



# **Strategy and structure of entrepreneurial universities in Sweden: The case of BTH, Chalmers and Linköping universities**

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## **Abstract**

These days' universities are playing a major role in leading society to more social and economic growth by transferring knowledge to society, as this leads to new firms being created, new products and services injected into markets, and shifts society toward a more knowledge intensive system.

This thesis is related to a larger study on Nordic entrepreneurial universities. The study is to be carried out between 2011 and 2013 and is funded by Riksbankens Jubileumsfond under the management of Professor Bengtsson. The purpose of this study as the first phase of this research project is to increase empirical knowledge regarding three Swedish university cases: Blekinge Institute of Technology, Chalmers University of Technology, and Linköping University and their strategies and structures regarding entrepreneurial policy and activities. The study illustrates that even within universities in the same country there are different unexploited resources and opportunities toward academic entrepreneurship. The study provides useful information about the entrepreneurial activities in three heterogeneous Swedish universities.

Keywords: Entrepreneurship, university, strategy, structure, Sweden

Paper type: Case study

# Chapter 1: Introduction

## 1. Introduction

One of the most important components of the innovation system are universities (Poh-Kam et al., 2007) and their significant impacts on leading societies toward more innovation and entrepreneurship, and consequently development and knowledge based economic and social development. Universities around the world are becoming more and more focused on entrepreneurial activities. In Sweden this flow started in the 1990's when the government started to change its national policy to a strategy for innovation. The most important part of this policy was related to transforming Swedish universities to entrepreneurial activities (Giannetti et al., 2004, Jacob et al., 2003). This paper uses case studies of three Swedish university cases: Blekinge Institute of Technology, Chalmers University of Technology, and Linköping University and their strategies and structures regarding entrepreneurial policies and activities. The theoretical purpose of this study is to increase empirical knowledge regarding the mentioned three university cases into entrepreneurial activities and develop the resources and capabilities of the firms involved in the organization of the universities with a focus on each university's entrepreneurial role by understanding the broad cross-sectional differences in entrepreneurial attempts and the results of their attempts and activities.

Recently, a major challenge that most universities are facing, is that it's not enough anymore to provide education and generate scientific knowledge based on research, but to have a complex role of "the entrepreneurial university" (Etzkowitz et al., 2000), so universities have roles in commercialization of knowledge which they provide and development of regional and national economy system (Poh-Kam et al., 2007).

Since the universities' impact on national and regional education's development is undeniable (William and Kitaev, 2005), so unsurprisingly Educational institutes in developed countries are encouraged to engage with knowledge-based entrepreneurial activities. Difference in institutional structure in making and pursuing different policy to play better role to be more entrepreneurial make this topic interesting for conducting more research.

Result shows that most of the attention went toward the university technology transfer which were mostly specified around some particular elements such as university spin-offs, patents, Licensing, science park, incubators and other elements which were categorized as university technology transfer methods (Yusof et al., 2007), this paper is mainly conducted based on "entrepreneurial university" aspect.

According to Clark (1998), "entrepreneurial universities" are universities which are responsible to make the use of their knowledge creation; "entrepreneurial university" can also call university third role.

## **1.1 Research purpose**

This research investigates entrepreneurial trends among three universities in Sweden from the perspective of a resource-based view (RBV). The second purpose is to explore how the mentioned universities take advantage of their resources and investigates how this shapes their entrepreneurial activities. The universities are listed below:

- BTH university
- Chalmers university
- Linköping university

This paper also examines some elements which can be considered as tools to lead the institutions toward more entrepreneurial and innovative directions such as collaboration with industry, incubators, and science parks and institution knowledge transfer attempts. Furthermore, this study identifies how the universities mentioned have developed their strategies, organizational structures, and capabilities in order to become more entrepreneurial during a certain period, i.e. from 2004-2009.

Selecting these three universities helps to compare and develop the research theory. Moreover, the reviewed research showed the multiple channels between these universities and industry and the importance of their effect on boosting innovation and entrepreneurship in society (Nilsson et al. 2010).

## **1.2. Research questions**

1. How have BTH, Linköping, and Chalmers University developed their strategies, organizational structures and capabilities to become more entrepreneurial?
  - 1.1. What are the outcomes/results of this process?
2. What are the main similarities and differences in effects between the universities?
3. What type of industries and companies generally collaborate with the universities?
4. What advice can be given to academic institutes' to become more entrepreneurial?

## **1.3. Structure of the Thesis**

The thesis is divided into two parts:

Theoretical and empirical analysis; the theoretical section is covered by Chapters 1 and 2. Chapter 1 clarifies the importance of the universities third role, i.e. “entrepreneurial universities”, and the research purpose and questions also mentioned in this chapter.

Theoretical groundwork of the research can be found in Chapter 2 and includes different categories of articles. The empirical section begins with Chapter 3. Methodology, including the research process and model, data collection, and comparative analysis of the cases can be found in Chapter 4, where the three university cases are analyzed based on the research model.

Research cases, and the TTO's organization and their structure are described in Chapters 5 to 7. The research results and findings are concluded in Chapters 8 and 9. The references used in this research are given in chapter 10. The appendix is chapter 11 and includes the research questions and a list of figures.

## Chapter 2: State Of Art

## **2. Review/ State of art**

Three categories have been recognized and defined based on the reviewed scholar (Yusof et al., 2008) in this research and analyzed through different reviews:

- 1) entrepreneurial university
- 2) academic entrepreneurship
- 3) university technology transfer

Additionally, an attempt has been made to find a common path among literature articles in order to reach the principles which assist us through more analytical and practical data. The main purpose of this research is to examine the strategies and structures of entrepreneurial universities with a focus on the cases of three Swedish universities. This concept is judged based on the different published articles for each mentioned category.

### **2.1. Three research categories in university entrepreneurship concept**

26 articles were gathered regarding university entrepreneurship; among them 9 articles focused on Entrepreneurial Universities, 10 on university's technology transfer topics, and 7 published articles are focused on academic entrepreneurship. The gathered articles regarding entrepreneurial universities are concentrated on different systems such as Tripe Helix (Etzkowitz et al., 2000) and the national policy system (Klofsten 1999). The articles which are based on the academic entrepreneurship topic are focused on the results of academic entrepreneurship, i.e. the commercialization and commodification knowledge created in academia (Jacob et al., 2003; O'Shea et al., 2007). Most of the gathered articles are about university technology transfers with different points of view, such as investigating one of the knowledge commercializing approaches like patenting, licensing, incubators, science parks, and other different means which are described in chapter 3 of this research, and the rest is explained in the later chapters based on the research cases and framework.

#### **2.1.1. "Entrepreneurial university"**

According to Clark (1998) organizations which practice "entrepreneurial university" are responsible for making use of their knowledge creation; "entrepreneurial university" can also be referred to as the university's third role. "Entrepreneurial university" has been defined and developed with different focuses and based on different cases. Jacob et al., 2003 have developed the concept of "entrepreneurial university" which highlights the challenges and obstacles which universities must overcome such as university administrator and faculty doubt regarding new entrepreneurial systems and their harmony with the traditional role of the university in creating knowledge.



Various definitions for “entrepreneurial university” have been revealed (Etzkowitz 1983; Clark 1998; Jacob et al., 2003; O’Shea et al. 2007; Henrekson & Rosenberg 2001). A number of definitions concentrate on different aspects of the “entrepreneurial university” concept such as technology transfer as well as commercialisation and commodification of university knowledge (Jacob et al., 2003) or impressing the organisational role and framework on university level entrepreneurship (Etzkowitz 1983; Clark 1998).

### 2.1.2. Academic entrepreneurship

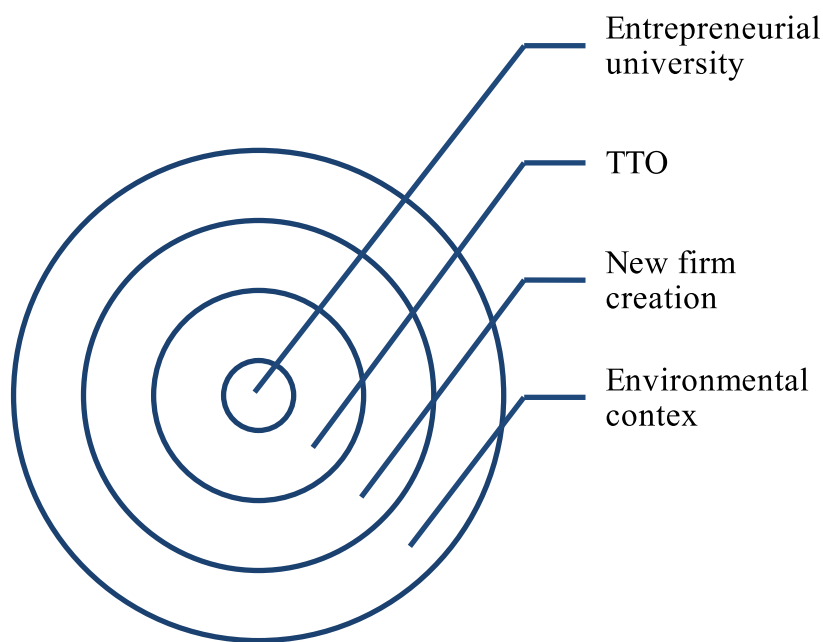


Figure1 hieratical relations of university entrepreneurship levels system (Rothaermel et al., 2007)

The above figure illustrates the entrepreneurial university framework. At the center of these figures are “entrepreneurial universities” which create use of academia knowledge through their Technology Transfer systems and policies. The result of this activity may lead to the creation of new business, new firms, patents, startups and other types of knowledge commercialisation. Universities located in larger systems can be affected by environmental factors; these factors can consist of innovation network, national and governmental policy or law, cultural stream, and have a significant effect on universities’ entrepreneurial activities (Rothaermel et al., 2007).

The mechanism which universities implement in order to facilitate the process of technology transfer or knowledge creation and commercialisation is to make some universities more entrepreneurial. This unique mechanism will be elaborated on in Chapter 3 of this research.

This research will concentrate on the core levels of the academic entrepreneurship, namely “entrepreneurial university” and TTOs which are recognised as infrastructures in order to create sustainable academic entrepreneurship.

### **2.1.3. University Technology Transfer**

Since 1997 Swedish universities have begun to involve a “third mission” in the country’s national policy, meaning that the university role has changed from traditional knowledge creation to new arenas of teaching, research and “interaction with society” (Sellenthin et al., 2003). Interaction with society is a very broad term which cannot be fully defined with regards to some elements since it is one of the main elements of universities’ “third mission”. TTOs work as a bridge in order to transfer knowledge created through academia to outside of the university border and the result of this Technology Transfer can be seen as a new patent, product or service, company, licensing agreement, startups or any other aspect which affects society through knowledge which is created at the university. Universities tend to have Technology Transfer Offices which protect their Intellectual Property and facilitate their knowledge commercialisation, registering their patents, licensing and commercialising research results from all kinds of academic entrepreneurship (Phan et al., 2006). In the following sections, the existing literature regarding TTOs is scrutinised.

## **2.2. First articles category**

The selected papers in this section are organised according to keywords and the body of the paper. The following gathered articles, for the most part, place their focus on the resources and capabilities of entrepreneurial universities.

