Lund University
Centre for East and South-East Asian Studies
Master's Program in Asian Studies
East and South-East Asia track
Spring Semester, 2009

The Triadic Relationship
With a Triple Helix Approach
Between
Industry, University and State in Japan

Author: Ronald T. Nordqvist
Supervisor: Dr. Stefan Brehm

Abstract

Purpose - This study is about the triadic relationship with a Triple Helix approach between the state, industry and university in Japan. The intention is to see if an increase in collaboration between the three actors generates an increase in patents, start-up companies and new organisations. I will use the Triple Helix model as a hypothesis and see if the increase in collaboration leads to an increase in patents, start-up companies and new organisations as stated by the Triple Helix model. This study will also answer how the actors experience the increase in collaboration patterns with other actors at a national level and what are the consequences if we study the pace and amount of knowledge transfer.
Design/methodology/approach – Primary data by conducting interviews and sending out questionnaires
Findings – Increase in patents, new organisations and start-up companies due to a new formalized system. The formalized system has not created a 'real' increase in patents, start-up companies and new organisations. Instead it is informal existing networks being visible through new formalized system.
Conclusions - Due to a new formalized system regarding knowledge transfer we can see that pace of knowledge transfer has become more bureaucratic and slow compared to the informal system of knowledge transfer

Keywords: State, Industry, University, Collaboration, Knowledge Transfer, Japan.

Contents

Acknowledgements

Many people have assisted me with this study. First and foremost I am grateful to my supervisor at Lund University, Dr. Stefan Brehm, who always supported me with useful suggestions, especially regarding my theoretical framework, in order to improve my study. Also, many thanks go to my supervisor at Waseda University, Prof Takamichi Mito, who got me started with my study and introduced me to people to interview in Japan and gave me a lot of good literature in order to fully understand the whole picture of industry, government and university collaboration in Japan.

I am also very grateful to all the respondents who took valuable time from their busy schedule to meet me in person for an interview, answer my questionnaire and suggesting other people to contact. Due to secrecy I will not mention their names. Also I want to thank the person at KTH (you know who you are) who provided me with people to contact for my questionnaires. Finally a big ‘arigatou’ go to my wife and daughter for their patience with me during the last six months.

Abbreviations

AIST	National Institute of Advance Industrial Science and Technology
CIRCLE	Centre for Innovation, Research and Competence in the Learning Economy
HEI	Higher Education Institutions
ICT	Information and Communication Technology
IP	Intellectual Property
IPLS	International Patent Licensing Seminar
ITPS	Swedish Institute for Growth Policy Studies
JETRO	Japan External Trade Organization
JSPS	Japan Society for the Promotion of Science
KTH	Royal Institute of Technology
LDP	Liberal Democratic Party
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports and Science and Technology
MITI	Ministry of International Trade and Industry
NIAD-UE	National Institution for Academic Degrees and University Evaluation
OECD	Organisation for Economic Co-operation and Development
RIKEN	Rikagaku Kenkyusho
R&D	Research and Development
TLO	Technology Licensing Organization

List of Figures

List of Tables

1. Introduction

This study is about the triadic relationship between the state, industry and university in Japan. Historically, in Japan, collaboration has been between industrial groups and between government and industry (Rahm et.al, 2000:117). Currently the Japanese government tries to involve universities with industry for further collaboration. The first push came in the 1980s and the second one in 1995 when the Japanese Diet enacted the Science and Technology Basic Law in order to reinforce industry and university collaboration. My research question is to see if an increase in collaboration between industry, university and the state generates an increase in patents, start-up companies and new organisations. I will use the Triple Helix model as a hypothesis and see if the increase in collaboration in Japan leads to an increase in patents, start-up companies and new organisations. The Triple Helix model builds on cooperation between government, industry and state. This model and my hypothesis suggest an increase in interactions that did not exist before, coordination of resources and integration of goals and interests will lead to a change in the amount of knowledge transfer.

My objectives are threefold, firstly, how the participants experience the collaboration with other actors (success, status quo or failure) and if the effect of a change in collaboration patterns change the pace and amount of knowledge transfer. Secondly, any conflicts of interests and/or change in research focus due to collaboration with other actors. The third and final objective is to produce knowledge of emerging forms of collaboration patterns. I intend to measure the success, failure or status quo by finding out if there is a change in the amount of generated start-up companies, patents and new organizations. The significance of this study is to find out if a change in collaboration patterns has generated a change in the amount and pace of knowledge transfer.

2. Part I – Research Methodology

2.1 Introduction

I have mainly focused on the university compared to the other two actors. The reasons for this are twofold, firstly my initial belief is that the change in collaboration patterns is greater at a university compared to the state and the industry and secondly, the universities are more accessible for me as a student compared to the other two actors regarding arranging

interviews and finding people to send out questionnaires. In order to make this doable when considering my amount of time available for this study I have limited myself, with one exception, to highly ranked universities, based on an academic ranking made by the Center of World-Class Universities at Jiao Tong University in China (http://www.arwu.org/), and research institutes within the Information and Communication Technology Sector (ICT) in Japan, namely: University of Tokyo, Waseda University, Tokyo Institute of Technology, Hokkaido University, Tohoku University, Shibaura Institute of Technology and Rikagaku Kenkyusho (RIKEN) a former private research foundation re-organized in 2003 to an independent administrative institution under the Ministry of Education, Sports, Science and Technology (MEXT). When I talk about ‘’industry’’ I mainly focus on the ICT sector. Regarding ‘’the state’’ I have focused on The Ministry of Economy, Trade and Industry (METI) and MEXT since these are the ministries that are most relevant for this study being involved in policies, budgets and decision-making in questions related to my topic.

2.2 Methods and Selection

In order to gather primary data I spent five weeks in Japan conducting interviews with university staff and a former employee from the industry at Waseda University, University of Tokyo and Tokyo Institute of Technology and the technical attaché at the Science and Technology Office at the Swedish Embassy in Tokyo also representing the Swedish Institute of Growth Policy Studies (ITPS), which 1st of April 2009 changed its name to Growth Analysis. On top of this I also received tips and ideas about secondary data, literature and interviews conducted by my interviewees, from my supervisor at Waseda University and from people I interviewed.

Back in Sweden I sent out e-mail-questionnaires to academic staff, all professors or associate professors, at Hokkaido University, Tokyo Institute of Technology, University of Tokyo, Keio University, Shibaura Institute of Technology, Tohoku University, Nara Institute of Technology and RIKEN. The reason for the focus on professors and assistant professors are that they are usually the only access point in if you contact a laboratory. As one respondent expressed himself ‘’*the professor is the king regarding everything that happens in the lab’’* (respondent nr.3). Meaning that he (it is most likely to be a ‘he’ in Japan) is the only one who knows the whole picture regarding what is happening in relation to the laboratory.
In addition, I also sent out questionnaires to several common e-mail addresses at organisations like the Japan Society for the Promotion of Science (JSPS), Japan External Trade

Organization (JETRO), National Institute of Advanced Industrial Science and Technology (AIST). Finally, I also contacted staff at the Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE) at Lund University through recommendations from JSPS Office in Stockholm.

This study is based on five interviews and 11 questionnaires (44 were originally sent out). A summary of universities/organisations who received questionnaires can be seen in Table 4.1.

Table 2.1 A summary of who received questionnaires.

University/Organisation	Number of Questionnaires
University of Tokyo	7
Tohoku University	6
Nara Institute of Science and Technology	5
RIKEN	5
Hokkaido University	4
Tokyo Institute of Technology	3
Keio University	3
Shibaura Institute of Technology	2
VINNOVA	2
AIST, CIRCLE, ITPS, JETRO, JSPS, Kyushu University, SCMotor/Japanese Businessmen's Club Stockholm	1

The outcome of the 44 questionnaires sent out can be seen in Table 4.2. The first round of questionnaires was sent out during the period of 8th of March and 4th of April. Two weeks after sending the first questionnaire a reminder was sent out.

Table 2.2 Outcome of 44 questionnaires sent out.

Outcome	Number of respondents
Did reply	11
Could not reply due to lack of knowledge	5
Could not reply due to lack of time	1
Could not reply, but provided articles, books and/or websites suitable for this study.	4
Did not reply	22
E-mail bounced back	1

A summary of the respondents' title, university/organisation and if it was an interview or a questionnaire can be seen in Table 4.3. The author promised the respondents anonymity and therefore each person has been provided with a respondent number in order to make it more convenient for the reader.

Table 2.3 Summary of respondents

Title	**University/Organisation**	**Interview/Questionnaire**	**Respondent Number.**
Professor	Waseda University	Interview	1
Professor	Tokyo Institute of Technology	Interview	2
Assistant Professor	Waseda University	Interview	3
PhD	University of Tokyo	Interview	4
Technical Attaché	ITPS/Growth Analysis	Interview	5
Professor	Hokkaido University	Questionnaires	6
Professor	Tohoku University	Questionnaires	7
Professor	Tohoku University	Questionnaires	8
Professor	Tokyo Institute of Technology	Questionnaires	9
Professor	University of Tokyo	Questionnaires	10
Professor	RIKEN	Questionnaires	11
Professor	Shibaura Institute of Technology	Questionnaires	12
Deputy Director	Japan Society for the Promotion of Science	Questionnaires	13
Assistant Professor	CIRCLE	Questionnaires	14
Professor	University of Tokyo	Questionnaires	15
Professor	Tohoku University	Questionnaire	16

Among the sixteen respondents I have twelve respondents that represent universities. Waseda University and Shibaura Institute of Technology are private universities and University of Tokyo, Tokyo Institute of Technology, Hokkaido University and Tohoku University are national universities. Of the twelve respondents I have one with 30 years experience from Mitsubishi and that respondent also represent the industry.

The respondent from JSPS represents the government point of view since JSPS is an independent administrative institution that works under the auspices of MEXT. ITPS/Growth Analysis is a Swedish governmental agency that monitor, analyse and report on important trends in research, innovation and growth in Japan and therefore have knowledge about all actors in the Triple Helix. My respondent's research interest at CIRCLE at Lund University include the role of higher education in innovation systems, multi-level governance of innovation and regionalization of science and innovation and just like the respondent from ITPS/Growth Analysis have knowledge about all three actors. RIKEN is a research institute in science and technology funded mostly by the Japanese government. I consider RIKEN to be a neutral place for the actors involved in the Triple Helix and therefore it can contribute with interesting views about collaboration. Most of the views represent universities but that is also where a big change will occur and it is also the actor that I focus on in my study.

In total I had six areas that were discussed on my interviews and in my questionnaires. In order to be able to summarize and come to a conclusion in the end I must look for general trends among the replies that I received. Since there are no yes-or-no questions or questions where the respondent can grade their opinion, I cannot measure my result in numbers or figures. I have to look for general trends and try to find what is behind these trends. The questions are general questions (see Appendix 1 and 2) since I did not want to lead the respondents into any particular field or direction.

The sample strategy I used was a sample based on the snowball effect. This strategy begins with one or few people and spreads out on the basis of links to the initial cases (Neuman, 1994:199). In Japan I received assistance from my supervisor in Japan to arrange some of the interviews and from there I got connected to more and more people to contact for interviews. The same strategy was used during my selection of strategy when sending out questionnaires. I started with contacting staff at the ICT School at the Royal Institute of Technology (KTH) in Stockholm, Sweden, asking for professors at their partner universities in Japan to contact. I decided to stop when I received eleven replies due to not being able to gather any new information and it was the limit of what I had time to analyse. Snowball sampling is divided into the category of non-probability theory, which are used in special situations or if there is a lack of time or if the researcher uses it out of pure ignorance. I used the strategy due to a special situation such as the difficulty of being able to meet people directly or contact them

directly by e-mail in Japan without being introduced by some one who can vouch for you. I often received a question over the e-mail from the Japanese respondents asking where I got hold of their e-mail address. If I could inform them that I got it from a person they knew then it was fine. The opposite of non-probability sampling is probability sampling and that would be better from a statistical point of view. I could say more precise things about sampling backed up by powerful statistics. Bryman (2004:102) states that it is unlikely that the snowball sample is representative of the population. Further on Bryman says that snowball sampling is better used within qualitative research (not quantitative) and since I am conducting a qualitative study and it is a special situation I found this strategy to be justified and to fit my purpose.

