companies are hesitant to hire fresh graduates from the university. So we can say that practical application of research and knowledge is not that much and further arrangements and initiatives are required to make the research and ideas commercial.

6.7 Role of Uminova and ENS

As explained in the theory the collaboration of university and industry contributes towards the economic growth of a country which is one of the basic purposes of commercialization. So there must be a connection between researchers and companies and this role can be played by Uminova and ENS. Sweden has law of “Professor’s Privilege” which gives benefit to researchers to have full rights of their research. This privilege to researchers makes it difficult for university management to commercialize research because the agreement has to be made directly with the researchers (Johannesson, 2008, p. 9). But as we have already analyzed that due to different factors, motivational level of researchers towards commercialization is not so high. On the other hand a huge gap between industry and researcher’s exit. So if we take a look on the whole picture, the support structure and management of the university are the key elements, who will have to play their role to motivate and educate researchers towards commercialization. As Respondent A in the category of researchers said that, there are quite a few, who are in contact with Uminova. But he thinks, “These are not the researchers who are going to interact with Uminova. The Uminova should go to the people and tell them about their functions and commercialization”. So it means Uminova will have to increase their interaction, penetration and involvement towards researchers.
Support structure will also have to work in reducing the gap between researchers and Industry. Although it’s not an easy task to do while keeping the policy of freedom of research, but still there are different initiative which can be taken. As empirical observation shows that, academic researchers work in a non-commercially oriented culture and it’s difficult for them to know which applications are more useful in the market and it takes time to find out the application of their research as well, which can reduce their time devoted for basic research. They also lack the knowledge of transferring technology into the marketable products or services and these skills can only be built by entrepreneurial experiences and by working in industry. So as expressed and suggested by the interviewed researcher, Uminova and ENS can play their role for giving information and awareness among researchers regarding commercialization. ENS and Uminova can also help them in finding applications and feasibility of their research for commercialization purposes. The programs like Summer Entrepreneurs or guest lecturers can be helpful. The Industrial graduate school is a good program launched by ENS in this regard and further programs like this can help to reduce this gap. There are other activities like seminars, interactive website, Idea Drop Box and meetings but as expressed by respondents, there are not so many researchers who are fully aware of Uminova or ENS activities. So the focus towards penetration and involvement of the students need to be increased. Mechanism should be devised so that ongoing research can be better analyzed for the purpose of commercialization and better propagated and marketed to the outside world, (while taking proper care of intellectual property issues).

As the respondents of Uminova expressed that they also interact with other existing agencies outside academic world. But this interaction with other commercializing agencies is not that organized. In our opinion, an organized interaction can help to increase the overall efficiency of Uminova and can produce a better synergic effect. Proper evaluation reports and track records can be helpful to analyze the efficiency of ongoing commercialization activities. While, highlighting and communication of success stories could be helpful to motivate the researchers, attract more companies and will boost the morale of support structures as well.
7. CONCLUSION AND END NOTES

In the following section the thesis will be ended up by stating the concluding comments, contributions of the study and giving some suggestions for further research.

7.1 Concluding Comments
On the basis of this study we would like to comment that, Umeå University is committed to perform its third role of contribution towards society and there is adequate infrastructure available in terms of support structures. But still as this role is new for the university and carrying on commercialization activities while insuring freedom of research is a challenging task. So, a detailed evaluation of existing support structure and reorganization of their existing activities is required. It may also require better understanding and communication of the concept of commercialization, generation of new ideas, policies and a greater attention both from the support structures and central management of the university.

7.2 Contribution of this Study
This study has contributed by highlighting different issues faced by Umeå University towards commercialization of academic research. Suggestions have also been presented to overcome these issues. This study gives a picture about the support structures available and their practical functioning. This report will certainly help the administration of Umeå University to take a quick look on its functioning towards commercialization of academic research. By finding out the practical issues related to commercialization of academic research it will somehow help to complement the existing research and theories. Although this research was conducted in specific environment of Umeå University but some of its outcomes can also be generalized to other Swedish and International universities. This study can also helpful in literature of commercialization and universities changing role towards commercialization. The third role of commercialization of academic research is mostly discussed in this paper.