### **2.2.1. Entrepreneurial orientation, technology transfer and spinoff performance of U.S. universities Research Policy**

O’Shea et al. investigate, from a resource-based perspective (RBV), why some universities are more successful when compared to others. With this in mind, the present paper clarifies some common elements among successful universities. This paper argues that academic entrepreneurship places stress on the creation of new business ventures which stems from university intellectual property and which can be initiated from university technology transfer,

commercialising of research and university spin-offs. The authors perceive universities as bundles of tangible and intangible resources which give each university a unique character. This research focuses on the importance of RBV as a source of sustainable competitive advantage hence, four types of resources are categorised in this paper: Institutional resources, human capital, financial resources and commercial resources.

O'Shea et al., (2005) scrutinize the role of RBV in universities' spin-off activity. Indeed, for this reason data is collected from between the years 1980 and 2001 using the econometrics method. The results which are taken from different universities in the U.S exemplify the importance of universities engaging in regional and national economic development, job creation and innovation.

Elements of academic entrepreneurship in this paper are:

- Creating new business venture;
- University technology transfer;
- Research commercialisation;
- University;
- Spin-offs.

### **2.2.2 University capabilities in facilitating entrepreneurship: A longitudinal study on spin-off ventures at mid-range universities**

Rasmussen et al., (2010) argue that universities can affect and ease the process of spin-offs by creating capability view. They also suggest three different types of university capabilities as shown below:

- “creating new paths of action”;
- “balancing both academic and commercial interests”;
- “Integrating new resources”.

Moreover they argue that all of the aforementioned different types of capabilities are reliant on previous university spin-offs' knowledge and their severe impact from inside and outside of the university. Their paper also investigates how different universities' capabilities are important in different scheming processes. They finally propose the USOs (University Spin-Offs) as new ventures which are “initiating from university setting and based on technology derived from university research”. Rasmussen et al. illustrate how universities' capabilities influence the process of USOs in two European mid-range universities and explain the role of different capabilities in different phases of USOs. This paper defines capabilities as “an extension of the resource-based view (RBV)” and a resource is defined as “an asset or input to production (tangible or intangible)” which universities own or control. The authors reveal that universities

which have better position in case of capabilities are more successful in USOs and entrepreneurial activities.

## **2.3 Second category of articles**

Since this study is researching entrepreneurial level of universities inside Sweden, therefore this category has been made to investigate the Swedish universities' entrepreneurial orientation, this results in the following articles.

### **2.3.1. Comparing academic entrepreneurship in Europe—the case of Sweden and Ireland**

This paper investigates entrepreneurial activities in two countries, namely Sweden and Ireland and describes whether the university is increasing their linkage with industry and if so, how different policies and targeting should be undertaken. The main concept is developed around investigation and comparison of academic entrepreneurial activities in Sweden and Ireland.

This paper identifies 8 different types of academic entrepreneurship in universities as mentioned below (Klofsten et al., 2000):

- Large scale science projects: obtaining external research funding through industry or government;
- Contracted research: engaging in a research project within the university for industry;
- Consulting: transferring academic expertise knowledge for solving specific problems;
- Patenting/licensing: industry usage of patent(s) or license(s) initiated from university;
- Spin-off firms: creating new firms or organizations which are the result of university technology commercialisation;
- External teaching: setting the short courses outside of university to external organizations or people;

- Sales: commercialising the new idea which is emerging via products or services to the market;
- Testing: providing testing facilities to organizations or personnel outside of the university.

Klofsten et al., (2000) state that the entrepreneurial activities of both countries are initiated from universities' involvement in consultancy and contract research, but not through spin-offs or the activities of start-up companies.

### **2.3.2. Entrepreneurial transformations in Swedish university system: The case of Chalmers University of Technology**

Jacob et al., (2003) mainly center their paper on how creating "entrepreneurial university" requires different stages and cultural changes. They use the case of Chalmers University of Technology as it is one of the biggest and most successful universities in Sweden. This article examines Swedish innovation policy from the perspective of micro and macro policy, and describes the concept of academic entrepreneurial as different stages which academics go through to achieve commercialisation and the commodification knowledge which they produce.

This paper also clarifies the system which encompasses both traditional and new roles of universities in the Swedish system and proposes that; Swedish university policy makers should not take their entrepreneurial policy from other university models such as Stanford, MIT or Colombia models, since they (policy makers) must balance their "knowledge exploitation activities with a strong culture of exploration and knowledge creation".

This paper also defines "entrepreneurial universities", as universities with a wide range of new infrastructural support mechanisms for fostering entrepreneurship within the organizations as well as packaging entrepreneurship as a product. Conversely, Jacob et al., (2003) develop the concept of "entrepreneurial university", which highlights the challenges and obstacles which a university must overcome; these obstacles include university administrator and faculty doubt regarding the new entrepreneurial system and its harmony with the traditional role of the university in creating knowledge.

Jacob et al., (2003) investigate how Chalmers University attempts to create an internal system for commercialisation and commodification of their knowledge which meets both traditional and new aspects of the universities in Swedish society.

This paper lists the main component for innovation infrastructure at Chalmers University from 1994 to 1998 as below:

- 1994 Innovationskapital—a venture capital company which is partly owned by Chalmers is founded;
- 1996 The Gothenburg Foundation of Technology Transfer, Chalmers and Gothenburg University jointly begins Research Patents West, Inc;
- 1997 Chalmers School of Entrepreneurship;
- 1998 Opening of Chalmers Innovation (a high tech incubator) at Stena Centre. This center is built with money from a US\$ 5 million endowment from the Sten A. Olsson foundation Chalmersinvest—a wholly Chalmers owned seed venture capital company is started. This company provides funding for the early stages of starting up a business.

## **2.4 Third category of articles**

The selected articles in this category are gathered in order to understand the role of different types of intermediary agents such as liaison offices, TTOs, R&D departments in universities, knowledge commercialisation, and entrepreneurial activities.

### **2.4.1. Creating a bridge between university and industry in small European Countries: the role of the industrial liaison office**

This research studies the impact of university industrial involvement with emphasis on ILOs (Industrial Liaison Office) in two European countries, Sweden and Ireland. It also stresses their different levels and methods of R&D expenditure. Jones-Evans & Klofsten (1999) tend to compare and analyse the role of universities in Sweden and Ireland in developing the link between academia and industry especially through the ILO mechanism. Moreover, this paper points out the clash of cultures as a main barrier to academic and industry collaboration. This paper demonstrates and compares the main industrial type of link which is formed by some Irish and Swedish universities as below:

- Research funding.
- Endowed chairs.
- Sponsorship- research centers.
- Sponsorship- researchers.
- Industry clubs/networks.
- Training partnership.
- Technical service contract.

This research also reveals the difference between ILOs in Sweden and Ireland; liaison offices in Ireland are mostly concentrated around marketing and promotional activities while Sweden ILOs are more active with industry whilst developing new business and creating employment.

#### **2.4.2. Initiatives to promote commercialization of university knowledge**

This paper clarifies the importance of universities in commercialisation and knowledge transfer during case studies from different European universities; Chalmers University of Technology in Sweden, the Norwegian University of Science and Technology, the University of Oulu in Finland, and Trinity College Dublin in Ireland. Rasmussen et al., (2006) examine several “commercialization initiatives” as mentioned below:

- IPR ownership;
- Entrepreneurship education;
- Business plan development;
- Program and advisory service;
- Commercialisation services on campus;
- External service provider for commercialisation;
- University on campus incubator;
- Outside incubators situated in town;
- University controlled seed-capital fund;
- Outside seed-capital;
- University legal shares in spin-offs and licenses;
- Official incentives for commercialisation.

This paper concludes the overview of commercialisation activities which are observed in different European universities with the aim of achieving a more in depth view of different processes of entrepreneurial activities and policies. Rasmussen et al., form a comparison base analysis in their paper which includes different commercialisation activities in university research cases (2006) such as; tracking the universities’ spin-offs, start-ups or licensing agreement statistics.

#### **2.4.3. Mid-range universities’ linkages with industry: Knowledge types and the role of intermediaries**

This article investigates how universities can affect the industry by transferring knowledge (tacit or codified) through:

- Spin-Offs;
- Licensing;
- Patents;
- Contract research;
- Graduate and researcher mobility.

Wright et al., (2008) carry out their investigation through interviews with different universities in the UK, Belgium, Germany and Sweden. As a result they suggest that universities must concentrate on creating and transferring knowledge to industry using different methods such as intermediary agents. The focus of this paper is on the crucial role of intermediaries in transferring knowledge to outside of university borders and their impact on facilitating knowledge transfer between two parties, namely university and industry via different methods such as value added services. Wright categorised Intermediaries and divides them into different types:

- External intermediaries such as technology transfer office;
- External intermediaries such as public research centers and R&D departments.

## **2.5 Forth articles category**

The aim of collecting articles in this section is mainly to understand and evaluate the universities' innovation infrastructure from the resource-based perspective (RBV).

### **2.5.1. Designing Efficient Institutions for Science-Based Entrepreneurship: Lesson from the US and Sweden**

This article defines the framework which demonstrates how science based entrepreneurship can be affected by individual decision or policy makers. This individual choice can begin with the decision to continue after high school to employment after PhD graduation. This framework analyses two different countries; Sweden and U.S. and clarifies why research in Sweden regarding high expenditure on R&D is not leading to commercialisation processes in comparison to the U.S. (Henrekson et al., 2001). The elements evaluated for measuring and comparing Sweden and the U.S. in terms of their science based entrepreneurial level are:

- Economic performance: GDP indicator;



- R&D Investment and result from the university sector;
- Government support;
- Invest in human capital;
- Motivation to become an entrepreneur: like self-employment role in Sweden;
- Incentives for entrepreneurs to expand. These include the taxation system in Sweden which is considered as one of discouraging elements with regards to employees becoming entrepreneurs;
- Incentives within the university system.

Following this they summaries the reasons why there is less willingness to become an entrepreneur in Swedish systems compared to U.S. systems.

### **2.5.2. Delineating the anatomy of an entrepreneurial university: the Massachusetts Institute of Technology experience**

This paper illustrates the process of spin-off as one of the most important processes of entrepreneurial universities through four components:

- Characteristics of individuals;
- Organisational policies and structures;
- Organisational culture;
- External environment.

O'Shea et al., (2007) argue that spin-off occurs as a result of the above mentioned processes. As for the "dimension of academic entrepreneurship" they use the MIT case and explain that MIT entrepreneurial success is based on these four dimensions.

They analyse the success of MIT based on the following measurements:

- Science and engineering resource base: MIT's high ability to attract funding for science and engineering research;
- Research funding;
- The flow of industry funds for research;
- The quality of the academic staff;
- Organisational characteristics such as the TLO (Technology Licensing Office) practices and policies;
- The mission of the university;
- The culture which has developed among the MIT faculty;
- The history and tradition of MIT;

- The external geographical context.

They consider these elements in very successful universities in order to demonstrate which elements are present and which are absent in the spin-off aspect. Moreover O'Shea et al., 2007 argue that the number of spin-off and entrepreneurial activities in academia reflect the society culture which supports commercialisation and commodification of research, as well as leading the university towards a more entrepreneurial level. With this in mind it is obvious that university environments and norms which do not support entrepreneurship will yield lower spin-off numbers (O'Shea et al., 2007).

In conclusion this paper creates a model for the MIT university spin-off system. It demonstrates four impacts of university which support spin-off activities in MIT; Entrepreneurial Orientation, Leadership and Policies, Faculty Quality, Science and Engineering resource base.

## 2.6 Results of the review

The studies have reviewed different published articles regarding universities' entrepreneurship activities, and have categorised three of these activities as identified by the main research; Entrepreneurial University, Academic entrepreneurship and University technology transfer.