2.3 Ontology and Epistemology

My ontological position will be the constructivist approach where meanings are continually being accomplished by social actors (Bryman, 2004: 17). The Industry-University-State collaboration in Japan is produced by social interaction between various actors and is in a constant state of revision due to a constantly changing world. As a constructivist I do not intend to secure an absolute truth. The opposite ontological position, objectivism, is not suitable due to the belief that external facts are beyond our reach or influence.
People look at the same thing and perceive it differently. This is a summary how I view knowledge, epistemology, in relation to my research. As a final statement I will use an interpretative approach as opposed to positivism.

2.4 Design of the Study - Choice of Theory and Research Strategy

The author will use a deductive approach where I begin with a logical relationship and move toward concrete empirical evidence (Neuman, 1994:41). My hypothesis is the Triple Helix model. The model suggests an outcome and after gathering and analysing data the author will learn if there is support for the hypothesis. This is opposite to the inductive approach where you begin with a few vague concepts building a theory from the ground up.

2.5 Reliability and Validity

Reliability and validity is important in social research because constructs in social theory are often diffuse, not directly observable and often ambiguous. According to Neuman (1994: 127) it is almost impossible to obtain perfect reliability and validity but is an ideal that I strive for

in my study. Each time I am asking my research questions to a respondent I will receive the same result during the period of this study or if another researcher would conduct this study he/she would get the same result. In the future, views from my respondents might change due to government policy changes or economic factors. But for this study I have a reliable indicator or measure.

After having my set of questions exposed to a pilot group consisting of two people I made some adjustments in order to avoid poorly worded questions and to be clearer in my questionnaire and interviews. My measurement validity has been an issue for me from the start and I argue that my questions do measure what it is supposed to measure.

2.6 Analysis and Transcribing Interviews

The purpose of this qualitative study is to understand specific events such as change in collaboration patterns between three actors and what consequences it have on knowledge transfer and therefore the method of successive approximation has been used in this study. The qualitative data has been organised into categories on basis of the objectives of this study. The successive approximation method starts with a research question and some vague concepts (Neuman, 1994:412). After gathering data to see if the concepts fit the data, new concepts are created to fit the data even better. Then new evidence is collected to modify over and over and in the end the evidence become successively more accurate.

2.7 Theoretical, Philosophical and Practical Matters

By using a qualitative approach I am aware of the risk of developing a close affinity to the people being interviewed and therefore my interpretation might be leaning somewhat to their interpretation of the situation. The author himself is a university employee since 2001 and therefore might be biased and values from that environment might be reflected in the outcome of the research. The advantage with this working background is that the author is familiar with the terms, vocabulary and organisational structure. I therefore find it relevant to state my background so the reader will know where I come from regarding work and study background.

The critique, according to Bryman (2004:284) using a qualitative method is the problems of generalizations, difficult to replicate and that it is too subjective. The author is aware that it I

difficult to transfer the results of this study to other settings and that it is difficult to replicate this study due to a changing environment and that it might become too subjective due to the authors background. The aim is to be as objective as possible and obtain a result that can be useful for other researchers in another setting.

I decided to contact 31 academic staff members at Japanese universities and contact 14 other organizations in order to receive enough replies. The reason for contacting a large number of respondents is that the end of March and the beginning of April is one of the busiest periods during the academic year in Japan

To avoid memory problems I used a recorder at the interview if the interviewees. It was no problem to get acceptance for this since I did not ask any personal or intimidating questions. By having interviews both the interviewer and the interviewee have the opportunity to clarify any questions and answers. When sending out my questionnaires I e-mailed several times to the respondents when something was unclear.

2.8 Criticism of Sources

Since many people are looking at the same thing from a different perspective, numerous supportive and contradictory statements can be found in the literature in relation to this topic. It is important to have in mind who and what the respondent and/or author represent and the effect it might have on the reply/statement received. A critical approach has been used throughout this study.

2.9 Ethical Considerations

I have carried out my master thesis in accordance with the ethical guidelines as described by The Swedish Research Council. More detailed information about the guidelines can be found on the following website: http://www.codex.vr.se/en/forskninghumsam.shtml

2.10 Limitations

One limitation of my study is my small sample of interviewees. I found it difficult during my stay in Japan to arrange meetings with people who could assist me regarding my topic. Based on my experience you must either know them yourself or be introduced by some one who can recommend me. During the beginning of my stay in Japan it was first an exam period and

then in the end of my stay it was entrance exams at the universities, which made it extra difficult to arrange meetings.
Another limitation is the reply frequency from my questionnaires. I sent out the questionnaires in the end of March and it is a very busy period of the academic year at Japanese universities due to the school year starts in April. This is the reason I sent out quite many in order to get a base of replies that I could work with. My goal was to receive enough replies until no new data is appearing from my respondents. It must be noted that this study is based on a small sample of universities, industries and state and therefore do not constitute a cross section representation of Japanese industry, ministries and academia.

2.11 Theoretical framework – The Triple Helix, Mode 1 and 2

2.11.1 The Triple Helix Model

The Triple Helix argues that interactive innovation networks need to be established between university, government and industry so that ‘’brain circulation’’ between actors flourish, academic research can be linked up with business practices, an entrepreneurial culture can be created as a result of knowledge sharing and finally, new policies might emerge from the networks (Lu and Etzkowitz, 2008:7). The Triple Helix is a model where the actors collaborate but still maintains its independent identity (Lu and Etzkowitz, 2008:8).

The Triple Helix model builds upon cooperation between the government, industry and university. Within a regional innovation system interplay builds on an active participation with regional actors in order to develop a common vision and coordinate resources to increase the ability to innovate and receive a financial return on what has been invested in various projects (http://www.tillvaxtverket.se/). The model suggests that boundaries are increasingly fading, giving rise to interactions that did not exist before by integrating goals and interests (Ughetto, 2007:15) and strengthening a region. According to Lu and Etzkowitz (2008:7) the Triple Helix provides an analytical framework for evaluating interactions within an innovation process at a national, regional, institutional and individual level.
This is the big picture of the Triple Helix model. In this study the intention is to look at the Triple Helix in terms of how do the actors experience the increase in collaboration with other actors at a national level and what are the consequences if we study the pace and amount of knowledge transfer. This study will also see if the increased collaboration in Japan between

the three actors lead to an increase in new organisations, patents and start-up companies as suggested by the Triple Helix model.

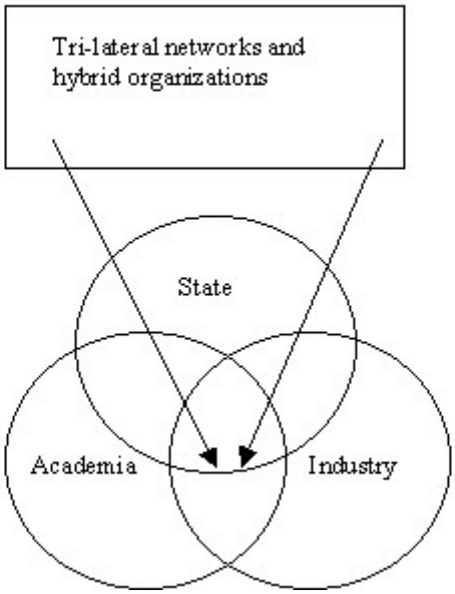


Figure 2.1 the Triple Helix Model of University-Industry-Government Relations

According to Etzkowitz and Leydesdorff (in Graham and Dickinson, 2007:2372) The Triple Helix identifies three patterns regarding state-university-industry relations, firstly the state encompasses the industry and academia directly controlling their relationship. Secondly, the university, industry and government are separate institutions with clear borders and hardly any interaction. Thirdly we have the pattern where the state, industry and academia interact with no clear boundaries. Relevant for this study it is the third pattern.

In my opinion the advantage identified with the third pattern is that with blurred boundaries it is easier to get access to people, information and as a consequence it might be easier to reach a consensus regarding goals, strategies and ideas. If different actors have the same goals then it is more likely to arrange common facilities and this together with a more effective relocation of staff you will receive cost saving effects compared to every actor having their own facility and staff working on the same topic.

At the same time I can see some negative aspects in terms of defining successful evaluation. What is evaluated and what is considered to be a success and/or failure of collaboration. For the academia it might be the amount of publications that is considered to be a success, but for the industry it might be the rise in profit and for the government it might be the cost saving effect on the government budget. To conduct an evaluation that is useful for all actors

involved might be difficult. To reach a common goal concerning a good evaluation will be a problem and if you evaluate every aspect that is useful for every one it will be time consuming and expensive. I find it crucial from the start to agree on a suitable evaluation in order to avoid cooperation problems down the road. This study will show if collaboration has become easier or if there is problem in reaching a consensus in various matters such evaluation, common goals and interests.

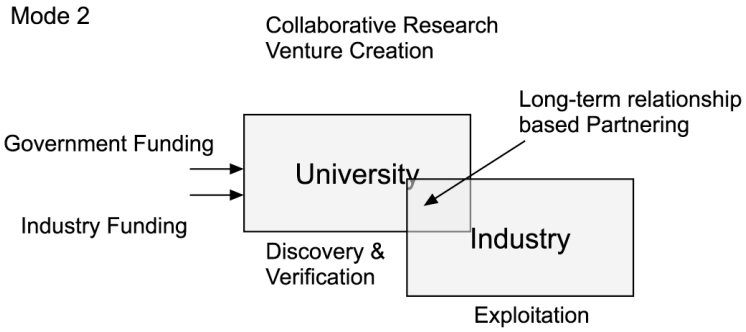
The third pattern of the Triple Helix model, which is the focus in this study, in itself can be seen in three dimensions. The first dimension is the internal transformation of the three different actors. The second dimension is how the different actors influence each other and thirdly is the creation of organizations and networks based on interactions between the actors (Etzkowitz, 2002:2). My aim here is to see what kind of internal transformation that might occur (if any), how the actors influence each other (if they do) and if new organisations are created in relation to collaboration between the university, industry and state.

2.11.2 Mode 1 and 2

When discussing the Triple Helix model I find it necessary to mention two modes of knowledge production, Mode 1 and Mode 2. It is a way of describing how the university position itself to the surrounding environment.

Mode 1 is described as a cleavage between academia and society. Academia is the lord of its manor where it revolves around an autonomous self-sustained and self-defined university defining what constitutes science and truth. Mode 2 science on the other hand is characterized by interdisciplinary short-term task-force teams brought together to work on problems (see also Figure 2.2) from the real world (Shinn, 2002:600). Mode 2 also generates faster feedback loops (see Figure 2.2) relating to output of the universities discoveries (Dooley and Kirk, 2007:320-321). Mode 1 and Mode 2 is relevant when looking at the history of collaboration patterns at Japanese universities. How they have changed from Mode 2 to Mode 1 after the Second World War and now during the last decade are moving back to Mode 2. More about the changes in Mode 1 and 2 will be discussed in Part II.

Figure 2.2 Mode 2



Consequence: Faster feedback and more effective discovery process

2.12 Perspectives to Explain Japan's Economic Success

I want to show that in Japan there is a tradition of collaboration between different actors in society. According to Mito (1992:2) there are five major perspectives attempting to explain Japan's economic success. The perspectives are the Culture-Centred school, the Exploitation School, the Market-Centred School, the State-Centred School and the Japan Inc. School.
By looking at the Japan Inc. School we can see that the belief is that Japan's economic growth is a result from government policy, joint actions with industry, the ruling Liberal Democratic Party (LDP) and the bureaucracy. This collaboration is sometimes called the legs of the tripod on which the Japanese political system rests (Mito, 1992:10). The State-Centred and the Market-Centred School think it is either the State or the Market that are responsible for the economic success. The other two, The Culture-Centred argues that the economic success is because of Japanese cultural traits and the Exploitation School argue that ''Japan's backwardness'' supported by American domination is the reason for its success. I find it problematic to grant only one actor (the state and the market), cultural traits and the exploitation argument to explain the whole picture regarding the success of Japan's economic growth, but it does not mean the explanations are not important factors, on the contrary I find them all to be part of the explanation. I find the Japan Inc. School to be closest to the truth. The point I want to make, in relation to my research purpose, is to show that if Japan Inc. School best explains the economic success then we can see that there is a history in Japan with deep collaboration between different actors. If we look more closely to the collaboration between state, industry and LDP there are many good examples but also examples of conflicts between the actors and not a harmonious, consensual image like many Japan Inc. supporters believe. Both positive and negative views will also be expressed in the case of the Triple

Helix between the three actors in this study. I find going from the tripod of actors in the Japanese political system to the Triple Helix of state, industry and university is quite a small step. If we assume that Japan Inc. is the best explanation for the economic success then many years of experience of collaboration is not uncommon for many people/organisations and that will, in my opinion, make collaboration a minor transition between the state, industry and university and therefore easier for the actors to accept.