7.3 Future Studies
Further studies can be conducted on different aspects highlighted in this study like, increasing researcher’s motivation, development of an effective communication system to raise awareness towards the importance of commercialization, Inside outside collaboration, and integration of support structures to improve commercialization activities. The role of management of university was not studied, so a similar study including the detailed role of central management of the university will be more useful.
REFERENCES


**Electronic Sources**

http://www.ens.umu.se/verksamhet/

http://scholar.google.com/

http://www.umu.se/english/about-umu/facts/information-material

http://www.uminovainnovation.se/default.asp?id=1230

http://www.vinnova.se/en/

http://www.uminova.se/

http://www.nbia.org/
APPENDIX A

Interview Manual

Questions for the Respondent of ENS

✓ What is the basic aim and functions of ENS?
✓ What is your organizational structure and strategy for commercialization of academic research?
✓ Who are your major stakeholders and how do you interact with them?
✓ What are the major obstacles and difficulties in commercialization of academic research?
✓ What are your suggestions to improve the process of commercialization of academic research?
✓ How you deal the intellectual property and licensing issues with the companies and university researchers?

Questions for the Respondents of Uminova

✓ What is your basic function and strategy for commercialization of academic research?
✓ What managerial practices you are using to run the Technology Transfer Office?
✓ What is the performance of Uminova to commercialize the university researches?
✓ How do you train the university researchers to work with companies and commercialize their researches?
✓ What steps you have taken to collaborate with companies to commercialize the researches?
✓ What are the problems you are facing towards commercialization of academic research?
✓ How you deal the intellectual property and licensing issues with the companies and university researchers?
✓ What are your suggestions and recommendations to improve the commercialization process in universities?

Questions for the University Scientists

✓ What are your experiences with commercialization of academic research?
✓ What do you think about collaboration with industry or Entrepreneurship?
✓ How the university assists the researchers to commercialize their researches with companies?
✓ What are the difficulties and obstacles regarding commercialization of academic research?
✓ How is your relationship with Technology transfer offices and university incubator?
✓ What will you suggest to improve the process of commercialization of academic research?
Questions for the Manager/entrepreneur

✓ What is commercialization of academic research for you and how you see the issues of pure and applied research?
✓ How the companies can improve collaboration with universities?
✓ What are the expectations of companies from university graduates and researchers?
✓ What are the major obstacles and difficulties in commercialization of academic research?
✓ What are your suggestions to improve the process of commercialization of academic research?
Appendix B

Organizational Structure of Umeå University

The University Board
The highest branch at Umeå University is the University Board of Directors. It is the responsibility of the Board to decide on, among other things, the distribution of resources within the University. The Board is made up of eight members who are appointed by the Swedish government. The board represents both community and business interests. Therefore, it is possible to have a Chairperson that is not a member of the University body.
The Board is also made up of the Vice-Chancellor, three members of the Board whom represent teachers, and three members of the Board for the student body as well.

The University Management
The university management is made up of the Vice-Chancellor Göran Sandberg, two Pro-Vice-Chancellors: Åsa Bergenheim (responsible for education) and Ulf Edlund (responsible for collaboration with the surrounding community), the Deputy Vice-Chancellor Marianne Sommarin, and the University Director Lars Lustig.

The Faculty
Every faculty at Umeå University is headed by a Dean, who is also the chairperson for their faculty's respective Faculty Board. The Faculty Board is responsible for scientific research, post-graduate education, as well as undergraduate education within the faculty. The board's members are elected to their posts, with exception to the student members.

The Department
The basic unit of the University is the department. Departments carry out education as well as research within one or several related issues. The department is the primary work place, not just for students, teacher and researchers, but as well for other professionals such as secretaries, janitors, technicians and instrument makers. The department is
normally lead by a departmental board where at least two students are members. The head of every department is called - Head of Department (in Swedish: Prefekt).

Source: [www.umu.se](http://www.umu.se)