Different articles have been reviewed, and the most common aspects among them, as emphasised by various authors, can be seen in the table below:

Concept proposed by	Of
Entrepreneurial university	Jacob et al. (2003), Henrekson and Rosenberg (2001), Rasmussen et al. (2006), Wright et al. (2008).
Academic entrepreneurship	Rasmussen et al.(2010), Klofsten and Jones-Evans (1999), Klofsten et al.(2000)
University technology transfer	O'Shea et al. (2005), Rasmussen et al. (2010) and (1999), Wright et al. (2008), Jones et al. (1999).

Table1 Research categories and focused articles

Up until this stage of the literature review, the results show that; most of the attention given to the university technology transfer is mostly focused on a number of specific elements such as

university spin-offs, patents, licensing, Science Park, incubators and other elements which are categorised as university technology transfer methods (Yusof et al., 2007).

Different aspects for evaluating academic entrepreneurship have been identified based on reviewed articles and will be investigated within the context of the resource-based view and research model:

- Creating new business ventures;
- University technology transfer;
- Research commercialisation;
- University spin-offs (O'Shea et al. 2005).

Various articles have been studied and mentioned in different parts of this study. Some articles are gathered in review of arts in order to exploit different aspects in broad terms of “entrepreneurial university”. Different review articles and the elements which are scrutinised by authors are collected in Table 2. In addition, the influence of each factor will be further clarified during the case study of Swedish universities.

Author(s)	Elements	Concentration	Country
Shane(2004)	Patent statistics in US	process of spin off as one of the main important of items which influence university incentive system and entrepreneurial activity	USA
Shane(2001)	Patenting and Licensing system of MIT	Effectiveness of patents and spin-offs in industries	USA (MIT)
Siegel et al., (2004)	University TTO's	In order to fostering entrepreneurial orientation, universities administration should concentrate on 5 factors: “reward systems for UITT, staffing practices in the technology transfer office (TTO), designing flexible university policies to facilitate university technology transfer, devoting additional resources to UITT and working to eliminate cultural and informational barriers that impede the UITT process”	USA
Rasmussen et al., (2010)	process of spin-off venture	Three set of university capabilities was developed and proposed: (1)” creating new paths of action,	Two European Mid –range universities

		(2) balancing both academic and commercial interests, and (3) integrating new resources and commercial interests, and (3) integrating new resources”	
Klofsten et al., (2000)	Technology- based spin-off firms	Eight specific types of academic entrepreneurship science projects Contracted research Consulting Patenting/licensing Spin-off firms External teaching Sales Testing	Sweden and Ireland
Jacob et al., (2003)	knowledge commercialization and commodification	new entrepreneurial system and its harmony with traditional role of university in creating knowledge that meet both traditional and new aspects of university in Swedish society	Sweden(Chalmers university)
Jones-Evans and Klofsten (1999)	ILO’s impact on universities entrepreneurship	This paper demonstrates and compares the main industrial type of link which formed by some Irish and Swedish universities:  Research funding Endowed chairs Sponsorship- research centers Sponsorship- researchers Industry clubs/networks Training partnership Technical service contract	Sweden and Ireland
RASMUSSEN et al., (2006)	importance of university in commercialization and knowledge transfer	Investigation of commercialization activities such as patenting, TTO’s performance, start-ups and licensing agreement in 4 university cases	Sweden, Norway, Finland and Ireland
Henrekson et al., (2001)	Science based entrepreneurship and the importance of policy	Economic performance : GDP indicator R&D Investment and result from	US and Sweden

	makers and governmental support scheme.	<p>the university sector</p> <p>Government support</p> <p>Invest in human capital</p> <p>Motivation to become an entrepreneur: like self-employment role in Sweden</p> <p>Incentives for entrepreneurs to expand. Like Taxation system in Sweden which considered as one of discourage element toward employee to be entrepreneurs</p> <p>Incentives within the university system</p>	
O'Shea et al (2007)	four impacts of university which supporting spin off activities in MIT; Entrepreneurial Orientation, Leadership and Policies, Faculty Quality, Science and Engineering resource base	<p>process of spin off as one of the main important of entrepreneurial university through four components:</p> <p>characteristics of individuals</p> <p>organizational policies and structures</p> <p>organizational culture</p> <p>external environment</p>	Massachusetts Institute of Technology

Table2 Empirical studies on “entrepreneurial universities”

## Chapter 3: Methodology

### **3. Methodology**

This research aims to develop resource and capability based views and adjusts them to entrepreneurial university organizations. The second aim is to create a theoretical perspective (where utilized in chapter 2 of the research) which can help universities to transfer their knowledge and the policy makers in different regions in Sweden to achieve their research aims and objectives and the study will be conducted in two phases:

#### **3.1. Research process**

##### **3.1.1. The theoretical process**

The research process of this thesis begins with the conducting of the theoretical aspect from the various existing literature and the gathering of empirical studies which have been published by different authors. Different views regarding the broad concept of “entrepreneurial universities” are also presented.

##### **3.1.2 The empirical research**

Empirical research will be conducted by gathering secondary data via a gray literature review. For the three universities participating in the case study; the universities annual report, governmental and other types of reports are gathered in order to analyse and research the three universities’ cases common structure and different policies toward entrepreneurial criteria. These reports and documents are gathered through searching university websites and contacting relevant departments in these universities regarding possible documents and reports which they may be able to provide.

University entrepreneurial level is investigated through annual reports and publications. In addition, the below mentioned elements of academic entrepreneurship will help to clarify this matter:

- Creating new business venture;
- University technology transfer;
- Research commercialisation;
- University spin-offs (O’Shea et al., 2005).

Annual reports can be crucial sources for data regarding universities’ cases entrepreneurial structure in order to answer research questions.

Research questions	Methods
Q1	Literature review, annual report, interview
Q2	Annual report, interview
Q3	Interview
Q4	Literature review, interview

Table3 research question and their methodology

### 3.2. Research model

Since university's role has changed from knowledge creation to more complex roles, universities are trying to create and implement effective structures and strategies in order to move toward "entrepreneurial university" model (poh-kam et al., 2007)

Universities around the world are developing their entrepreneurial structure and resources. Among them obviously universities in developed countries are ground breaker in this area. United States is the pioneers in this topic since they developed university entrepreneurship infrastructure from early 1980s, (Mowery et al., 2004).

As most of the reviewed articles were significantly derived from the following framework with different concentration points; the bellow framework which describes the university entrepreneurship has been chosen as a primary research framework in this research.



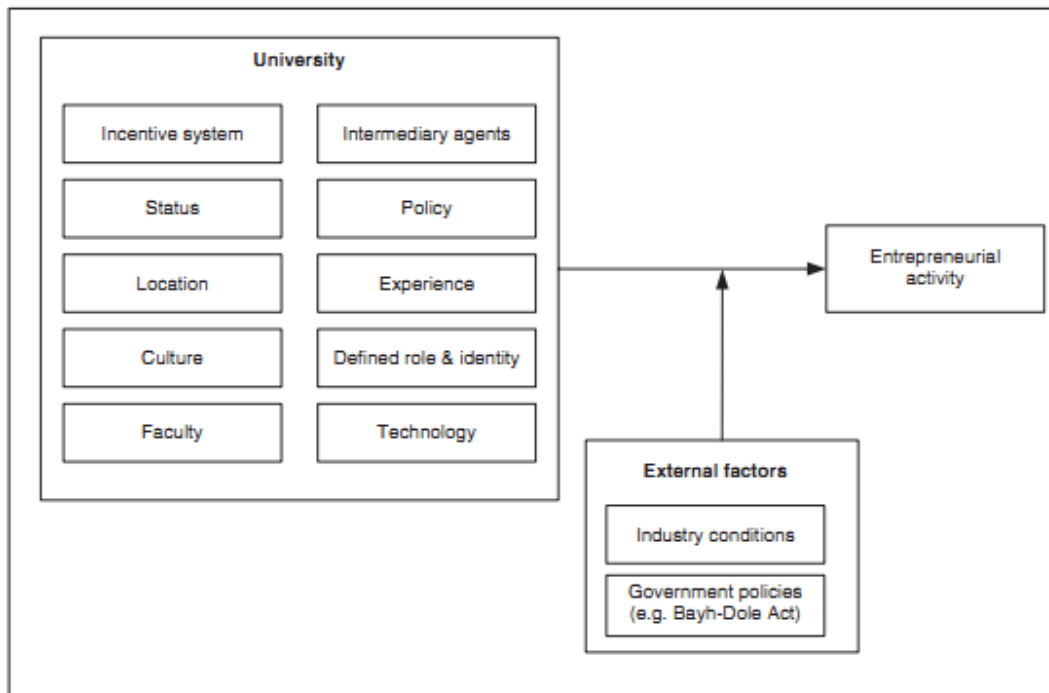


Figure 2 entrepreneurial university activities (Rothaermel et al., 2007)

### 3.3 Data collection

#### 3.3.1 Interview

Interviews will be done as theoretical framework, along with the empirical research to test and answer the research question. And this is the reason that I chose the case study method. I believe case study is a powerful method for theoretical research and investigating common characteristics in different cases (Ghauri et al. 2005). Moreover case study brings more depth to our understanding of research cases (Rothaermel et al., 2007). The case study that I am applying here is a single case study and it is conducted with academic policy makers in three university cases. These policy makers are university faculty members and responsible people for making any macro or micro decision regarding university entrepreneurship activities and policies.

#### 3.3.2 Study of annual report

The study of the annual report has been conducted with the aim of facilitating and complementing the interview data collected and bringing structure to the thesis concept. The annual report study covers five years, specifically the years 2004-2009.

### **3.3.3 Study of archival documents**

Archival documents include university bulletins, incubator companies, science park brochures and other external sources such as companies' websites, as well as newsletters which can increase understanding of the research cases and can complement the data collection and research questions.

### **3.4. Summary of data collection**

The interviews have left me with a deep understanding of the matters at hand. I can now also criticize university cases by observing different entrepreneurial environments and attempts, while studying annual reports and other secondary data collection, which can complement the interview data collection.

### **3.5 Case selection**

Three Swedish University structure and policy toward entrepreneurship concept were scrutinized with concerning universities difference in size, educational preferences and other elements which have recognized during the research process:

Blekinge Tekniska Hogskola; in which this research has been proposed, the smaller university in size (compare to other cases) with high profile is applied IT and Sustainable development.

Chalmers and Linköping universities with higher reputation amount of experience and expectations have always been trying to create their internal systems for commercialization and commodification of their knowledge that are able to meet both traditional and modern aspects of universities in Swedish society ( Jacob et al.2003).

## **Chapter 4: Comparative analysis of the cases**

## 4. Comparative analysis of the cases

According to the primary research model extracted from (Rothaermel et al., 2007), university entrepreneurial orientation activities can be affected by three main factors:

1. University incentive system, status, location, culture and faculty can be seen as the core of the university entrepreneurship system since these items can affect and enhance university entrepreneurial activities through intermediary elements such as University Technology Transfer Offices.
2. University intermediary agents, policies, experience, technology and university defined roles and identities. Based on figure 1, these elements can be classified in TTO's level.
3. External factors, which include the elements that influence the university system by environmental context, such as industry conditions and Governmental policies.

The research model below (Table 4) is extracted analysis from figures 1 and 2 in this research. The model illustrates each type of university resource in consequence with their hierarchical relationship of university entrepreneurship levels (figure 1).