2.13 Disposition

In Part II a short introduction and a historical overview of the three actors involved in the Triple Helix will be briefly discussed. First, after the introduction I will start with discussing the Government and in particular the promotion of the first and second wave of industry and university collaboration in order to show that what is happening today is not a new phenomena. Instead it is a continuation of a long on-going process. It is vital to understand how collaboration patterns have developed in order to understand the reasons why the situation looks like it does today. This argument was emphasized by my supervisor in Japan and by many of the people I interviewed and e-mailed. This is the reason why there are references to older books that brings up historical aspects that is necessary to know in order to understand what is happening today in Japan.
Then I will briefly discuss how the Japanese state implements its policies followed by a short description of two ministries most important for this study, MEXT and METI. Before 2001 METI was called MITI (Ministry of International Trade and Industry) so therefore I will use MITI regarding issues that happened before 2001 and METI after 2001.

Secondly, I will continue with the industry and briefly highlight its role during Japan's recovery from the Second World War and then from there I will continue to briefly mention a short historical summary of the ICT sector. In my study it is very important to know how they the different actors view each other from a historical perspective. Prejudice based on historical opinions is still a factor to consider regarding collaboration between the actors. Then finally I will go on to discuss the industry's collaboration patterns since the 1970s up to 2009.

The third actor in the Triple Helix, the university, will then be discussed by starting off with a historical overview followed by looking at the universities' collaboration partners since the

1870s. In order to understand what the respondents talk about during interviews and in my questionnaires it vital to be familiar with some definitions such as the mission of a university, recent reforms, the difference between basic and applied research, the US Bayh Dole Act and the Japanese version of the Bayh Dole Act. So these definitions will be a rather descriptive part of my work but is necessary to have the information in order to be able to follow the rest of my work. Since I will be looking at knowledge transfer, patents, start-up companies. I will then continue with looking at how the Japanese universities deal with knowledge transfer today and what role the TLOs have for knowledge transfer and start-up companies.

In Part III I will start with a short introduction followed by a discussion and analysis of how the actors perceive collaboration, conflicts of interest and emerging forms of collaboration. Finally, I will in the conclusion answer if the increased collaboration according to the Triple Helix model will change the pace and amount of knowledge transfer. Compare previous forms of collaboration with new forms of collaboration. I will also show if there are any conflicts of interest and show if there are any new forms of collaboration that will most likely occur in the next decade. Statistics to support the above is to measure the amount of start-up companies, new organisations and patents.

3. Part II – Government, Industry and University

3.1 Introduction

Universities need to maintain and develop its competitive edge by creating local, national and international strategies of collaboration. Government from many industrialized countries have encouraged and launched several initiatives to link industrial innovation with university research. Despite these initiatives there are still many gaps that need to be filled concerning university-industry linkages (Kitagawa, 2009:8). Collaboration with external actors is of great importance for the universities in order to compete on a global market. It is interesting to speculate what stands behind the above claim. My own opinion is that governments are not willing to spend so much money on the universities since they have so many other areas that need financial attention. Universities now have to be more active in arranging financial support from non-state actors and not depending only on the state. Etzkowitz et al. (2000:314) argues that the university is a resource to enhance innovation environments and create a regime of science based economic development. This partly supports my opinion regarding

seeing the university as an actor being able to generate money. Instead the universities should be more active and responsible for its work. Not all actors find this to be a proper development for universities. For example some members of the industry might see the universities as potential competitors and therefore would like the university to stick to research and teaching. According to my interviews/questionnaires, some university staff is not so thrilled about this development. They still see the teaching and research, by far, as the most important tasks.

From the Second World War until the mid-1990s, industry-university links in Japan has been on an informal basis where research commercialisation and income from industry through knowledge transfer activities had remained peripheral to academia (Kitagawa, 2009:11, Hane in Branscomb et al. 1999:53). Consulting and working for venture firms were strictly restricted for academia. To summarize, the industry-university relationship was informal, non-contracting and invisible for an outside actor until the mid-1990s.

3.2 Government

3.2.1 Introduction

Governments in almost every corner of the world are focusing on the university's potential to enhance economic progress, innovation environments and create a regime of science-based economic development (Etzkowitz et al. 2000:314, Etzkowitz and Leydesdorff, 2000:112, Etzkowitz, 2002:1, Kodama and Branscomb in Branscomb et al. 1999:16). The objective is to create an innovative environment consisting of university spin-offs, strategic alliances among companies, tri-lateral initiatives for knowledge-based economic development, government laboratories and academic research groups.

Prime Minister Taro Aso

3.2.2 First Wave of Promoting Industry-University Collaboration

In the late 1970s a public debate regarding the need to develop frontier technology surfaced and in the 1980s the Japanese government went through its first wave of promotion of industry-university collaboration (Hatakenanka, 2004:41, Rahm et al, 2000:137). In 1983 the Ministry of Education and Culture established joint research programs between universities and industry. An interesting point is that it only targeted the around 100 national universities

and totally ignored the around 400 private universities which enrolled 80% of all students (Hatakenaka, 2004:43, Rahm et al, 2000:122). In a way it is logic since most of the national universities have a high level of research capacity but on the other hand it neglected the potential of some strong private universities. Unfortunately, in the 1980s, most of the programs set up by the government and other factors favouring university-industry collaboration, such as budget constraints for universities and a worsening of Japan-US relations, the outcome was that the industry formed ties with foreign universities instead and the national universities did not take any action at all. According to Hatakenaka (2004:46-47) the legacy from the Second World War and the student unrest of 1960s still saw collaboration between industry, government and university as evil.

3.2.3 Second Wave of Industry-University Collaboration

The second wave of promotion of industry-university collaboration happened in 1995 when the Japanese Diet enacted the Science and Technology Basic Law where collaboration between industry and university is a major objective. One of the 18 articles in the Basic Law is the establishment of a Basic Plan on Science and Technology. In 1996, a 5-year Basic Plan on Science and Technology was adopted by the Diet in order to further improve collaboration between industry, universities and research institutes by extending tax deductions for joint research, expanding facilities for joint research and permitting professors to benefit from joint research patents (Rahm et al, 2000:137-140). A summary of policy chronology can be found in Table 3.1.

Table 3.1: Policy Chronology

YEAR	EVENT	CONTENT
1995	Basic Science Law	Huge government funding commitment for basic science and technology starting 1996
1996	The 1st Basic Science and Technology Basic Plan	Reinforcement of collaboration between government, university, industry
1997	Deregulation of external employment of university professors	Enabled civil servant professors to do technical consulting, and to take a leave to work for private R&D initiatives without affecting their retirement benefits
1997	Greater flexibility in the Joint Research Program requirements	Greater flexibility in the Joint Research Program requirements
1997	Legal change to permit fixed-term appointments and leaves by Monbusho	Legal change to permit fixed-term appointments and leaves by Monbusho
1997	Regional consortium for R&D Program by MITI	Regional consortium for R&D Program by MITI
1998	Act on the Promotion of Technology Transfer from Universities to Private Business Operators	Many TLOs were set up under this Act in order to transfer R&D from university to industry.
1998	De-regulation on externally supported research	Consolidation of line item budgets for externally funded contracts and introduction of multi-year contracts
1998	Law for technology transfer from universities to private entities	So-called Japanese Bayh-Dole Law, but enacted to enable special subsidies for TLOs endorsed jointly by MITI and Monbusho
1999	Industrial Revitalization Law	The Japanese version of the Bayh Dole Act

1999	Creation of the National Institution for Academic Degrees and University Evaluation (NIAD-UE)	Contribute to further development of higher education in Japan by conducting evaluations.
2000	Industrial Technology Strengthening Law	To simplify procedural requirements for external funding in national universities; legalize TLO use of national facilities, academic discount on patent expenses
2000	Industrial Technology Enhancement Act	Deregulate professors' responsibility for full time engagement at universities. Enabled civil servant professors to work as board directors in TLO, other corporate boards in companies where their inventions are being commercialised, and as an external auditor. Increase in the university share of contracted research or patent income.
2001	2nd Science and Technology Basic Plan	Many programs started by MEXT and METI
2001	'Toyama Plan'	Introduction of reform plan for universities. Select top 30 universities for special treatment which evolve in COE 21.
2002	Centre of Excellence Scheme (COE 21)	Cultivate a competitive academic environment among Japanese universities by giving targeted support to the creation of world-standard research and education bases (centres of excellence
2004	Act on National University Corporation	All national universities were privatised.
2007	Global COE programme	MEXT lead and provide funding for establishing education and research centres that perform at the apex of global excellence to strengthen international competitiveness of Japanese universities.

Source: various selected government documents (Hatakenaka, 2004:42), Kitagawa in Palfreyman and Tapper (2008:7), NIAD website, JSPS website, JSPS Stockholm Office (2009: interview by author).

3.2.4 Japan – the Network State

How does the government implement its policies? It is clear that the government and its ministries cannot implement policy changes on its own. In relation to the economic success of Japan in the past it is not only because of the work by government staff and its bureaucracy and industrial policies implemented by MITI. Without the industry's willingness to collaborate, the Japanese state would not be as effective and powerful. Instead of calling the Japanese a 'strong' state a better description is a 'network', 'relational' or a 'societal' state (Okimoto, 1989:145).

3.2.5 Ministry of Economy, Trade and Industry (METI)

METI (former MITI) was re-organized in 2001, and relevant to this study, METI is responsible for industrial policies. In 2002 METI took policy measures to encourage start-ups and revitalize the growth of ICT by taking away the minimum capital requirement to start a company. Now a company can be established with a one yen of paid-in capital compared to the ten million yen requirement that existed earlier (Nezu, 2007:237).

3.2.6 Ministry of Education, Culture, Sports, Science and Technology (MEXT)

MEXT was established in 2001 as a merger of Ministry of Education, Sports and Science and the Science and Technology Agency. Two of MEXTs goals, relevant to this study, is to promote basic research and:

''Promotion of cooperation between the private sector, university and government agencies is essential to invigorate the Japanese economy and society with the creation of new technologies and new industries, and to revitalize university education and research''
(MEXT: http://www.mext.go.jp/list_001/list_016/__icsFiles/afieldfile/2009/03/19/mext_2007_e.pdf)

To mention the most important promotion strategies in relation to my topic, MEXT supports the expenses of obtaining patents for the results of research originating from universities. MEXT also support universities' set-up of intellectual property departments and intellectual property strategies and promoting policies to support joint research with companies and ventures. It also train and assign specialists who can manage intellectual property and technologies as well as being a coordinating link between private sector, government agencies and university.

3.3 Industry

3.3.1 Historical Overview

Japanese Industry in the post-war period ignored collaboration with universities and instead dealt directly with foreign actors in order to buy patents and consulting services (Hatakenaka, 2004:37). During the catch-up period from the Second World War the industry, not the universities, played an important role in closing in on technology gaps between Japan and the US and Western European countries (Wen & Kobayashi, 2000:88). Around 1990 economic growth stopped after decades of growth. Japan finally managed to catch up with United States and the prospect of borrowing ideas and technologies from other countries has become exhausted. Now Japan has to develop its own technologies as a front runner country (Nezu, 2007: 229).