As mentioned theoretically the aim of research is to develop resource and capability - view of university organization, different elements which can be categorized as resource and capability of universities bring to the table (3). Universities effort based on what resource and capability they have and their strategy and structure are covered in next part of this study.

Elements	Definition	Category	Location in Academic entrepreneurship system
Incentive system	Faculty, departments, TTO.	Resource & Capability	Core/Entrepreneurial university
Status	Public or private university, departments name.		Core/Entrepreneurial university
Location	Geographic location of firms.		Core/Entrepreneurial university
Faculty	Motivation, embeddedness, business knowledge and market understanding, involvement/cooperation, background, quality, exposure to external agents, status, perception, disclosure decision.		Core/Entrepreneurial university
Intermediary agents	TTO (age, availability, perspective), incubators.		TTO
Experience	University experience.		TTO
Defined role and identity	Boundaries of interaction with industry.	Structure	TTO
Policy	IP, budget allocation, active management	Strategy	Core/Entrepreneurial

	support.		university
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Table 4 resource-based view (RBV) to analyze strategy and structure of university entrepreneurship

## 4.1 Resource and Capabilities

Since theoretically, this research aims is to develop the resource and capability view of the firm to the university organization with emphasizes on the universities' entrepreneurial role, different items have been recognized and described under the title of university resources in this part. Universities attempt to turn their resources to capabilities is the way that makes the universities structure and strategy different in university entrepreneurial orientation. In entrepreneurship subjects and area there are more elements which can be categorized under university resource base; in this part we categorized the elements which are mentioned in table 4.

Indeed Table 4 is resulted from merging of figure 1 and 2 which are the primarily research model extracted from (Rothaermel et al., 2007), in order to:

1. Create more clear view of university cases entrepreneurial activity
2. Develop our theoretical framework which is the case study.

Resource and capabilities is recognized as the key elements of reducing the barriers toward university entrepreneurship (Rothaermel et al., 2007). Capability approach is the way to develop organization resource to react to environmental change and Increase University's ability to boost their innovation structure (Manoj A. Gupte, 2007 and Marie Löwegren, 2003). Although development of firm capabilities, can described by measuring different elements, but this research is emphasized on some aspects which can cover the research framework and purposes.

### 4.1.1 Status

University status is one of the elements framed under university resource items according to the research model, since it can affect the universities' entrepreneurial activity and their engagement with companies as well as taking equity in spin-off processes or owning and selling out IPR. Swedish universities are privately authorised except Chalmers University of Technology and Stockholm University. Differentiating between public and private universities in case of entrepreneurial policy and activity can stem from; private university eligibility in owning or selling Intellectual Property or creating income from taking equity in spin-offs or start-ups and other entrepreneurial activity as well as the fact that public universities are obliged to not take part directly in the aforementioned transaction (Jacob et al., 2003).

#### **4.1.2 Location**

Location or geographic status of firms is considered in resource categories which affect a firm's policy and interaction with industry. This can also affect a firm's position or levels in industry. Entrepreneurial university location from a resource-based perspective (RBV) can be illustrated in the business cluster approach or firms' competitive advantages. Universities can benefit from interacting with industries or from the nature of these industries. In addition, business clusters can reap the benefits of the university's academic environment (Wernerfelt B. 1984). For instance the Blekinge Institute of Technology is affected by Telecom City and IT cluster in this region; hence this university presents different IT courses to students in collaboration with industry. The benefits of location are not limited to universities since industries are affected from the transference of knowledge creation in academia using different methods such as new patent, licensing or accessing skilled professional employees and other tangible and intangible effects on industry.

#### **4.1.3 Experience**

Human capital resources, namely employees and managers' experience, as well as their intelligence and skills are other important elements which can affect a university's entrepreneurship system (Barney 1991). Human capital is a source of competitive advantage for the firm since employees and managers' experience and knowledge exploitation can form the position of firms in comparison to other organizations. University faculty and managers' experience have severe effects on a university's policy, structure and knowledge transference to students and society. This item is discussed as a source of competitive advantage of Technology Transfer Offices in the next chapters which are based on three Swedish cases.

#### **4.1.4 Incentive systems**

The university incentive system includes university Faculty, departments and TTO's organisation. It is clear that implementing different incentive systems in academia leads universities to different entrepreneurial levels. Scholars have demonstrated that divers set of strategies such as donating greater incentive system for universities' faculties has a positive effect on a university's commercialising activities and consequently the entrepreneurial system. Furthermore, TTOs' structures provide incentives for faculties and motivate them to become involved in entrepreneurial activities, for example TTOs arrange licensing contracts which can be effective incentive tools for faculties' entrepreneurial activity (Henrekson & Rosenberg, 2001, Rothaermel et al. 2007, Siegel et al. 2003).

##### **▪ Faculty**

Since this research focuses on Swedish universities, and professors' privilege law ("La rarundantaget") grants university faculty members own the patent right for their new ideas and research's (Rasmussen et al., 2006); therefore, faculty members have their ownership of their Intellectual Property (IP).

University faculty is recognized as an important resource which gives unique characteristics to each university and it is recognized as one of the most important elements that make the difference among universities entrepreneurial activity. Entrepreneurial activities by professors can be recognized by different outcomes i.e. patenting and spinning off companies, collaboration with industry which each of these variables can effect university technology transfer and entrepreneurship measurements (Renault 2006).

#### ▪ **TTO's**

In recent years universities have tried to increase their interaction with industry and to contribute directly to economic development by establishing Technology Transfer Offices (TTOs). "TTOs facilitate technological diffusion through the licensing to industry of inventions or intellectual property resulting from university research" (Siegel et al., 2003). There are strong motives for investigating TTOs in Sweden, while they have been one of the most frequently discussed factors with regards to the entrepreneurship topic by existing scholars (DevrimGöktepe 2010). In addition, there are no studies which focus primarily on Swedish universities' systems.

Different policies have been adapted and their activities have had different results in Technology Transfer systems in academia (Jones-Evans & Klofsten, 1999) which in addition obviously leads to different levels of entrepreneurship.

#### **4.1.5 Intermediary agents**

Intermediary agents are consistent of TTO's age and perspective and their availability in different entrepreneurial activity. The Intermediary agents and their strong influence on universities and industries innovation level are analyzed in different parts of this research according to theoretical frame of this paper and university cases.

## **Chapter 5: Blekinge Tekniska Högskola**



## **5.1 Location, Status and experience**

Blekinge Institute of Technology first opened in 1989 and is located in the south-eastern part of Sweden in Blekinge province. The presence of more than 200 IT companies in the region has greatly influenced the education system of Blekinge. Having 2000 IT students has placed BTH as the country's second biggest and most concentrated college in the field of IT and telecommunications (Karlskrona Kommun 2010).

BTH's main gateway through companies in the region is Telecom City; BTH is a part of the Karlskrona Telecom City organization which creates strong networks between this university and the IT companies in this region. Strong sustainable collaboration with national and global IT companies has affected the Technology transfer process at BTH and created effective innovative systems. (TelecomCity Karlskrona- annual report, 2010). BTH University is a public university like the majority of other universities in Sweden and acts according to certain educational and Governmental statutes.

## **5.2 BTH Incentive system**

### **5.2.1 Faculty**

As mentioned in Chapter 4, a university faculty plays a crucial role in the university environmental context as well as entrepreneurship orientation which can make the difference in university position and educational level. With this in mind, BTH University with more than 550 employees is attempting to increase the quality of education and research in the region.

### **5.2.2 Department**

BTH university education system consist of 5 different schools and 2 different centers; BTH Innovation and centers for Spatial Development and Planning.

BTH different schools:

- School of Computing
- School of Engineering
- School of Health Science
- School of Management
- School of Planning and Media Design

BTH Schools comprises the different departments which run different education systems and cooperate with other departments in order to create a globally attractive knowledge system.

### 5.2.3 TTO'S

Universities have formed many types of TTOs, either internally or outside of the university border (DevrimGöktepe-Hulten 2010). BTH University formally developed BTH innovation in the year 2009, before which entrepreneurship activities were more individual or limited to a special department. There are some external TTOs in regions which also collaborate with BTH University such as Blekinge Business Incubator BBI, which is owned by BTH University, Blekinge region and Almi. BTH innovation, BBI and Almi have closely cooperate and collaborate with each other in order to foster the region's innovation and entrepreneurship movement. They support new ideas in order to create the business idea for commercial products or new firm creation in the region. BTH innovation occupies the role of pre incubator in this process and focuses on the early stage of innovation process whilst the next step is creating a new firm, start-up and entering Incubation process. At this stage incubation will help the new start-up companies and will lead them to growth without any work overlaps.

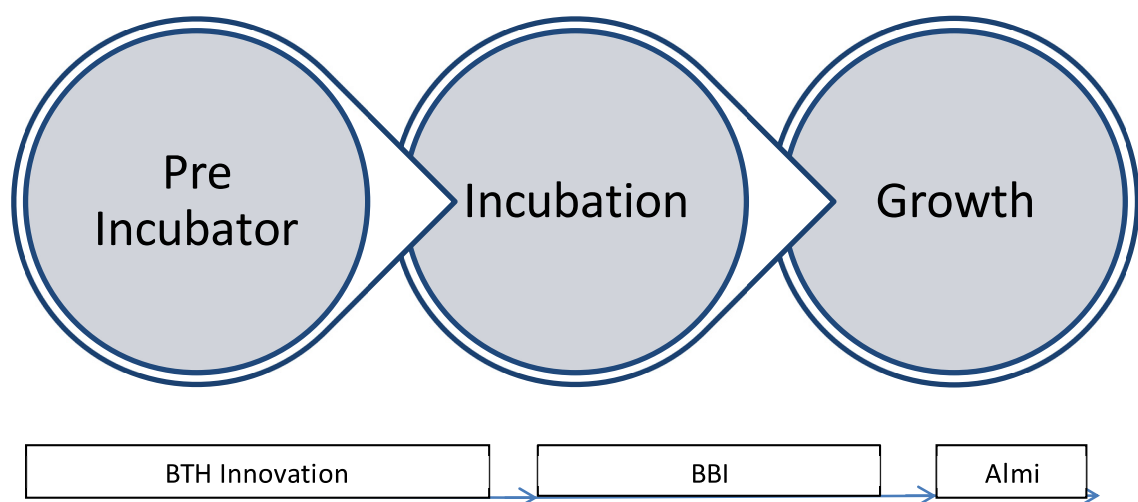


Figure 3 BTH university innovation systems

### 5.3. Intermediary agents

The intention of this research is to investigate resources and capability view of the university with a focus on university entrepreneurial role and activity, different resources have been identified based on Rothaermel et al., (2007) Entrepreneurial university research model. Intermediary agents are consisting of TTO's age and perspective and their availability in

different entrepreneurial activity. The Intermediary agents have been analyzed in different parts of this research according to theoretical frame of this paper.

### **5.3.1 BTH Innovation**

BTH Innovation can be described as a nursery for new ideas in which students, researchers and teachers as well as students can get help to develop their ideas for a more full term business concepts. In more formal terms represent BTH Innovation a center in the Blekinge Institute of Technology reports directly to the president. This organization main mission is to stimulate, develop and strengthen the practical innovation at BTH. BTH innovation is also working to initiate and support research and education related to innovation and entrepreneurship. Another important task is to work with both internal and external stakeholders to strengthen and clarify BTH role in the regional innovation system.

The activities of BTH Innovation are divided into two partly overlapping areas which call wise and business lab.

- **WISE**

In wise BTH “conduct experimental business development in the form of short-called proof-of-concept” project, in these projects, entrepreneurs work in a designed and proven method by which an primary idea is developed and verified by technical, user-rate and commercial perspective. The ideas are retrieved from students, researchers or from entrepreneurs and companies in the region.

- **BUSINESS LAB**

Business lab arranges giveaways, inspirational lectures, and holds different seminars and courses on topics related to commercialization and business development, with an aim to encourage, train and support BTH researchers, teachers and students in entrepreneurship and innovation aspects.

A large part of the activities of BTH Innovation is in the form of externally funded projects where they collaborate with various stakeholders in the region such as Blekinge Business Incubator, Telecom City, NetPort Science Park, Soft Center, Region Blekinge and various businesses.

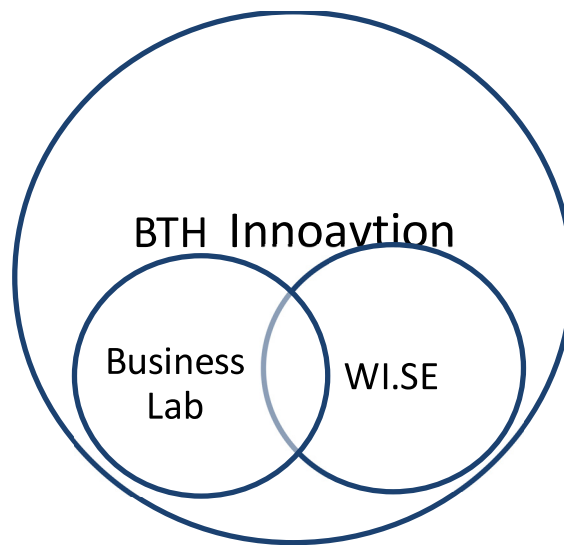


Figure 4 BTH Innovation structure

#### 5.4 BTH Innovation strategy and structure

BTH Innovation formed its structure in order to boost BTH university academic entrepreneurship and fill the gap between university and Industry through some main Strategies:

- I. Straighten practical support for innovation and entrepreneurship within the BTH University (target groups in this objective are researchers, staffs and students) they offer individual advice to find right business contact and preliminary advice if they want to start up their business in order to help them to find the right guide in different offices in region.
- II. Initiate and support research and education which is related to entrepreneurship and innovation. This support can be work with different schools, developing new courses and get involve in teaching and development of the course.

BTH strategy has been changed from sustainable development and applied IT to applied IT and innovation for sustainable growth. Innovation has become strategic matter of concern for BTH since three years ago which before it wasn't considered to this extend, although it doesn't mean that university wasn't involve in innovative activity but it means that it wasn't part of strategic policy of the school. Regarding organizational structure of university, BTH didn't become more entrepreneurship and no policy and action have been applied in this regard, but creation of BTH Innovation unit within the university can be seen as structural change in the university to facilitate technology transfer from academia.

## **5.5 BTH Innovation resource and capabilities**

BTH Innovation started its formal organization in 2009 with 4.6 full time employees and 7.2 permanent employees. In 2010 this organization had 4.2 permanent employees and 12 employees worked as project assistants. BTH Innovation is running by professionals coming from both Industry and academic background. Majority of the employees involve in the various projects which have academic backgrounds and business knowledge. Although BTH Innovation is very small organization in case of employees, yet the organization involve students, researchers, staff in different entrepreneurial project; for instance in 2010; 12 doctoral students involved in different P.O.C (Proof Of Concept) projects and the result until April, 2011 was 11 finished P.O.C projects and 6 startups.

Since tracking number of startups or spin-offs except those coming out from BTH Innovation track is hard task. There is no data which show the outcome of entrepreneurial activities in terms of spin-offs or startups numbers. BTH University since the government of Sweden is working on announcing new rules that any patentable result in academia is obliged to be reported to the university.

Financial status of organization can be categorized as organization resources, and institute efforts to create capability from resources that organization have, by applying different structures and policies. BTH innovation cost of operation and Turnover was 4.5 million SEK in 2009 as the company was just 9 months old. Year 2010 about 8.5 million SEK and 2011 is 18 million SEK. About 80% of this money is external fund from national, European and regional funding sources.

## **Chapter 6: Chalmers University of Technology**

## **6.1 Location, status and experience**

Chalmers University was founded in 1829 in Gothenburg to be an industrial school. Gothenburg is the second largest city in Sweden after Stockholm and the fifth largest city in the Nordic countries. The City of Gothenburg is situated on the west coast of Sweden and has been the center of industry and manufacturing ever since the city has been a major center for many of manufacturing plants and industries such as Volvo, SKF, and Ericsson. Chalmers University of Technology is situated in the Lindholmen area in order to create strong interactions between Chalmers, Gothenburg University, Industry and the City of Gothenburg (City of Gothenburg 2009).

Most universities in Sweden are largely public authorities, with the exception Chalmers University of Technology and Stockholm School of Economics (Jacob et al., 2003). Before Chalmers University of technology became Foundation Operation University, “Chalmers was governed by state ordinances and official documents placing appropriations (government grants, votes of supply) at the disposal of the authorities concerned, which is common to all Swedish universities and colleges (Chalmers foundation annual report, 2004)” . Today Chalmers University “governed by the rule of private law, mainly the Foundation Act and the Companies Act, as Chalmers University of Technology is now owned by a foundation and operations are running in the form of a limited company” (Chalmers foundation annual report, 2004).

Privatization led university to:

- Freedom of creating university own fund
- Freedom of managing its own properties
- Freedom of develop its own recruitment
- Freedom of develop its own internal structure

Although Chalmers University is a private university, differentiating public and private institute is still a challenge, because Chalmers operational and startups funds are coming from both public and private sectors (Jacob et al 2003). Indeed Chalmers relation with government now is based on agreement instead of law but, there is also some certain public law which has been applied for all university state of foundation (Chalmers foundation annual report, 2004).

## **6.2 Chalmers Incentive system**

### **6.2.1 Faculty**

Chalmers University is presenting different courses and programs, in order to provide industry with world leading high quality knowledge with support of 2292 full terms employees, with an aim of moving university position toward more innovation and entrepreneurial orientation.

### 6.2.2 Department

Chalmers University is consisted of 17 different departments<sup>1</sup>and 43 different centers which cooperate across university departments with different roles such as Centre for Business Innovation, Centre for Intellectual Property/CIP, and Centre for Environment and Sustainability/GMV and the other 40 centers. Chalmers different department policy with cooperation of different centers and incubators organizations are closely aligned with the goals of the Chalmers University of Technology.

### 6.2.3 TTO'S

The infrastructure of entrepreneurship and technology transfer in Chalmers University started by establishment of Innovationskapital in 1994, this organization is a venture capital partly owned by Chalmers.

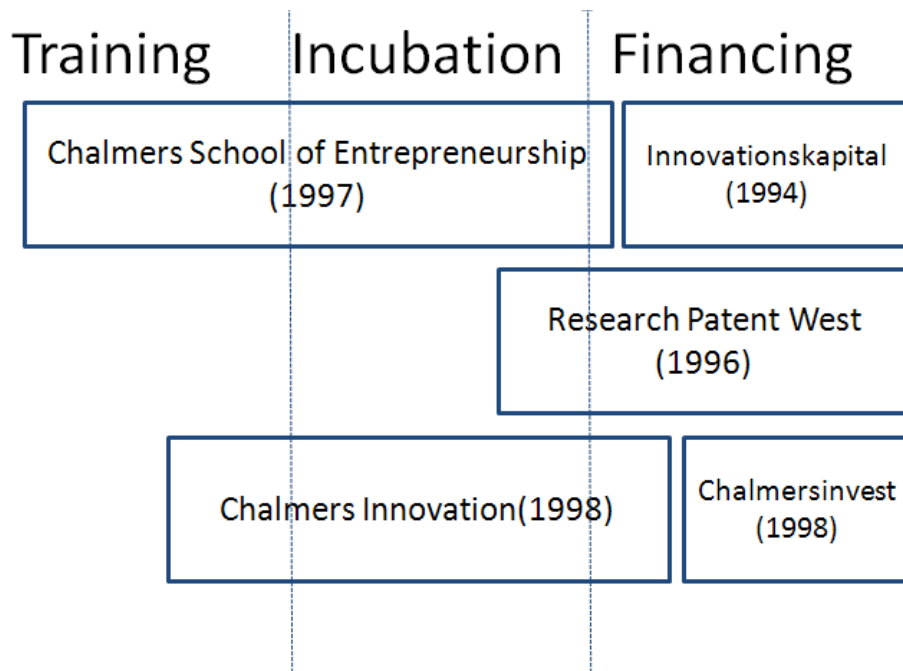


Figure 4 Chalmers university innovation infrastructure (Jacob et al.2003)

### 6.3 Intermediary agents

Chalmers Intermediary agents include different organizations and offices which enhance Chalmers entrepreneurial activities and strengthen the role of this university with regards to regional and national growth. A different Chalmers Intermediary system is illustrated in Figure 5.



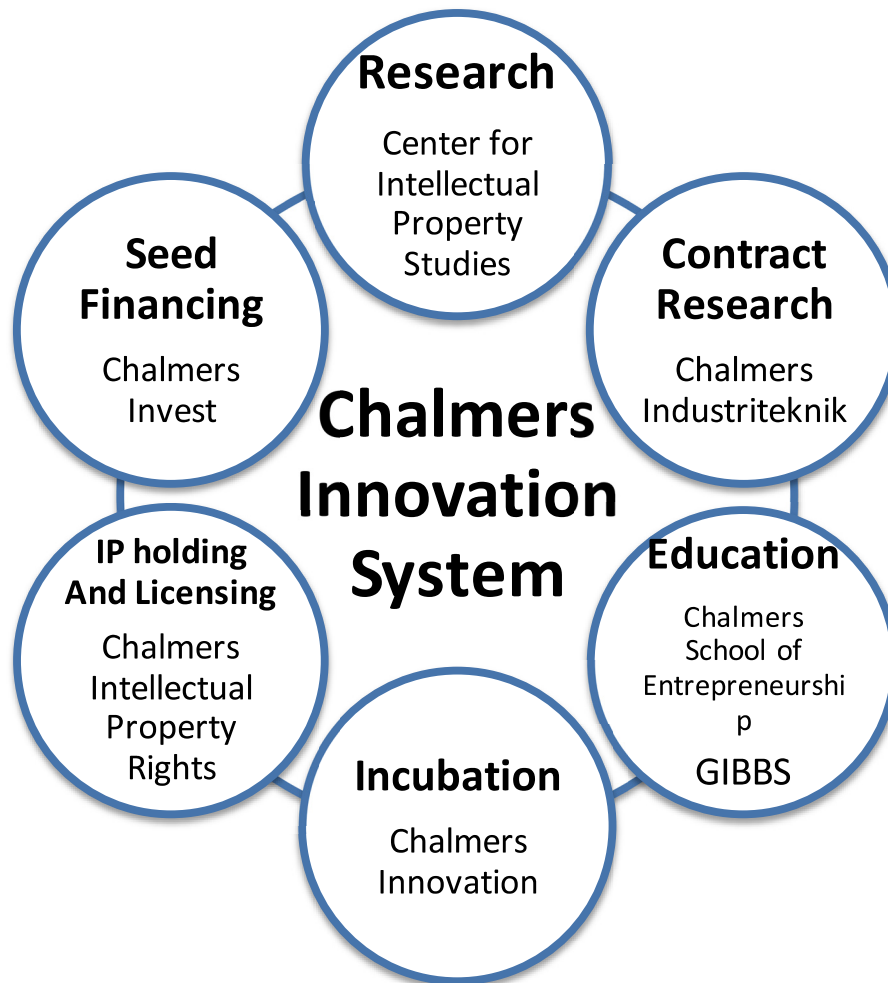


Figure 5 Chalmers university innovation system

### 6.3.1 Chalmers Industriteknik

Chalmers Industriteknik (CIT) was founded in 1984 by Chalmers University of Technology and since this time they have:

- Had commissions on 5 continents;
- Performed business in 49 countries;
- Worked with 1 500 customers;
- Generated 700 MSEK of accumulated revenue.