3.3.2 The Information and Communication Technology Sector

In the early 1960s the emphasis of governmental industrial policies was not focusing on the computer industry since it was not yet considered a key area of concern and the industry was still at an immature stage of development (Shinjo in Komiya, Okuno and Suzumuka, 1988:343). The MITI promotion of the computer industry in Japan was to protect its domestic market from foreign domination. A distinctive feature of Japanese policies was the use of joint private and government R&D projects (Shinjo in Komiya, Okuno and Suzumuka,

1998:358). According to Fransman (1995:198), without government support then the Japanese computer industry would not have survived. The universities did not play an important role at this stage. The reason for this will be explained in the next section.

3.3.3 How Industry View Universities

In general, the industry sees universities as a source of employees and not as a source of scientific and technical knowledge or as potential collaborator (Rahm et al, 2000:124, Low in Etzkowitz and Leydesdorff, 1997:135). It is worthwhile to mention that it is important from what university a company find employees. The most prestigious university in Japan, University of Tokyo, are an attractive place to recruit staff due to classmates graduating receive jobs in and out of government and they stay in touch in their working life and this is one type of collaboration that exists between government and industry. Industry wants graduates from University of Tokyo in order to receive good contacts with the government (Johnson, 1982:60). The industry wants Bachelor or Master students, not PhD students. PhDs are considered to be too theoretical compared to the practical Bachelor students who can be trained by the company internally (Rahm et al, 2000:126). The company uses the university as a filtering device, knowing that if a student managed to enter a prestigious university through very competitive entrance exams it must be a bright and talented student. It is not that important what the student study at the university, since the company train the employees themselves (Feigenbaum and McCorduck in Okimoto and Rohlen, 1988:245, Sugimoto, 2003:124).

Most research has traditionally been done within large companies, *keiretsu* (Kitagawa, 2009:6, Karlsson, 2009:20, Kneller, 2003:3). Approximately 80% of R&D in Japan is conducted by the industry themselves in Japan or abroad or in collaboration with foreign universities. This does not mean that there is no collaboration at all between universities and industry. According to Hicks (1993) in Rahm et al (2000:125) there is not much formal R&D collaboration but a lot of informal relationships between industry and university. The author had the opportunity to communicate with Prof Kneller through ITPS/Growth Analysis and Prof Kneller confirmed that there has always been joint collaboration between industry and university. More specifically companies provide equipment and/or financial support and in return the companies receive information about the latest development in research and recommendations of students who might become future employees at the company (Karlsson, 2009:22). It is a way of advertising the university's students. Further on, researchers quite

often hand over joint project discoveries to a company and let them be the one who administrate and benefit from a patent. Some royalties are paid to the researcher as compensation.

3.3.4 The Industry's Collaboration Partners

Japanese firms are expanding their relationships with universities and at the same time firms are requesting more funding from the government in fundamental research (Branscomb and Kodama, 1993:2). Firms collaborate with universities in order to get access to students and professors equipped with the latest state-of-the-art knowledge. Further reasons might be the prestige of cooperating with a highly ranked university and of course the cost sharing aspect is also a motivating factor for cooperation.

Japanese industry have been more selective in their partnerships in the face of hard times, more differentiated in their practices and more open regarding practices and norms (Vogel, 2006:220). When company budgets have been smaller then universities are now seen as a possible solution for collaboration (Rahm et al, 2000:118). Many structural barriers, not all related to economy still remains. The industry's relation to government is often believed in the West to be a highly effective and cooperative partnership, but according to Callon (1995:55) the relationship is marked with disputes and conflicts over appropriate goals, funding and organization, especially during the 1970s and 1980s which is the focus of Callons work. Companies attitude towards MITI are often described as 'hostile cooperation' or 'grudging cooperation'. There are many examples of the industry not sending the best researchers to joint projects, obstructing inter-company collaboration in government-industry joint projects such as VLSI (Very Large-Scale Integration) integrated-circuit technologies project between 1975-1979. High-tech consortia are according Callon (1995:183) a public show where these cooperative institutions are a mask hiding the fierce bureaucratic and corporate competition. It does not mean that there is no collaboration at all, but it is not as great as one might believe.

Tsukuba Science City

An opposing view, compared to Callon, is argued by Low (In Etzkowitz and Leydesdorff, 1997:140). Low argues that the key to Japan's success are the institutions such as Tsukuba

Research Consortium where ‘controlled competition’ is facilitated with a more flexible nature. At Tsukuba Science City there are more than 300 national and private research institutions employing almost 12,000 researchers centred around the University of Tsukuba.

.

3.4 University

3.4.1 Historical Overview

Nine imperial universities were founded between 1877 and 1939, one in Korea, one in Taiwan, University of Tokyo (1877), Kyoto (1897), Kyushu (1911), Hokkaido (1918), Tohoku (1907), Osaka (1931) and Nagoya (1939). A number of prestigious polytechnics were also created such as Tokyo Institute of Technology (1929) receiving national university status (Kitagawa in Palfreyman and Tapper, 2008). In the Japanese higher education system there is a coexistence of three higher education systems, national, private and local public. National universities are funded by the national government, the public by regional or municipal governments (Rahm et al, 2000:120) and private universities by private actors and tuition fees.

National universities, due to recent reforms, became corporate organisations and cannot rely on government protection anymore. Nowadays they have to manage their finances and be entrepreneurial in order to guarantee external funding (Kitagawa in Palfreyman and Tapper, 2008). At the moment according to Kitagawa citing MEXT 2008 (2009:4) there are 86 national universities, 589 private universities and 90 local public universities with the right to award degrees.

A happy student who passed the entrance exam to a highly ranked Japanese university.

3.4.2 The Universities’ Collaboration Partners

Universities want to collaborate with industry in order to challenge students to practical real-life problems. Other important factors are access to scientific and technical information, funding and employment for graduates (Rahm et.al, 2000:8). Collaboration is nothing new, from historical point of view, for Japanese universities. Industry and government cooperation was not uncommon in the 1870s when Japan saw a need for catching up with Western science in fear of facing economic colonization, as China did. The tradition of Mode 2 collaboration

continued up to the end of Second World War. After Japan's defeat in the war the academia in Japan faced the fact with a profound loss of face (Hatakenaka, 2004:36). The consequence was that after 1945 the universities dissociated themselves from industry and government influence. The post-war university reform created an independent and autonomous organization, a so-called Mode 1 attitude on collaboration with other actors.
During the post-war era the universities mainly focused on producing and training graduates for employment in government or industry. Instead the formal industry-university ties changed from formal to an informal mode (Etzkowitz et al. 2000:324-325, Kneller, 2007:436). Through the informal contacts between professor and industry sometimes an interesting topic would be pursued parallel in a company lab. In these informal relationships the professor turned over the intellectual property to the company to patent and as a thank you the professor received a small amount of research support. In the 1960s there were some attempts of industry collaboration but it was crushed during student unrest in the late 1960s. It was not until the 1980s the stigma attached to industry-university collaboration disappeared (Hatakenaka, 2004:37, Hashimoto in Branscomb et al. 1999:250). In the 1980s R&D activities was still mainly concentrated in companies with few ties to the universities. Now some academia encouraged by the government, are trying to go back to a modified pre-war system with academic-industry relations.

3.4.3 Three Missions of a university

The traditional first mission of a university is teaching. The second mission is research, which has been named the 'first academic revolution'. According to Etzkowitz in 1998 (in Gullbrandsen and Slipsaeter in Bonaccorsi and Daraio, 2007:113) when the first revolution took place in the 19th century it was met with great resistance that it might influence teaching negatively. Today we do not see these missions as any problem in relation to each other.
In recent years governments have been demanding social contribution by universities, the third mission of a university or the ''second academic revolution''.

The most important social contribution, according Professor Toshimitsu at the International Patent Licensing Seminar (IPLS) in 2008, for a university to society is to have collaborative research linkages to industry, contributing to innovation and social change and becoming an entrepreneurial university (2008, IPLS, D2:242). The role of the university is gradually changing. Universities task have been expanded to include knowledge transfer, together with traditional tasks such as education and research, while collaborating with industry,

government and society. The university now have to be visible and accessible to the needs of the society, no longer any exclusive knowledge habitats. For example, in Hokkaido University Industry-Academia-Government Collaboration Policy (approved January 11, 2005), the first out of seven goals state that:

> '' *Hokkaido University is committed to performing creative research activities, which range from basic research based on long-range perspectives to applied research that meets the needs of society, in accordance with HU's guiding principles and long-term objectives. HU is additionally committed to returning the results of such research to society* (http://www.mcip.hokudai.ac.jp/eng/3100policies/collaboration_policy.html)

It shows that universities in Japan consider the three missions, education, research and social contribution through collaboration with other actors, important.

3.4.4 Reforms and challenges in university-industry collaboration

One of the main reforms in recent years was to change the university's status to a 'corporate' entity in order to provide greater independence so the university can become more entrepreneurial and responsive to societal needs. According to an OECD (Organisation for Economic Co-operation and Development) report in 2007 the emphasis for traditional higher education institutions (HEI) has been to serve national goals or on the pursuit of knowledge with few considerations to the surrounding environment (2007:11). This is now about to change. Through the National University Incorporation Law in 2004 the university was granted more independence from the government (Kitagawa, 2009:7, Karlsson, 2009:18). This will also force the universities to collect funding from other sources in a more competitive environment than before.

New frameworks to promote industry-university technology transfer were enacted from 1998, and as of 2007, 44 Technology Licensing Organizations (TLO) has been established in order to support and assist academia to obtain patents and license inventions to industry. The share of university patents in Japan in 1994 was only 0.04% (Fujisue, 1998:375) and that is something the government want to increase. Also since 2003, 43 universities have received financial support from the government to set up Intellectual Property (IP) Headquarters so the universities can develop their own licensing culture. Pelikan (1992) argues (in Etzkowitz et al. 2000:314) that many academics in general see the entrepreneurial paradigm as a threat to the

university's traditional integrity. For the public good the university should stick to production of graduates and publication of research. On top of this some companies see spin-off companies as a threat and therefore argue that university should confine to consultation with industry.

According to Leydesdorff (2003), Tijssen (2006) and Narin et al. (1997) in Leydesdorff and Sun (2009:2) co-authored publications have been used as indicators of the Triple Helix model, entrepreneurial science and generally for the study of science-technology relations.
In Japan, the percentage of articles with only domestic universities declined from 69.4% in 1991 to 45.3% in 2004 (Leydesdorff and Sun, 2009:6). The reason for this according to Leydesdorff and Sun is that academia is much more involved in collaborations.

A challenge regarding university-industry collaboration is in-breeding which is the straightest course to scientific groupthink. Big research universities are usually organized into ''Koza groups'', usually one professor, one associate professor, two research assistants and graduate students, where promotion are based on seniority which undercuts scientists to contribute early in their career (Rahm et al, 2000:128). Another challenge is the interplay between educational ideals and market forces that will be a big challenge for the universities to overcome. How will the university find a balance between the three missions in order to prosper academically and economically?

In order to understand what the respondents in this study talk about, some definitions will be explained, such as the difference between applied and basic research, an explanation of the US Bayh-Dole Act and the Japanese version of the Act, Technological Licensing Organizations (TLO) and start-up companies.

3.4.5 Basic and Applied Research

I define applied and basic research the same way as the Lawrence Berkeley National Laboratory, which is a member of the national laboratory system supported by the US Department of Energy and a member of University of California (http://www.lbl.gov/).
In short, basic research is driven by the curiosity of the researcher. The main motivation is not to invent something that leads to commercialisation. Applied research is the opposite. It is suppose to solve practical problems and improve human conditions in the real world.