Industriteknik is considered as a foundation, indeed “they have no formal owner and their activity is governed by national regulation”.

### **6.3.2 Chalmers innovation**

Chalmers innovation non-profit foundation was established in 1999. This organisation is an incubator organisation which owns Stena Centre and operates in both the Stena and Lindholmen Science Park. From 1999 up until 2010, Chalmers innovation have worked with and started 102 companies of which 75 companies are still surviving and developing today. In 2010 the company turnover was 415 million SEK with 415 employees. Chalmers innovation's goal is to support innovation emerging from academia and in turn to transform it into a sustainable and successful company.

### **6.3.3 Chalmers Encubators**

Encubator was established in 1997 at the Department of Technology Management and Economics at Chalmers University of Technology in order to increase commercial value of scientific results in Chalmers and Industry.

In the year 2010 Chalmers Encubators founded 5 new companies and started 10 new projects. Encubator's role is to "provide an environment for actively managing its project and company portfolio with an objective to generate strong financial and societal returns".

### **6.3.4 Centre for Intellectual Property, CIP**

CIP acts as a hub between the city of Gothenburg and Chalmers University. CIP's main goal is to enhance regional development by transferring knowledge and innovation which is created in academia and which interfaces with many groups of organizations and academic partners through managing a variety of events, programs and projects. This center was established in the 1990s and was intended to act as a knowledge intensive organisation, creating close collaboration between the academic world and the business environment. CIP is owned by Chalmers University (51%) and the University of Gothenburg (49%).

### **6.3.5 Chalmersinvest, Seed Financing**

Chalmersinvest has been created to contribute to the development process of new start-up companies, by providing financial support for their early stage of growth. This center is a university-owned seed capital fund which assists companies with: capital, knowledge, contacts, legitimacy and skills in board work.

Chalmers invest is very small offices and has broad collaboration with other networks such as Almi, Chalmers School of Entrepreneurship, Chalmers Industriteknik, Venture cup and many other organizations and units.

## **6.4 Chalmers Industriteknik strategy and structure**

Chalmers Industriteknik is active in the general planning of science parks in Gothenburg and in the management and development of Johanseberg Science Park. This is consistent with Chalmers' efforts to promote and make more efficient commercial use of new scientific research and skills. Chalmers Industriteknik's main strategy can be concluded as the following:

- Provide research and development for industry on commercial terms;
- Strengthen the bonds between Chalmers and industry;
- Be the commercial entrance to Chalmers.

## **6.5 Chalmers Industriteknik resource and capabilities**

In terms of organisations' financial resources; CIT had a Cost of Operation of approximately 72 million SEK and 70 employees in the year 2009. Similar to BTH Innovation, CIT also does not have any revenue from licensing. The reason for this, as stated by Mr. Henric Rhedin is that "Licensing is more or less absent in Sweden entrepreneurship".

Although structure of developing and supporting innovation has been present for a long time, many researchers at this university are not aware of the function or existence of such a unit inside of Chalmers' system (Jacob et al., 2003).

## Chapter 7: Linköping University

## **7.1 Location, Status and experience**

Linköping University was founded in 1965 as an autonomous faculty within University. In 1969 it became an independent university under the name of Linköping Institute of Technology. This university located in Linköping city in the southern part of Sweden. Linköping University is recognized as one of the biggest computer clusters in Europe with very close interaction with the IT industry. There are so many well-known international companies located in this city such as Saab, Motorola, Ericsson, Cambio Healthcare Systems AB, and others which use their close collaboration with Linköping University to boost the entrepreneurial activity in this region.

## **7.2 Linköping Incentive system**

### **7.2.1 Faculty**

Linköping University is organised into four faculties: Arts and Sciences, Health Sciences, Educational Sciences and the Institute of Technology. These faculties are in charge of creating education from basic to advance level, PhD training and research inside of the Linköping education system. The faculty number during 2004 to 2009 was approximately 3500 personnel.

### **7.2.2 Department**

Linköping University runs different organisation systems from traditional academic organizations. The system includes four faculties: Institute of Technology, Faculty of Health Sciences, Faculty of Educational Sciences and Faculty of Arts and Sciences which are integrated with 14 departments<sup>1</sup> and 32 centers such as the center for Innovation and Entrepreneurship (CIE), the center for Industrial Information Technology (CENIIT), the center for Learning and Teaching (CUL) and different centers which pursue the Linköping mission towards education and entrepreneurship.

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<sup>1</sup> Linköping department of: Applied IT with, Applied mechanics, Applied physics (2 patent application at 2008), Architecture, Chemical and biological engineering (1 patent application), Civil and environmental engineering

Behavioral Sciences and Learning (IBL), Biomedical Engineering (IMT)  
Clinical and Experimental Medicine (IKE), Computer and Information Science (IDA), Culture and Communication (IKK), Electrical Engineering (ISY), Management and Engineering (IEI), Mathematics (MAI), Medical and Health Sciences, Physics, Chemistry and Biology (IFM), Science and Technology (ITN), Studies of Social Change and Culture (ISAK), The Tema Institute Social and Welfare Studies (ISV)

### **7.2.3 TTO's**

Linköping University has created an infrastructure for promoting and enhancing commercialisation activities by establishing different TTO organizations with different focuses and directions based on the needs of industry and university research fields. In order to achieve better clarification and to prevent overlapping in different activities, Linköping University has divided its innovation offices into three parts based on different tasks:

- 1. LiU Innovation**

For researchers / graduate students and teachers

- 2. Venture Zone**

For student

- 3. LiU contact**

For business and society

## **7.3 Intermediary agents**

### **7.3.1 Center for Innovation and Entrepreneurship (CIE)**

The Center for Innovation and Entrepreneurship (CIE) was established in 1993 and is located in the Department of Economic and Industrial Development with more than 450 employees who are linked to the research and educational track in Linköping University. Creating a superb environment for facilitating research and education as well as new business growth, is the main task of this center at Linköping University. CIE core research areas are; early growth and development processes of businesses, supporting new ideas and firms, early stage financing, successful growth environments, and university – industry Links. CIE working strategy differs from traditional business support, that is, this institute sets its strategy and structure to assist groups of entrepreneurs or groups of companies with the same need, because this strategy aids this institute in fulfilling their strategic issue, which creates a dynamic learning environment between participants. In addition, it is also cost effective as stated by Professor Magnus Klofsten (Leader of the CIE Holders of Innovation Bronze Chair in Innovation and Entrepreneurship).

The CIE program and activities are described in the figure below:

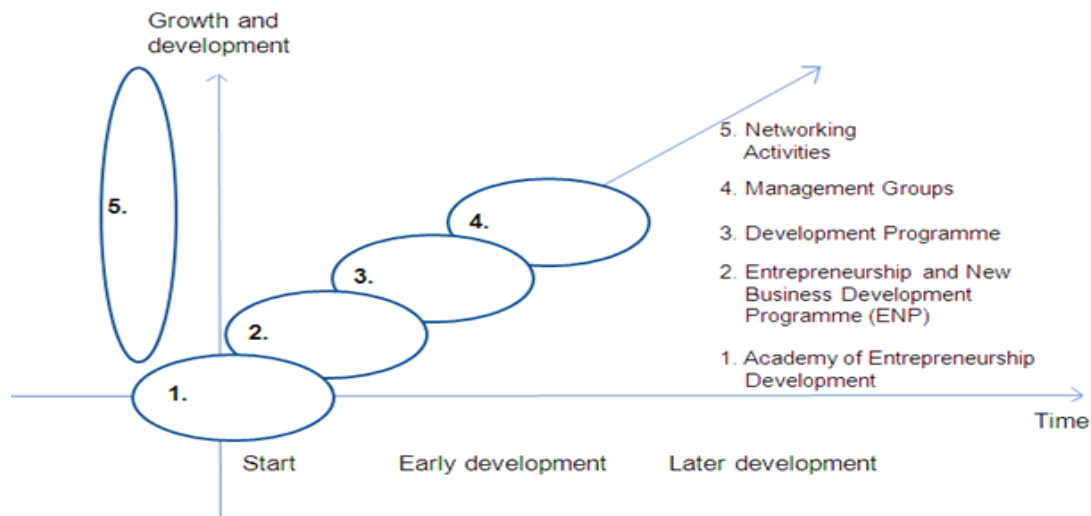


Figure 5 CIE programs and activities

### 7.3.2 Liu Innovation

The Linköping Innovation office, which was started in 2009, is an incubator based company including professional staff and researchers, lawyers and patent attorneys both from industry and academia. Linköping University is owned by Liu Innovation and aims to create infrastructure inside of academia in order to facilitate the process of technology transfer from university to industry. It also helps students and researchers to convey their knowledge and ideas regarding commercialised products and services. Liu Innovation can lend support to various potential and patentable ideas through different methods such as:

- Finance advice;
- Legal advice;
- Business advice;
- Contractor supply;
- Patent lawyer;
- Seminars.

### 7.3.3 LEAD

LEAD is also known as Liu Entrepreneurship and Development. It was founded in 2002 and is owned by Linköping University. The company merged with Norrköping incubator in 2007, with the aim of aiding entrepreneurs in achieving more feasible business outcomes. LEAD set the companies milestone for increasing customer sustainable growth by supporting entrepreneurs

from start-up level to high growth in fields of life science, microelectronics, visualisation and digital imaging. The LEAD start-up support period lasts for three years with new start-up companies given coaching in order to prepare for sustainable enlargement. LEAD is currently run by 68 employees with 44.2 MSEK net incomes. LEAD is a quality assured business incubator (certified with the ISO 9001 business tool). Its activities result in a minimum of 10 start-up companies per year with an approximate total of 79 start-up companies since 2002.

LEAD's Key competences are:

- **Components:** LEAD's most crucial asset is their professional background along with the ISO 9001 certified business plan tool;
- **Capital:** LEAD assist mature companies with financial support, which is the most frequent limitation in the early stage of a company's growth;
- **Contacts:** The broad network of LEAD can be seen as a resource;
- **Context:** LEAD creates facilitated environments such as offices, where new start-up companies can meet other entrepreneurs and share their knowledge and experience in a creative environment.

## **7.4 Center for Innovation and Entrepreneurship (CIE), strategy and structure**

CIE has shaped its structure to fulfill its main strategic issue, namely creating a dynamic learning environment. With this in mind, the institute designs its activity to "stimulate the successful development and growth of technology and knowledge intensive firm". In addition, it also aims to combine these programs with research and the best teaching platforms for combining theory and business practice. CIE is involved with the Linköping University teaching system in the entrepreneurship field in order to exceed its target strategy, which is, creating an effective learning environment.

CIE has developed its structure in order to enhance Linköping's entrepreneurship environment and to transfer knowledge created in academia to industry through a number of major yet different strategies:

- I. **Entrepreneurship and new business development program:** CIE hold this program for students, researchers and companies at Linköping University with the cooperation of SMIL (Business Development in Linköping) and KIN (Knowledge-based companies in Norrköping). The aim is to train and assist students, researchers, companies and potential entrepreneurs to transform their ideas into commercial value in the form of new start-up companies, products or services.



- II. **Development programs:** This program has been running from 1985 with the aim of enhancing established companies' business knowledge. For this reason, different companies are being sorted based on their need, and receive training and development skills based on their defined requirement. Moreover, they can reap the benefits of sharing knowledge in dynamic groups and can create a powerful connection through their interaction with different groups of companies.
- III. **Management groups:** This program has been active since 1988 and focuses on the same strategic issues which are mutual for different groups of companies, for example sales issues and brand positioning issues. Since its conception, more than 180 companies have been active in this program.
- IV. **Networking:** The purpose of CIE is to create network by holding different programs, seminars and business presentations.

## **7.5 Center for Innovation and Entrepreneurship (CIE), resource and capabilities**

In addition to the items we have categorised under the resource and capabilities of the firm such as university incentive system, status, faculty and location, financial support of an organisation can also be considered as a firm resource. Indeed, this additional resource can create short run competitive advantage for the firms and can create sustainable competitive advantage (capability) through the application of different policies and structures. CIE cost of operation in 2009 was approximately 5 million SEK; this institute does not gain revenue from licensing or other commercialisation processes. Indeed, as confirmed by Professor Magnus Klofsten (CIE director) this is not the goal of the organisation.

## Chapter 8: Finding

The purpose of this study is to outline a framework for identifying the strategies and structures underlying each university's entrepreneurial orientation, and based on the research model different elements are investigated and universities attempt to increase their capabilities by deploying their available resources better. A direct comparison of the examined universities is difficult since many factors such as internal features and contextual environment differ a lot, even though the university cases are selected from the same country. Chalmers University is exclusively an engineering school while the other two cases are presenting different courses and programs, and moreover almost all of the research cases do not have complete statistics of their commercialization activities results even though each department may have records of their activities. The findings below are gathered through interviews and published reports from the universities, and all interviews mentioned that the follow up of entrepreneurial activities is difficult since many of them are not involved in the complete commercialization process and entrepreneurs may not report their activities to the university when they are not obliged to.

## **8.1 Patenting**

Universities' attempts to commercialize and commodify the knowledge that has been produced by them: is an approach which can illustrate the university entrepreneurial activities. Chalmers Institute of Technology has two grant patents each year. BTH has no statistics about its patents. Tracking down the patent numbers are difficult in Sweden, because of two main reasons:

- I. Professors' privilege law
- II. Patentable entrepreneurial activities are conducted out of university's channel.

Linköping University has not published statistics so the number of patent granted is ambiguous in case of Linköping University.

## **8.2 Spin offs**

According to Shane "spin-off" describing: as new firm that reveals the intellectual property which created in university (Shane2004). Chalmers University with average five spin-offs formation taking more visible role in shifting knowledge to the industry Since BTH and Linköping Universities are public university and cannot take equities in university spin offs like Chalmers or other private universities, these university strategy is more focused on student academic entrepreneurship rather than result-orientation strategy's like spin-off.

## **8.3 Start ups**

The BTH Innovation strategy in 2010 resulted in 6 new startup companies. However, the exact number of startup companies remains ambiguous due to the aforementioned reasons which are

summarised in the previous sections. Chalmers' success with startup companies stems from different activities among different schools and departments in this university. For instance, Chalmers' school of Entrepreneurship activity in 2003 resulted in 32 new startup companies with 14 million Euros in turnover. In addition Chalmers' Innovation activity in 2003 has led to 23 startup companies with 56 million SEK in annual turnover. Knowledge commercialisation has an impact on Chalmers' internal entrepreneurship system and also affects the regional and national system through the creation of job opportunities in the region. Linköping University's entrepreneurial attempts and training have led to an annual total of 7 start-ups. However, the exact figure is not known as the majority of start-up companies are created by trained entrepreneurs or researchers and thus are not recorded in university figures due to the fact that they are not obliged to inform the university.

## 8.4 Licensing

The findings imply that the least popular academic entrepreneurial activity among Swedish universities is licensing, since only 12% of academic entrepreneurship activity falls into this category while 51% of university research exploitation is consulting activity and 45% is contract research (Klofsten et al., 2000).

All three university cases are not actively involved in the licensing aspect. Indeed, Nilsson, Rhedin and Klofsten feel that this is because a "licensing agreement is not harmonized with the rule which is defined for such organization in schools".

More research result can be found in Table (5):

Indicators	BTH	Chalmers	Linköping
Number of students	8,600	10,000	18,910
Number of International s students	1,100	338	-
Number of active Ph.D. students	123	1015	688
Number of publications	200	1600	1401
Number of personnel (full-time equivalents)	595	2292	3,469
Incubator office	1	6	4
Annual turn over	448 M.SEK	2671	3,202

Research Turnover	149 MSEK	1760	1,674
Commissioned courses	24MSEK	911	1,528

Table (4) Summary of research finding (year2010)

## **Chapter 9: Discussion and conclusion**

## 9.1 Contribution and discussion

The purpose of this study is to contribute to analyzing the research framework with a resource based view which facilitates the understanding of dynamic and complicated systems of entrepreneurship in the universities, especially when most of the papers in an entrepreneurial aspect were concentrated on single aspects or resources such as patents, licenses, or Science Parks, etc. In this study, the ambition has been to cover “entrepreneurial universities” and their strategy and structure from the perspective of RBV in order to answer the research questions and create a comparison case study and increase the empirical knowledge regarding Swedish universities entrepreneurial systems.

Question 1; How have BTH, Linköping, and Chalmers University developed their strategies, organizational structures, and capabilities to become more entrepreneurial?

This question has been answered by investigation of each university cases organizational structure and capabilities separately in chapters 5, 6 and 7.

Universities in this research are taking different policies and path actions according to their structures and main identified role in Swedish educational system. Blekinge Institute of Technology with high interaction with industry has positively influenced the industry and university entrepreneurial level. University boundaries with industry for instance strong networks between this university and the IT companies can be accomplish through Karlskrona Telecom City organization which creates strong networks between this university and the IT companies in this region, Technology Transfer mechanism is growing by the formation of university Technology Transfer Offices (TTO's) i.e. BTH Innovation and the other external TTO's such as Blekinge Business Incubator (BBI) and Almi. These organizations support new ideas in order to create the business ideas to commercial products or new firm creation in region.

BTH University with increasing the cooperation with industry and transferring the knowledge creation to outside of university border by applying different structural policies trying to fostering the footprint of this institute in region and the whole country.

Chalmers University of Technology with around 2300 employees, 17 departments and 43 different centers has great influence on city of Gothenburg industry trend and also national educational and innovation system. In fact Chalmers as a private university have different infrastructure compare to BTH and Linköping universities in terms of internal structure, owning its own property and creating university fund. Another important difference between Chalmers and two other university cases is Chalmers innovation infrastructure background; the infrastructure of entrepreneurship and technology transfer in Chalmers University started by establishment of Innovationskapital in 1994, this organization is a venture capital partly owned by Chalmers.

Chalmers University created different intermediary organization in order to foster university innovation and entrepreneurship levels and technology transfer follows.

- Chalmers Industriteknik
- Chalmers innovation
- Chalmers Encubators
- Centre for Intellectual Property, CIP
- Chalmersinvest, Seed Financing
- Chalmers Intellectual Property Right, IP Holding and licensing

Linköping University with 3500 employees, 14 departments and 32 centers Have strong influence to turn the Linköping to one of the biggest computer clusters in Europe with very close interaction with the IT industry. This university also created different centers with divers roles and task like; center for Innovation and Entrepreneurship (CIE), center for Industrial Information Technology (CENIIT), center for Learning and Teaching (CUL) and different centers which perusing this university mission toward education and entrepreneurship. Moreover Linköping, University has formed innovation offices based on three different tasks which are:

**1. LiU Innovation**

For researchers / graduate students and teachers

**2. Venture Zone**

For student

**3. LiU contact**

For business and society

Linköping University is built infrastructure inside of academia in order to facilitate the process of technology transfer from university to industry, and also help students and researchers and business owners to convey their knowledge and idea to commercialized products and services.

Question 1.1.; what are the outcomes/results of this process? What are the main similarities and differences in effects between the universities?

In order to answer this questions a primary research model were developed in order to analyze the outcome of the entrepreneurial activities and capabilities in case of each university. The answers to these questions are examined in chapter 8 of this study. Different measurable elements have considered in order investigating each university entrepreneurial level and orientation.

1. Patenting is an approach which can illustrate the university entrepreneurial activities. Chalmers Institute of Technology has two grant patents each year. BTH has no statistics



about its patents. Tracking down the patent numbers are difficult in Sweden, because of two main reasons:

- Professors' privilege law
- Patentable entrepreneurial activities are conducted out of university's channel.

Linköping University has not published statistics so the number of patent granted is ambiguous in case of Linköping University.

2. Spin offs: Chalmers University with average five spin-offs formation taking more visible role in shifting knowledge to the industry Since BTH and Linköping Universities are public universities and cannot take equities in university spin offs like Chalmers or other private universities, these two universities strategy is more focused on student academic entrepreneurship rather than result-orientation strategy's like spin-offs.
3. Startups: BTH Innovation strategy in 2010 resulted in 6 new startup companies, But still the number of startup companies is ambiguous due to the reason have discussed in previous part. Chalmers success in startup companies is coming from different activities among different schools and departments in this university, for instance Chalmers school of Entrepreneurship activity in 2003 resulted in 32 newly startup companies with 14 million Euro turnovers. And Chalmers Innovation activity in 2003 led to 23 startup companies with 56million SEK annual turnover. Linköping university entrepreneurial attempt and training leads to 7 start ups yearly, this numbers and figures still is not whole figures since, majority of start-ups companies creating by trained entrepreneurs or researchers are not record in university figures as they are not obliged to inform university.
4. Licensing: All three university cases are not actively involved in licensing aspect, since "licensing agreement is not harmonize with the rule which is defined for such organization in schools" as Mr. Nilsson, Rhedin and Klofsten said.

Question 3; what type of industries and companies generally collaborate with the universities?

This question have been answered in the section regarding the location of the universities as one the resource categories which affect the universities interaction with industries, so because of each university location in Sweden different industry nature effecting university educational system and consequently university interaction with industry.

Blekinge Institute of Technology is located in the south-eastern part of Sweden in Blekinge province. The presence of more than 200 IT companies in the region has greatly influenced the education system of Blekinge. Having 2000 IT students has placed BTH as the country's second

biggest and most concentrated college in the field of IT and telecommunications (Karlskrona Kummun 2010).

Gothenburg is the second largest city in Sweden after Stockholm and the fifth largest city in the Nordic countries. The City of Gothenburg is situated on the west coast of Sweden and has been the center of industry and manufacturing ever since the city has been a major center for many of manufacturing plants and industries such as Volvo, SKF, and Ericsson. Chalmers University of Technology is situated in the Lindholmen area in order to create strong interactions between Chalmers, Gothenburg University, Industry and the City of Gothenburg (City of Gothenburg 2009).

Linköping University is located in the southern part of Sweden. Linköping University is recognized as one of the biggest computer clusters in Europe with very close interaction with the IT industry. There are so many well-known international companies located in this city such as Saab, Motorola, Ericsson, Cambio Healthcare Systems AB, and others which use their close collaboration with Linköping University to boost the entrepreneurial activity in this region.