3.4.6 The US Bayh-Dole Act of 1980 and the Japanese version between 1998-2004

In United States the Bayh-Dole Act of 1980 was promoted by the OECD as a recipe to enhance commercialisation of university research (Leydesdorff and Meyer, 2009:1). The Act is considered as a landmark where federally funded researchers can file for patents and issue licenses for these patents. The Bayh-Dole Act was copied by other governments all around the world, but recently university patenting has been on the decline in the US both in absolute terms as well as percentage. Leydesdorff and Meyer (2009:9) suggest that the decline is due to the new regime of university ranking where patents and spin-offs are not considered in university ranking. Comparing Oxford and Cambridge University, National University of Singapore and University of Tokyo all but University of Tokyo are experiencing a decrease in patenting. So the decline is not an exclusively American case. How come there is a rise in patents at University of Tokyo and at Japanese universities in general. Karlsson (2009:23) argues that the historical informal collaborations are now seen in a visible formal context due to a change from a donation system to a formal system of joint research. By looking at the US, UK and Singapore situation I predict that Japan will also come to standstill or a decrease in the next one or two decades due to the fact that Japan recently implemented the Japanese Bayh-Dole Act. Kneller (2007:437) also concludes that the growth of joint research between industry and university is not so much an achievement from the new system it is more a continuation of the old system that allows direct transfer of inventions from a researcher to a company where conditions are worked out between the actors. As a consequence the old system limits inventions that TLOs can manage and limits opportunities for start-up companies.

Before 2004 inventions originating from national universities funded by government research grants and contractual sponsored research were owned by the nation (Kneller, 2008:1). In effect it meant that inventions were free for anyone to use or would be licensed nonexclusively for a small amount of money. A way for inventors, before 2004, to retain ownership is if the invention originates from a corporate donation. In addition, before 1998 faculty members in national universities were not allowed to receive compensation for consulting for outside organisations.

The Japanese version of the Bayh-Dole Act System was implemented between 1998 and 2004 with the following four laws. In 1998 the Law to Promote the Transfer of University Technologies (The TLO Law), the 1999 Law of Special Measures to Revive Industry (the

Japanese Bayh-Dole Act), the 2000 Law to Strengthen Industrial Technology that made it possible for researchers to found companies and finally, the University Incorporation Law that gave national universities independent legal status went into effect in 2004 (Kneller, 2008:2-3, Kneller, 2007:440). To summarize, Japan moved from a mixed system of either individual inventor or government ownership to a system where universities can claim ownership of all inventions by their staff. Prior to the change of system the form of technology transfer was cheap and fast. The negative aspect was that companies received the inventions for free and some inventions where left 'sleeping' without any further development by the company. What can be seen in Japan is that by changing its legal framework it does not mean the system will change in itself. It is a continuation of the system that existed before the reforms (Kneller, 2007:212).

3.4.7 Technological Licensing Organization

Most Japanese national universities have TLOs that has been approved by the government in accordance with the TLO Law. A lot of TLOs, which is the organisation to transfer research and technology from university into companies for technology licensing, were set up since TLOs could be subsidized by the state under the 1998, Act on the Promotion of Technology Transfer from Universities to Private Business Operators (respondent nr.13). The main problem with TLO offices is that many offices lack qualified personnel and funds for patent prosecution (Kneller, 2007:212).

I had the opportunity myself to ask some questions, through my contact at ITPS/Growth Analysis, to Prof Kneller at University of Tokyo regarding TLOs. I asked about escape mechanisms in the system due to slow and bureaucratic TLOs (and Intellectual Propety Centres) and joint collaboration is the most common escape mechanism in order to get around the TLOs. Around 75% is joint collaboration according to Prof Kneller. In addition the TLOs are rather small and cannot manage so much work. On the positive side the TLOs are useful if the inventor wants to spread its invention to many different companies and from there receive royalties.

In order to overcome some of the problems MEXT established IP offices inside the universities. Some difficulties have arisen due to the fact that there is some overlapping of responsibilities. Relations between the TLO and the IP office have been managed smoothly in some cases but in some cases there have been frictions (Kneller, 2007:212). At universities

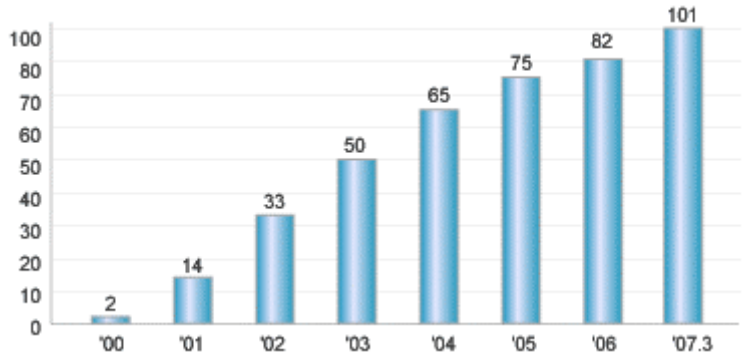
where TLOs are weak and researchers are strong it is crucial to have joint research with large companies in order for technology transfer to prosper. The risk with inventions going directly to companies might take away the entrepreneurial spirit from researchers and TLOs. The President of Tokyo University of Agriculture and Technology, Mr. Shin Ito, says it is regrettable that after ten years since implementation of the TLO Law and five years after the IP headquarters began to operate the result is still meagre (IPLS, D2:2008).
It might take a while before these systems of informal networks and informal technology transfer change. Today it is still common for a researcher with an assigned patent to not receive any financial, legal or administrative support for processing. Patents are often turned over to industry in return for research equipment and material instead of formal collaboration with industry (Hane in Branscomb et al. 1999:35). Companies sometimes want to keep status quo in order to acquire ownership of inventions for a low cost and the academia's reason is that it wants to keep stable research funding from industry (Yoshihara and Tamai in Branscomb et al. 1999:356).

3.4.8 Start-Up Companies

There are no start-up companies in Japan originating from national university professors before 2000 (Kneller, 2007:439). Japan is a country where discovery and refinement of new products and process occurs mainly in large established companies. One problem is related with weak TLOs and weak institutional structures that favour direct transfer from university researchers to industry compared to promotion of start-up companies based on new discoveries. In sum, according to Kneller (2007:214) big companies drain a big amount of university discoveries. The companies are doing so by signing joint research agreements with universities in order to collaborate on R&D. Nakayama et al. (2005) and MEXT (2005) in Kneller (2007:215) clearly show the trend in Japan where it can be seen that there has been a dramatic increase in joint research between large private companies (large companies is defined as companies with more than 300 employees) and national universities from around 2,000 joint research projects in 1998 when the reforms started to approximately 8,000 projects in 2004. Since large companies absorb most inventions there are not many niches left for new companies to exploit and according to Kneller (2007:217) this is also a reason for why start-up companies in the high technology sector is so weak. Presently, it is better that the inventions go to the large companies than not being developed at all.
I asked Prof Kneller at the University of Tokyo about start-up companies and one of my questions was why entrepreneurship is so weak at Japanese universities and the reason is that

joint collaboration is the natural form of collaboration for the researchers and innovations from university-industry cooperation go directly to the industry. The huge foot-print of joint research is one reason for non-entrepreneurship. It is also difficult to receive 'later-stage' funding which makes it difficult to hire researchers and managers. This makes many people hesitant to start their own business. Despite weak entrepreneurship as stated by Prof Kneller, Kitagawa conclude (2009:13-14) that there has been an increase in start-up companies based on university research. As of March 2008 the cumulative number of spin-off companies originating from universities are 1,773 (compared to around 100 in 1997) mostly financed by public sources. Supporting Kitagawa, we can see in Figure 3.1 the growth for venture companies originating from Waseda University as a proof of some increase in start-up companies.

Figure 3.1 Number of companies established per year originating from Waseda University. As of March, 2007, a total of 101 companies have been established.



Source: Waseda University: http://tlo.wul.waseda.ac.jp/ENG/data_e.html

Despite this, most inventions and ideas go to industry through informal networks not generating any new companies. The issue of growth and sustainability among the 1,773 companies that has been generated is something that would be an interesting topic to follow up in order to see if the ideas generated are the good ones or the mediocre ones.

4. Part III – Interviews and Questionnaires

4.1 Introduction

The result of my interviews and questionnaires will be divided into three sections, firstly, how university, industry and state experience collaboration. Secondly, conflicts of interest and the third and final section are about emerging forms of collaboration.

4.2 How university, industry and state experience collaboration

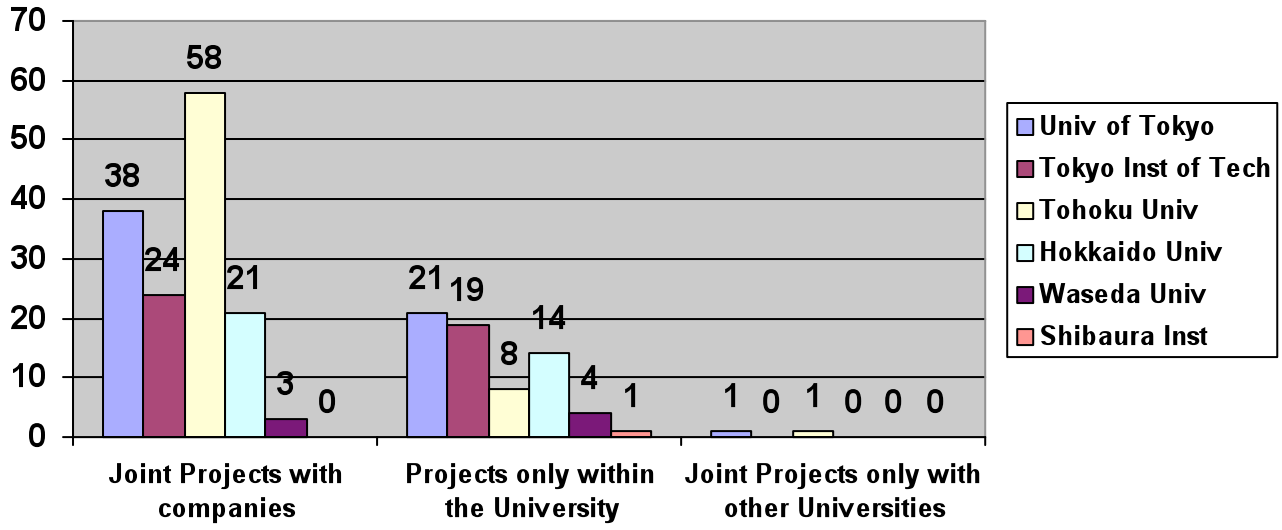
According to a vast amount of literature, such as Callon (1995), you will find many examples of formal collaboration that did not work well and of challenges that lie ahead regarding market forces versus educational ideals. On the other hand there are many good examples of cooperation such as the examples given by panellists at the IPLS (2008, A1 and A2); Fukuoka Soft Research Park, Kitakyushu Academic Research City and as I brought up by referring to Low (in Etzkowitz and Leydesdorff, 1997) in Part II, Tsukuba Science City.

As expressed by respondent nr.1 it is important to know the history of industry-university collaboration. For example if the government want to draft a text for a new law they will request a committee based on members from university and industry. In this way the actors reach a consensus before the law is passed. It makes every one go in the same direction according to respondent nr.5 and therefore is a good example of university, industry and government cooperation.

One of the big challenges, profit vs. publishing papers, was discussed at the IPLS (2008, DS:242) and the concern how to overcome the different perspectives in ‘a good result’. The universities focus on publishing good papers and research outcomes and the industry focus on increased profit. The universities might not want to cooperate with industry under such circumstances. Industry must provide some sort of incentive for the university and one incentive that is brought up at the IPLS is co-ownership. Respondent nr.1 said if a company do not get the patent from the professor without any claims, which is common, then a contract is signed. If it is a great idea and a lot of money is involved then a contract will be signed. Minor inventions are usually passed on through informal networks. While reading about co-ownership and joint projects at the IPLS made me wonder how many patents are applied as joint projects between university and company. I decided to investigate how many patents that

have been applied worldwide by Hokkaido University, Tokyo Institute of Technology, Waseda University, Shibaura Institute of Technology, Tohoku University and University of Tokyo during the period of 1st of January 2009 to 7th of May 2009.

Figure 4.1
Patents applied from selected Japanese universities worldwide during the period of 1st of January 2009 – 7th of May 2009.



Source: European Patent Office, Esp@cenet.

Figure 4.1 confirms that most patents are applied as university-industry patents. If we then consider that 75% of all joint projects are informal, according to the reply I received from Prof Kneller, then there are a hidden number of even more joint projects that cannot be found in statistics. This tells us that there is deep industry-university collaboration at work, mainly through informal contacts. Formally it looks like a Mode 1 setting with hardly any contacts in the Triple Helix, but informally it leans toward a Mode 2 setting.

If we look at patent applications by TLOs and royalty income we can also see an increase here as confirmed by respondent nr.13. The number of application for patent in 1999 by TLO was 280 and the royalty income in 1999 was 20,394 (thousand JPY), the number of application in 2002 was 1,335 and income in 2002 was 410,191 (thousand JPY). Is it a success? I would say that according to the figures I received from respondent nr.13 it is growing, but most of the respondents and literature such as Kneller (2007) are critical to the TLOs. Slow, bureaucratic and lack of experience from industry and the technological field are among the things that are criticised the most. For me it is obvious that the government are trying to bring up the positive

things by measuring patent applications since it is the government who created the TLOs by its TLO Law. For the people directly involved at the universities the story seems to be a bit different. The slow and bureaucratic pace at the TLOs, I would say, encourage keeping the informal networks and/or slow down the process of change regarding industry-university contacts. From the universities point of view there seem to be no problem with keeping the old system of informal contacts, and what is wrong with informal contacts? I find that the important thing is that there is mutual understanding, room for some flexibility and a clearly specified purpose between the industry and university concerning successful collaboration.

It is also important not to generalize the industry as one unified culture or for that matter the universities. According to respondent nr.2, every company have their own company culture and that sometimes create problems for the university. Examples given during the interview was that some companies are very bureaucratic and slow and some are hard-working and fast in communicating with the university. The different company cultures are experienced as a challenge to overcome regarding collaboration. The only time companies changes its company culture are if companies experiences a recession, according to respondent nr.2.

If we return to the informal vs. formal contacts between industry and university, respondent nr.10 express that the government cut university budget with 2% every year. Government must consider budget and are reluctant to increase budget and for me it is clear that the government want to see and promote a more formalized system. Another remark is that the industry prefers to collaborate with national universities due to its focus on research. The students from national universities are also more attractive for the industry to employ due to the focus on research and bright students who passed very difficult entrance exams. Private universities, except universities like Keio, Waseda, Ritsumeikan, have no focus on research and are therefore not interesting a collaboration partner, according to respondent nr.2. All the respondents agreed on that collaboration is important. No university is a single island, but challenges and positive aspects already at work, mentioned by the respondents, can be summarized like this:

Challenges

- Universities are looking for persons at companies that have the same research topic and common goal.
- Profit (company) vs. publishing papers (university)

- Universities formal links vs. informal links with industry
- Different company cultures vs. different university cultures

Positive aspects

- Graduated students who work for companies can provide contacts to the right people regarding collaboration in research
- Once a project started it not difficult to share a common interest and goal
- University is a part of research laboratory at companies
- Importance of informal relationships between university and industry
- Rise in patent applications

If we outline the change of collaboration patterns the last decade we can study legal framework and policies (see Table 1 in Part II) and see that there is a lot of change regarding industry-university collaboration. But this does not necessary mean that the respondents experience any change. This feeling of no change was expressed by respondent nr.6 who said it has been little change. Among the respondents who experienced change I found the following six changes felt by the respondents, 1) established a division that deals with university-industry collaboration, 2) a focus on short-term development due to the industry's demand for profit, 3) due to the bad financial situation in the world companies send part-time researchers instead of contributing financial support, 4) industries feel the necessity due to emphasis from government to get help from universities and institutes regarding basic research. On the other hand universities and institutes need financial support and assistance in developing high technology from industry, 5) an increase in business partners, 6) TLOs. The TLOs are causing problems for the academia by lacking qualified personnel and slow, as expressed by Prof Kneller in this study (see 3.4.7) or as expressed by respondent nr.10:

''The TLO of University of Tokyo is not well functioning. It is a "greedy beast". This is my headache. Japanese version of "Bayh Dole Act" started almost 10 years ago. Moreover, MEXT (Ministry of Education, Culture, Sports, Science and Technology) and Japanese universities believe that they can get "INCOME" which can be used for running universities. This is a very dangerous and stupid Japanese government policy.'' (Respondent nr.10)

Respondent nr.15 also emphasize that the TLOs in Japan in general are problematic and the one at University of Tokyo is probably the best one since it has twelve employees with some technical experience and/or experience from industry.

According to Liaison Department Group Leader Furukawa at Kyushu University who participated in the IPLS (2008, D2:243) stated that the main purpose of industry-university cooperation for universities is to stimulate academic activities, for the industry it is to reinforce competitiveness and for social institutions it is to improve social service. No purpose is better that the other and they should all be respected by every actor and if this is accomplished then collaboration becomes a success. I find this to be a formal opinion expressed by Furukawa. When talking to university staff I found that universities must work harder, as expressed by respondent nr.1, to get money from industry due to cut-backs from government budget. This 'hunt for money' is time consuming for the professors and of course this might lead to a decrease in quality regarding supervision of students, teaching and research. One professor from a private university made an amusing remark saying: 'now national universities also must work'. Of course, there is some truth in that if government wants to decrease university budgets. According to my interviews the goal for university staff is not only to stimulate academic activities, now they also must be more outgoing towards industry in order to generate money. For many it is nothing new, due to informal networking with industry, but for academia that managed fine with money from government and did not have many contacts with industry it will be a change. Educate students toward a degree is still the main purpose, according to both respondent nr.1 and nr.2.

Other changes in university-industry collaboration the last decade are more human collaboration such as company staff coming to universities in order to give lectures, share and/or work on current research and patents. In addition, positions in committees have increased, as expressed by respondent nr.2 and nr.4. One way of measuring the change in collaboration is to see if there has been an increase, decrease or status quo regarding patents, start-up companies, new organisations and publications the last decade. Respondent nr.11 expressed that 'really important scientific achievement cannot often be measured by numbers'. But in order for the author to have some hard data in this study the findings are relevant even if some aspects such as better working conditions between actors are important, but it s hard to measure. An interesting point while conducting this study was a difference

between the respondents' replies at the same university within the same area of research. A summary of the outcome can be seen in Table 4.4.

Table 4.1 Changes regarding patents, start-up companies, organisations and publications.

	No Change	Increase	Decrease	Do not know	No reply
Patent	18.75%	68.75%	6.25%	6.25%	-
Start-up companies	31.25%	50%	12.5%	6.25%	-
Organisations	18.75%	56.25%	12.5%	12.5%	-
Publications	25%	37.5%	6.25%	18.75%	12.5%

Explanations for an increase in patents, start-up companies, organisations and publications are for example a greater demand by industry and the university. In addition the universities are now paying respect to the inventors compared to how it used to be according to respondent nr. 11. Another reason for the increase expressed is government policy. One respondent (nr.10) do not see the increase as totally beneficial to Japanese tax payers/society and one respondent (nr.11) do not see increase as something important in relation to scientific achievement.

> *''The fruits will be harvested by industries in US and EU Japanese biology researchers are very naive "worms" that produce "good data" and "good publications". MEXT is simply counting the number of patents for research investments for their accounting for the Ministry of Finance but the most important issue is that who will use those patents. Most bio-venture companies which started up in the last decade are now dying. New organizations created by MEXT are exhausting a huge amount of money without significant outcome to Japanese tax payers.'' (Respondent nr.10)*

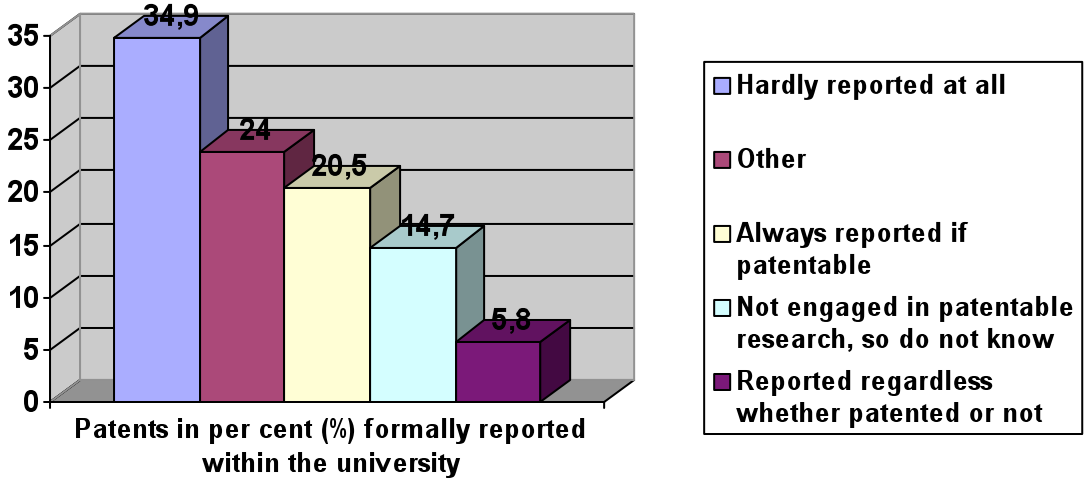
According to respondent nr.13 the amount of accepted patents by TLO in 1999 was 18 and in 2002 it was 349 and the number of accepted patents by all universities in 2002 was 185 compared to 2,872 in 2005 according to an evaluation report in 2006 by MEXT. In addition, by looking at patent applications submitted by national universities in joint research with companies during the Second (5 year) Basic Plan the number increased about ten times (MEXT, White Paper on Science and Technology 2007). The respondents who experienced a

decrease the explanation is due to one single factor and that is the bad economic situation in Japan. The respondents who experienced no change said that ideas need a complicated and difficult application process and if it is not a great idea then the professors hesitate to apply since it takes a long time. One of my respondents had 2-3 patents the last ten years; the rest of his ideas are shared with industry/academia without any secrecy. In return he expects opinions instead of money. As we see in Figure 4.2, 34.9% hardly report patents at universities. The second biggest reason of those who hardly reported is that the procedure for applying is too difficult (See Figure 4.3).

Figure 4.2 Patents formally reported within the university

Note 1. Response to the question ‘’If research is implemented at the institution to which you belong, where research achievements are obtained as deliverables, and there is a possibility that they may be patented, is this formally reported within the organisation to which you belong?’’ (The term ‘’reported’’ here refers to departmental or divisional meetings to report achievements, or reports to intellectual property departments or invention committees in the institution.).

Note 2. ‘’Other’’ includes ‘’Do not know’’ and ‘’no response’’.