In this study, different types of university resources and university strategies for transforming their available resources to sustainable capabilities were investigated. And reasons have been identified for why the Chalmers and Linköping cases have become more successful in Technology Transfer. One significant reason can be categorized in the resource phase and the university TTO's ages. BTH University is the youngest organization in this study, Chalmers and Linköping universities had structured their innovation infrastructure before BTH University was even established.

Data of university case strategies and their efforts which resulted in implementing their strategy was collected through face-to-face interviews with the TTOs organization managers. Among the university cases, Blekinge Institute of Technology needs to be more active to reform the University structure, i.e. with an incentive system and staff structure in order to change the organizational culture toward a more academic entrepreneurship which is one of the important elements that can be recommended in order to answer question 4 of this study. The three universities in this study certainly have a long background and traditions in the entrepreneurship phenomenon, even though most of the TTO's offices and incubators to support commercialization activities have only been established a decade ago, and this can create its own difficulties in tracking the number of the commercialization results in these universities.

## **9.2 Conclusion**

Universities around the world are more and more focused on entrepreneurial activities. In Sweden this flow started in the 1990's when the government began to change its national policy toward a strategy for innovation, and the most important part of this policy was related to transforming Swedish universities into entrepreneurial universities (Giannetti et al., 2004, Jacob

et al., 2003). This paper uses case studies of three Swedish universities; Blekinge Institute of Technology, Chalmers University of Technology, and Linköping University and their strategies and structures toward entrepreneurial policies and activities. The theoretical purpose of this study is to increase empirical knowledge regarding the three mentioned university cases into entrepreneurial activities and develop the resources and capabilities of the firms involved in the university organization with a focus on each university's entrepreneurial role by understanding a broad cross-sectional difference in entrepreneurial attempts and the results of their attempts and activities. Moreover, this study looked at the universities success in an entrepreneurship aspect as variables which can affect different elements in a resource-based view (RBV).

Finally, the theoretical background of the study according to (RBV) signifies that the availability of resources and universities structures and policies are playing crucial roles in university successes. According to the definition of resources, it can be seen as one of the influential reasons for firm competitive advantages.

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<http://www.liu.se/insidan/innovation/erbjudande?l=sv>

## 11. Appendix

### 11.1 BTH Triple-Helix system

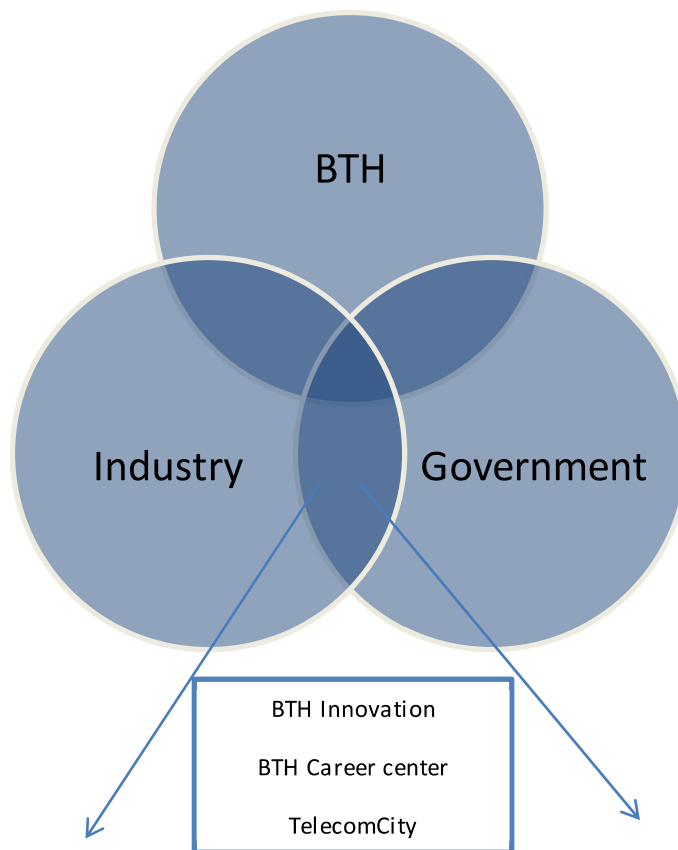


Figure (6) BTH and Triple Helix system

## 11.2 Chalmers Science Parks

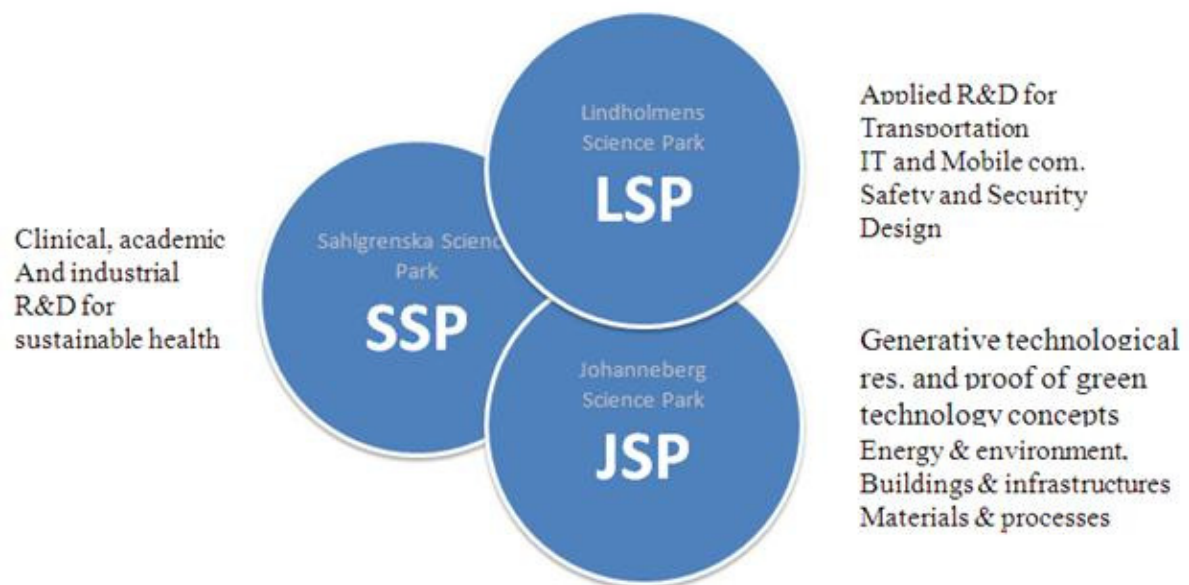


Figure (7) Chalmers Science Parks system



### 11.3 Swedish University's total turnover (M) 2007

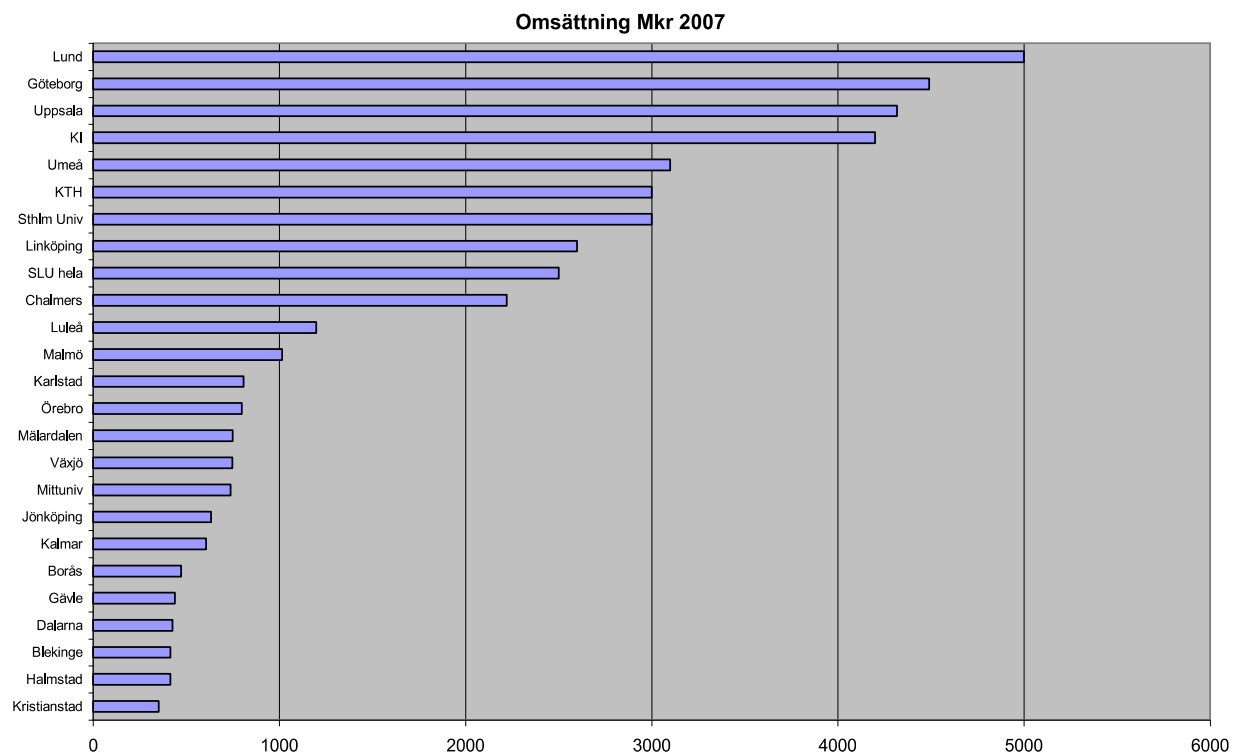


Figure (8) Swedish University Turnover

## 11.4 Research Questionnaire

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**University case** \_\_\_\_\_ **Address** \_\_\_\_\_

**Interviewee Name** \_\_\_\_\_ **position** \_\_\_\_\_

**Organization name** \_\_\_\_\_ **Telephone** \_\_\_\_\_

**E-Mail**

\_\_\_\_\_

.....

- 1) What is the objective of the innovation organization of Chalmers?
  - What is services innovation organization can offer?
  - Examples of spin offs and everything that Chalmers Industriteknik help them with or involvement in knowledge of the USO(University Spin Offs) project from inception to the present
- 2) How is business idea communication between researchers, students, employees and Chalmers Industriteknik staff works?
  - How do you get contact with researcher, student with their commercial ideas?
  - Where the ideas come from; researchers, faculty or just students?
- 3) How top university managers involved in supporting your department and projects?
  - Is your organization placed under vice chancellor supervision in university organization chart?
- 4) How many spin-offs your company granted specifically during years 2004 to 2009?
- 5) How many patents you granted during 2004-2009?
  - How many patents were owned by university?
- 6) How many startup companies you have during 2004-2009?

- 7) How much money do you spent last year (cost of operation) and how much was your annual turnover in 2009
  - Where does the money come from?
- 8) Do you have normal income in terms of licensing agreement income?
- 9) What is your policy in order to fill the gap between university and industry?
- 10) What type of industries and companies are mostly collaborating with the university?
- 11) How Chalmers University developed its strategy, organizational structure, and capabilities to become more entrepreneurial?
  - What Chalmers university doing to become more entrepreneurial in your point of view?
- 12) Chalmers Industriteknik capabilities and resources
  - Number of employee(part time and full time), their background
  - Are they coming from university or industry