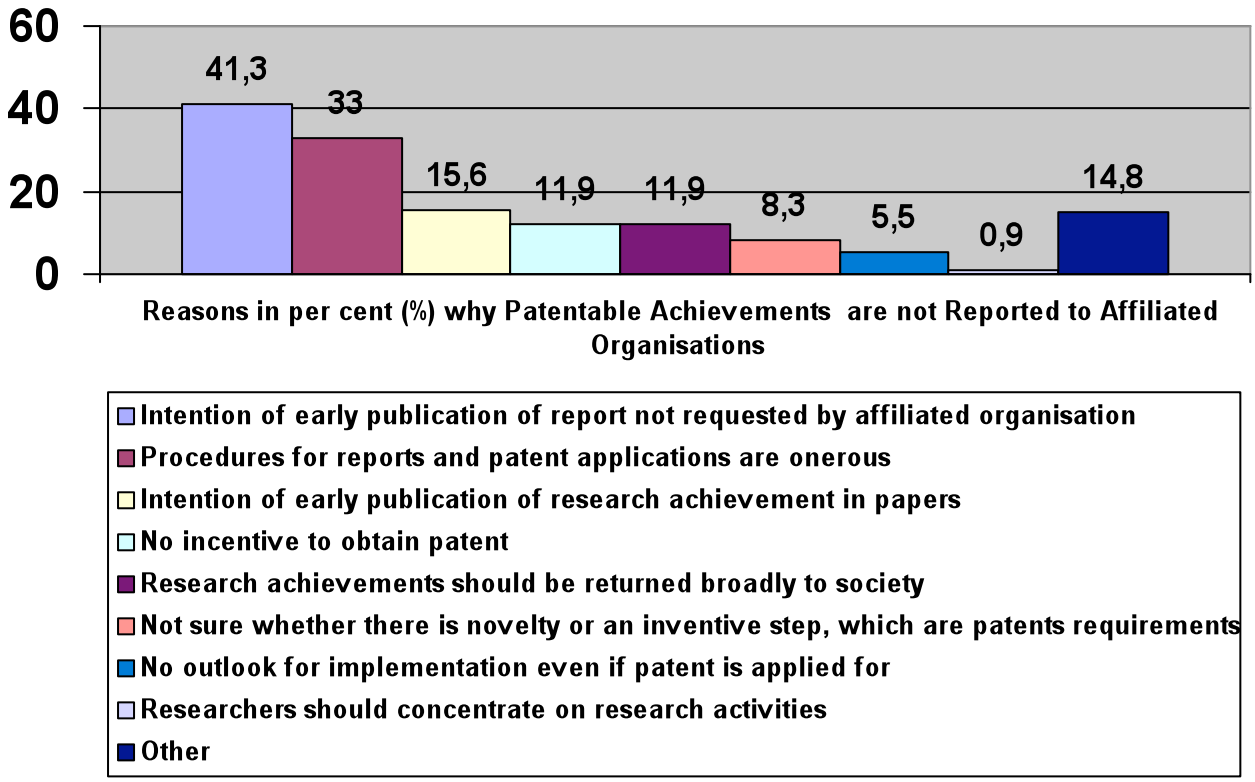


Source: MEXT, Annual Report on the Promotion of Science and Technology 2002.
‘’Survey of the State of Japan’s Research Activities (FY2001).

Figure 4.3 Reasons Why Patentable Achievements are not reported to Affiliated Organisations.

Note 1. Response to question ‘’Why did you not report?’’ to people who responded ‘’Hardly ever report’’ in Figure 4.2.

Note 2. ‘’Other’’ includes ‘’Do not know’’ and ‘’no response’’.



Source: MEXT, Annual Report on the Promotion of Science and Technology 2002.
''Survey of the State of Japan's Research Activities (FY2001).

Another way to look at it is if we look at how many months it takes before an applicant gets the first notification from the examiner to the applicant. As we see in Table 4.5 it takes in average 21.1 months in Japan. It is understandable that many academics think the process is too slow and therefore hand it over to the industry instead.

Table 4.2 First Action Period for Patents

Year	Japan	US	Europe
2000	21.1 months	13.0 months	20.7 months

Source: Japan Patent Office. ''Trilateral Statistical Report'', examination period is from ''Japan Patent Office Annual Report'' in MEXT, Annual Report on the Promotion of Science and Technology 2002.

Five respondents all agreed that the state is an important actor being supportive. Shortly expressed by respondent nr.6 'The State provides budget'. The most common positive example given was the budget and investment support to universities. Two of the five respondents believed the leadership role and strategy are supportive factors that triggered the

university-industry collaboration through legal changes in 1998. One view that was expressed was the disappointment over TLOs.

4.3 Conflicts of Interest

The three biggest problems for companies in research with domestic universities are firstly, few research topics that could be implemented by the firm. Secondly, differences of consciousness between companies and universities regarding goals of joint research and thirdly, differences in the consciousness of speed of research and development (MEXT, Annual Report on the Promotion of Science and Technology 2002). Patent is also an issue of conflict when it comes to joint research according to Prof Harayama, Tohoku University (IPLS, A1:2008). As expressed by respondent nr.2, ten years ago university staff did not care about patents, but now with the legal change professors can benefit from their inventions then now university people wants patents as well, and most of the time the contract is written 50%-50% between the two actors.

In Japan it is difficult to be successful regarding venture companies. Problems expressed are budget, tax problems and competition from big business. The claim regarding competition from big business finds support from Kneller. He states that big companies drain a big amount of university discoveries, see 3.4.8 in this study. If there is a superior technology then a big company can provide 100 researchers on the development of new technology and as a small start-up company it is impossible to compete, according to respondent nr.1 and nr.2.

Factors that influence change in collaboration patterns between university, industry and government in Japan are global effects such as the current bad economy. The tax system (the assessment on workers in industry and researchers at universities) and a change of bureaucracy are some domestic issues that cause some concern among the respondents. State related internal transformation as expressed by respondent nr.13 is the coordinators placed by MEXT to serve as bridges between academia and industry. Other examples are the support to researchers' that attempts R&D that links basic research and research for product development. This stage is nicknamed 'death valley'. Companies should hire more PhDs and delegate more staff to the universities, and the universities should integrate scientists more in projects since many believe, according to one professor, that originality only emerges from

independence. In addition, university reforms to include incentive mechanisms and financial conditions for the academia are also a concern.

> *''For instance, we could not spend company money on some purposes, e.g., for purchasing experimental equipment, to avoid extra tax. We need a cleverer government that improves the efficacy seriously.''* (Respondent nr. 11)

4.4 Emerging Forms of Collaboration

With both positive and negative views it is interesting to find out what predictions the respondents have regarding university-industry collaboration for the next decade. Respondent nr.11 thinks that both sides are sceptical about the success and necessity of the collaboration. Therefore the collaboration will be slow in the next 3~4 years. However, the modern technology and science are inseparable, and respondent nr.11 believes the collaboration will be more successful and stronger in the next decade.

There seems to be many challenges that need to be solved before the full potential of university-industry collaboration can prosper. More specific collaboration predictions are that the companies will contribute not only to research but also to education. At the moment it is quite low in Japan according to respondent nr. 7. One example that respondent nr.4 mentioned was that the companies at his laboratory often come to the university with the latest developments and show it to students during class and while visiting the laboratories. According to respondent nr.7 this will increase in the next decade. There is also a fear that due to Japanese government policy universities need more cooperation with industry and the income generated through collaboration are used to fill the gaps of decreasing budgets for Japanese universities and the consequence will according to respondent nr.10 ‘’damage our academic minds’’. Another gap that need to be filled according to respondent nr.12 is between university research and industry request. To overcome this gap respondent nr.12 suggests that excellent coordinators are needed as a solution. Respondent nr.13 expresses that collaboration between universities, industry and state will be reinforced much more. The growth of number of patents and collaborative research generating profit is not big enough. Respondent nr.13 continues with the belief that collaboration might be more regional or local-oriented. Respondent nr.2 believes it will be more collaboration beyond countries compared to a very domestic collaboration pattern in Japan today. This statement is also supported by Patent

Attorney/Professor Kozo Kubo from Nara Institute of Science and Technology at the IPLS (2008, A1:68) where he says:

> *''Japanese universities' greatest weakness is their relationship with foreign companies, foreign governments, and foreign venture capital, which we need to strengthen.''*

The above view is confirmed by Vice President Wataru Koterayama from Kyushu University, also at the IPLS (2008, A1:68) who says that his university would like to become a global university and this is why they made academia-industry collaboration an inevitable goal.

5. Conclusion

The purpose of this study, and research questions, was to see if an increase in collaboration between the state, industry and university generates more patents, start-up companies and new organisations according to the Triple Helix model. The Triple Helix suggests that an increase in interactions that did not exist before, coordination of resources and integration of goals will happen and lead to an increase in knowledge transfer. It was this hypothesis that has been tested in this study.

My objectives is threefold, firstly, how the participants experience collaboration with other actors and if the effect of a change in collaboration patterns changes the pace and amount of knowledge transfer. The second objective was to find out if any conflicts of interests occur due to increased collaboration and thirdly, to produce knowledge of emerging forms of collaboration patterns.

The major concern, or conflicts of interest, for the participants regarding collaboration is the different goals between the industry (profit) vs. university (educational ideals such as publishing papers, graduating students). Due to a new formalized system regarding knowledge transfer we can see that pace of knowledge transfer has become more bureaucratic and slow compared to the informal system of knowledge transfer between industry and university that occurs through various channels such as informal contacts, mobility of staff, joint research and consulting relationships. At the same time we can see an increase in the amount of patents. By only looking at patenting and start-up companies I argue that it plays a rather small role in the process of knowledge transfer if you consider all the informal

collaboration and joint research. The informal networks are a kind of escape mechanism in order to avoid the bureaucratic, slow and as expressed by some respondents, incompetent. So at the moment there are two parallel systems working side by side and it will probably do so for a while unless the TLOs radically change its effectiveness.

The strategic challenge that lies ahead is to make the actors collaborate under trust and understanding. Therefore the author suggests that the industry should delegate more staff to the universities, and the universities should integrate scientists more in projects. In addition, university reforms to include incentive mechanisms would be of great help in order to create a more formalized knowledge transfer. Before the Second World War the universities cooperated with the industry as explained under Mode 2, then after Second World War it changed to Mode 1 and then during the last decade we can gradually see a change towards Mode 2 again. This is an explanation of formal networks and contacts. When talking to university staff there has always been a lot informal networks with industry and from an informal perspective this study show that Mode 2 has always been at work.

For the industry Mode 2 advantages would be lower cost of Research and Development (R&D) expenditures, access to highly skilled researchers, access to base scientific competence built up within the university and advantages for the university would be more sources of funding, access to proprietary technology, enhanced status and faster feedback loops relating to output of the universities discoveries.

Challenges to overcome in industry-university collaboration would be the different cultures of the organisations, the academia's desire to publish and the industry's desire to maintain secrecy to secure intellectual property and issues concerning ownership of intellectual property. I find the disadvantage with Mode 2 is that outside actors have more to say regarding what topic the researcher should focus on. There is a risk for a loss of long-term focus in research. Success under Mode 2 is the ability to transfer knowledge that has been created at the research centre effectively to industry. Success under Mode 1 is to attract industry partners as it creates a scientific knowledge pool that the industry wants to take part of. Worst case scenario with Mode 1 is that it can conduct research without any benefit for the society. The positive side with mode 1 is that the researcher is not influenced from outside actors what topic to focus on and it can conduct research in a long-term context without being

influenced by short-term profit demands from actors such as industry. In a way I find the society to benefit from mode 1 when new discoveries are ‘produced’ to students and knowledge transfer happens when students pick up this new information and bring it with them after graduation. It is not the fastest process but the discoveries do not necessary stay put within the spheres of the university.

The pace of change is slow and therefore not many new forms of collaboration will take place according to some respondents. But some changes that have happened and/or are about to increase are involvement in education by companies. Another form of collaboration that stands out is the cooperation with other countries compared to the domestic university collaboration pattern, today, in Japan.

One way of measuring if there is an increase in collaboration is to see if there is a change in amount patents, start-up companies and organisations. According to figures, as showed in Part III, there is an increase in patents, start-up companies and organisations. But is this a sign of success? The answer varies depending on what actor the respondent represents. If you ask some one related to the government the answer is yes, but if you ask some one from the universities the answer is leaning towards a no due to slow and bureaucratic TLOs. This will probably mean that the informal contacts will be further strengthened and maintained instead of using the formal channels and therefore it is not so useful to measure patents when most of knowledge transfer is dealt with through joint projects or informal contacts. The TLOs and big companies are partly responsible for the few start-up companies. The big companies drain the universities of big discoveries and then refine the ideas in their big company laboratories with many researchers compared to a small start-up company with only a few researchers.

References

Bonaccorsi, Andrea and Ciniza Daraio (ed). 2007. ‘’Universities and Strategic Knowledge Creation’’. Edward Elgar Publishing Limited.

Branscomb, Lewis M. and Fumio Kodama. 1993. ‘’Japanese Innovation Strategy’’. United Press of America, Inc.

Branscomb, Lewis M., Fumio Kodama and Richard Florida (edited). 1999. ‘’Industrializing Knowledge – University-Industry Linkages in Japan and the United States’’. The MIT Press, Cambridge, Massachusetts, and London, England.

Bryman, Alan. 2004. ‘’Social Research Methods’’. Oxford University Press.

Callon, Scott. 1995. ‘’Divided Sun – MITI and the Breakdown of Japanese High-Tech Industrial Policy’’. Stanford University Press, Stanford, California.

Dooley, Lawrence and David Kirk. 2007. ‘’University-industry collaboration – Grafting the entrepreneurial paradigm onto academic structures’’. European Journal of Innovation Management. Vol.10. No.3. pp. 316-332.

Etzkowitz, Henry and Loet Leydersdorff (ed), 1997. ‘’Universities and the Global Knowledge Economy – A Triple Helix of University-Industry-Government Relations’’. Continuum. London and New York.

Etzkowitz, Henry. 2002. ‘’The Triple Helix of University-Industry-Government Implications for Policy and Evaluation’’. Working Paper 2002:11. Swedish Institute for Studies in Education and Research (SISTER).

Etzkowitz, Henry, Andrea Webster, Christiane Gebhardt and Branco Regina Cantisano Terra. 2000. ‘’The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm’’. Research Policy. Vol.29. Issue 2. pp. 313-330.

Etzkowitz, Henry and Loet Leydesdorff. 2000. ‘’The dynamics of innovation: from National Systems and ‘’Mode 2’’ to a Triple Helix of university-industry-government relations’’. Research Policy. Vol. 29, **Issue** , pp. 109-123.

Fransman, Martin. 1995. ‘’Japan’s Computer and Communications Industry’’. Oxford University Press.

Fujisue, Kenzo. 1998. ‘’Promotion of academia-industry cooperation in Japan – establishing the ‘law of promoting technology transfer from university to industry’ in Japan’’. Technovation, Vol.18. Nos 6/7. pp. 371-381.

Graham, Paul J. and Harley D. Dickinson. 2007. ‘’Knowledge-system theory in society: Charting the growth of knowledge-system models over a decade, 1994-2003’’. Journal of the American Society for Information Science and Technology. Vol. 58, Issue 14. pp. 2372-2381.

Hatakenaka, Sachi, 2004. ‘’University-Industry Partnerships in MIT, Cambridge, and Tokyo’’. RoutledgeFalmer, New York & London.

Johnson, Chalmers. 1982. ‘’MITI and the Japanese Miracle’’. Stanford University Press, Stanford, California.

Karlsson, Anders. 2009. ‘’Forskning och Innovation i Japan – en överblick’’. ITPS – Institutet för Tillväxtpolitiska Studier. PM 2009:002.

Kitagawa, Fumi. 2009. ’’University-Industry Links and Regional Development in Japan: Connecting Excellence and Relevance?’’. Science, Technology & Society. 14:1 (2009): pp. 1-33. SAGE Publications.

Kneller, Robert. 2008. ‘’Invention Management in a Major Japanese University and its Implications for Innovation’’. http://www.kneller.jp/

Kneller, Robert. 2007. ‘’Bridging Islands – Venture Companies and the Future of Japanese and American Industry’’. Oxford University Press.

Kneller, RW. 2007. ‘’The beginning of university entrepreneurship in Japan: TLOs and bioventures lead the way’’. Journal of Technology Transfer 32 (no.4, August). pp. 435-456.

Kneller, Robert. 2006. ‘’Japan’s new technology transfer system and the pre-emption of university discoveries by sponsored research and co-inventorship’’. Journal of the Association of University Technology Managers 18 (no. 1, summer 2006). Pp. 15-35. Republished with permission in Industry and Higher Education 21 (no.3, June 2007, pp.211-220).

Kneller, Robert. 2003. ‘’Implications for university-industry cooperation of the transformation of national universities into university corporations’’. http://www.kneller.jp/

Komiya, Ryutaro, Masahiro Okuno and Kotaro Suzumura (ed). 1988. ‘’Industrial Policy of Japan’’. Academic Press, Inc.

Leydesdorff, Loet and Yuan Sun. 2009. ‘’National and International Dimensions of the Triple Helix in Japan: University-Industry-Government *versus* International Co-Authorship Relations’’. Journal of the American Society for Information Science and Technology 60(4). pp. 348-362.

Leydesdorff, Loet and Martin Meyer. 2009. ‘’The Decline of University Patenting and the End of the Bayh-Dole Effect’’. Scientometrics forthcoming. pp. 1-14.

Lu, Lucy and Henry Etzkowitz. 2008. ‘’Strategic challenges for creating knowledge-based innovation in China – Transforming triple helix university-government-industry relations’’. Journal of Technology Management. Vol.3. No.1.pp.5-11.

Mito, Takamichi. 1992. ‘’Contending Perspectives on the Japanese ‘Economic Miracle’ ‘’. Published by Japanese Studies Centre, Monash University.

Neuman, W. Lawrence. 1994. ‘’Social Research Methods – Qualitative and Quantitative Methods’’. Allyn and Bacon. Boston, London, Toronto, Sydney, Tokyo, Singapore.

Nezu, Risaburo. 2007. ‘’Industrial Policy in Japan’’. Journal of Industry, Competition and Trade. Vol. 7, Issue 3, pp. 229-243.

OECD. 2007. ‘’Higher Education and Regions – Globally Competitive, Locally Engaged’’. ISBN 978-92-64-03414-3.

Okimoto, Daniel I. and Thomas P. Rohlen (ed). 1988. ‘’Inside the Japanese System – Readings on Contemporary Society and Political Economy’’. Stanford University Press. Stanford, California.

Okimoto, Daniel I. 1989. ‘’Between MITI and the Market’’. Stanford University Press. Stanford, California.

Palfreyman, David and Ted Tapper (ed). 2008. ‘’Structuring Mass Higher Education – The Role of Elite Institutions’’. Routledge.

Rahm, D, J.Kirkland and B.Bozeman. 2000. ‘’University-Industry R&D Collaboration in the United States, the United Kingdom and Japan’’. Kluwer Academic Publishers. Dordrecht/Boston/London.

Report on the International Patent Licensing Seminar, D2. 2008. ‘’Academia-Industry-Government Collaborations – Why do Japanese companies not invest heavily in R&D?: Release from the Deadlock of IP Clauses and the Future’’. http://www.ryutu.inpit.go.jp/seminar_a/2008/pdf/D2_e.pdf

Report on the International Patent Licensing Seminar,A1. 2008. ‘’International Academia-Industry Collaboration and IP Management’’. http://www.ryutu.inpit.go.jp/seminar_a/2008/pdf/A1_e.pdf

Report on the International Patent Licensing Seminar, A2. 2008. ‘’Ten Years after the Enforcement of ‘TLO Law’: Vitalization of Regional Economies through Academia-Industry Collaboration’’. http://www.ryutu.inpit.go.jp/seminar_a/2008/pdf/A2_e.pdf

Shinn, Terry. 2002. ‘’The Triple Helix and New Production of Knowledge: Prepackaged Thinking on Science and Technology’’. Social Studies of Science. Vol. 32, Issue 4. pp. 599-614.

Sugimoto, Yoshio. 2003. ‘’An Introduction to Japanese Society’’. Cambridge University Press.

Ughetto, Elisa. 2007. ‘’Foresight as a triple helix of industry, university, and government relations’’. Foresight: the journal for future studies, strategic thinking and policy. Vol. 9. Issue 5. pp. 14-22.

Vogel, Steven Kent. 2006. ‘’Japan Remodelled – How Government and Industry are Reforming Japanese Capitalism’’. Cornell University Press. Ithaca and London.

Wen, Jiang and Shinichi Kobayashi. 2000. ‘’Policy and Practice in Japan: and Empirical Study on University-Industry Collaboration’’. Engineering Management Society, 2000. pp. 88-92.

Websites – useful in relation to this study

Academic Ranking of Universities: http://www.arwu.org/

AIST: http://www.aist.go.jp/index_en.html

Berkeley Lab, Lawrence Berkeley National Laboratory: http://www.lbl.gov/

Embassy of Japan, Stockholm, Sweden: http://www.se.emb-japan.go.jp/

European Patent Office, Esp@cenet: http://ep.espacenet.com/?locale=en_EP

Hokkaido University: http://www.hokudai.ac.jp/en/

Japan Patent Office: http://www.jpo.go.jp/index.htm

JEITA: www.jeita.or.jp

JETRO Sweden: http://www.jetro.go.jp/sweden/

JSPS: http://www.jsps.go.jp/english/index.html

JSPS, Stockholm Office: http://www.jsps-sto.com/

JST: http://www.jst.go.jp/EN/

MEXT: http://www.mext.go.jp/english/

METI: http://www.meti.go.jp/english/

NIAD: http://www.niad.ac.jp/english/about/h_sketch.htm

RIKEN: http://www.riken.go.jp/engn/

Shibaura Institute of Technology: http://www.shibaura-it.ac.jp/english/index.html

Swedish Agency for Economic and Regional Growth: http://www.tillvaxtverket.se/

The Swedish Research Council: http://www.codex.vr.se/en/forskninghumsam.shtml

Tohoku University: http://www.tohoku.ac.jp/english/

Tokyo institute of Technology: http://www.titech.ac.jp/english/index.html

University of Tokyo: http://www.u-tokyo.ac.jp/index_e.html

University of Tsukuba: http://www.tsukuba.ac.jp/english/about/tsukuba.html

Waseda University: http://www.waseda.jp/top/index-e.html

Appendix 1: BACKGROUND INFORMATION

Name: (Mr) Ronald T. NORDQVIST

E-mail: ron@kth.se

Occupation: 5th year Master student from Lund University (Sweden).

Programme: Master in Asia Studies

Programme Focus: Politics, Economy and Social Science

Supervisor at Lund University: Dr. Stefan BREHM, E-mail: Stefan.Brehm@ace.lu.se

Master Thesis title: *''The Triadic Relationship with a Triple Helix Approach between Industry, University and State in Japan''*

Background work in Japan: I have spent five weeks at Waseda University (13th of Jan-16th of Feb, 2009) under the supervision of Associate Dean, Prof Takamichi MITO (E-mail: tmito@aoni.waseda.jp), conducting fieldwork studies. I have done interviews with academic staff in the Information and Communication Technology sector at Waseda University, University of Tokyo, Tokyo Institute of Technology and also with the Technical Attaché at the Science and Technology Office at the Swedish Embassy in Tokyo. In addition I have done a lot of literature studies while being in Japan.

Work in Sweden: I intend to conduct questionnaires to academic staff in Japan in the Information and Communication Technology sector and to interview staff at the Japan Society for the Promotion of Science (JSPS) and Japan External Trade Organisation (JETRO) in Stockholm, Sweden.

Secrecy: All information from respondents will be treated as an anonymous source. No names will be stated in my master thesis.

Appendix 2: QUESTIONS 1-7

1. How do you perceive the collaboration between university and industry?
   Regarding common goals, interactions, boundaries between industry and university and/or other factors.
   □□□□□□□□□□□□□□□□□□□□□□□□□□□□□
   □□□□□□□□□□□□□□□□□□□□□□□□□□□□□

2. Have there been any change regarding university – industry collaboration the last decade regarding common goals, interactions, boundaries between industry and university and/or other factors.
   □□10□□□□□□□□□□□□□□□□□□□□□
   □□□□□□□□□□□□□□□□□□□□□□□□□□□□□

3. A) During the last ten years have there been any increase, decrease or status quo regarding:
   patents, start-up companies. new organizations, publications
   B) Please explain why it has become an increase, decrease or status quo.

   A) □□10□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□
   □□□□
   □□□□□□□
   □□□□□/□□□□
   □□□□□□
   B)□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□□

4. What are your predictions for the next decade regarding collaboration between university and industry?
   □□□□□□□□□□10□□□□□□□□□□□□□□□□□□□□

5. How do you perceive the role of the state as an actor concerning university and industry collaboration?
   Supportive, non-supportive or invisible as an actor. Please give an example.
   産学連携に関する国の役割についてどう考えますか（協力的、非協力的、国の役割は感じない等）。例などがありましたらお書き下さい。

6. What other factors might influence change in collaboration patterns between university, industry and government in Japan?
   □□

7. Any additional information/comments?
   □□□□□□□□□□□□□□□□□□□□□□□□□□□□□

□□□□□□□□□□□□□□□□□□