CHALMERS

Knowledge and Technology Transactions in the Automotive Industry

- *A study of five cases*

Master of Science Thesis in the Master degree programme, Business Design

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1. Abstract

This thesis investigates the activities in the automotive industry related to knowledge and technology transactions. It will through a case study show a palette of examples of these kinds of activities which gives indications on how those transactions are structured in the automotive industry.

The thesis aims to answer four research questions:

1. **How are transactions of knowledge and technology structured between OEMs in the automotive industry?**
2. **What is being transacted and what form does it have?**
3. **What means for control are being used?**
4. **In what ways are these control mechanisms enabling the transaction?**

To answer these questions data has been collected from five different cases where knowledge and technology has been transacted between OEMs (Original Equipment Manufacturers) in the automotive industry. Interviews with persons from the involved companies have been conducted and together with publicly available information the cases have been analyzed by using relevant literature in relation to the research questions. The theoretical framework around the questions is presented in a separate chapter where concepts and theories around knowledge and technology transactions are introduced. These concepts and theories concerns mostly the nature and management of so called intellectual assets as the interesting aspects from the case studies concerns the arrangements and the protection of intellectual assets, in this case the knowledge and technology.

The case study will show on various solutions used for transaction of knowledge and technology. From closely integrated Joint Venture solutions to strictly keeping the companies apart and only transacting physical products. The use and the role of IP in these deals are also varying heavily while the use of secrecy in order to control the transfer of knowledge is used to different extent in all of the cases.

The cases studied are:

1. **Toyota – PSA:** Manufacturing Joint Venture in Czech Republic
2. **Toyota – Nissan:** Supply of Toyota's hybrid driveline for the Nissan Altima
3. **Saab – BAIC:** Sale of tools and documentations for discontinued models to China based automotive company BAIC
4. **Fiat – Ford:** Contract development and manufacturing based on shared architecture
5. **Lotus – Tesla:** Contract development and manufacturing based on previous architecture

The conclusions concern how the means for control that have been used in these cases have enabled the deals and how the set-up of the deals has affected the possibilities to transact knowledge and technology.

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2. Introduction

This thesis is written in the context of the automotive industry and the increasingly common transactions between OEMs (Original Equipment Manufacturers). The focus is on transactions of knowledge and technology between these actors and the aim is to supply insights into how these deals are structured and controlled. This introduction chapter will supply a background to the theoretical concepts later presented and the empirical data that have been collected.

The automotive industry is in many ways a mature industry. The car is widely spread and has been so for a long time. The conditions, actors, products and simplified – the rules of the game – have only in small steps changed during the last decades. Karlsson et al (2007) refers to this development when talking about the automotive industry as a mature industry. They continue by showing on the fierce competition that has evolved in the industry and by that the diminishing margins. The last few decades have therefore been dominated by desperate hunts for cost reduction and this development has in most cases ended up in the same conclusion. Get the volumes up in order to get economy of scale. (Karlsson et al 2007)

One of the major strategies during the 1990s and 2000s in the purpose of achieving this economy of scale has been the "multi-brand strategy", widely used by e.g. GM (General Motors). In this strategy so called platforms have been developed and then a number of different car models have been produced on the same platform with mostly visual components exchanged to differentiate them from each other. In a number of cases the strategy of using platforms have also been used in inter firm relations where two companies have collaborated on one platform to produce their respective models and by this share the fixed costs. (Karlsson et al 2005)

As an additional solution to the diminishing margins beside the cost reduction, more and more companies have started to look for additional sources of revenue to cover their R&D expenses. As an example of this one can mention the growing number of OEM consultancies. These are used by the OEMs to try to spread their technology to other actors and by that gaining better leverage from their developed technology. However, the automotive industry has traditionally not been a particularly IP intense industry and patenting have been conducted more in order to avoid conflicts rather than to create exploitation opportunities. (Ili et al 2010)

The emergence of OEM consultancies is one example that can be found of increased technology transactions in the automotive industry and that create an interesting area of research. This thesis aims to give indications of what kinds of activities that are taking place in the automotive industry in terms of knowledge and technology transactions. It will be achieved through a study of five different cases where OEMs have transacted knowledge or technology between each other. The cases are heavily shifting in terms of set-ups and nature of the transferred technology in order to supply a broad range of examples.

3. Purpose

The purpose of this thesis is to investigate the activities between OEMs in the automotive industry in terms of knowledge and technology transactions. The thesis will to supply a palette of different solutions used in the automotive industry for these activities and by that giving an indication of how OEMs handle and structure transactions of knowledge and technology between each other. The aim is to draw conclusions regarding potential patterns or best practices from a study of cases in recent times where OEMs have transacted knowledge and technology of large systems or automotive architectures.

4. Research Questions

In this section the four questions that this thesis aims to answer in order to fulfill the purpose is presented and explained.

The thesis will take a standpoint in the framework describing how economies and businesses change with an increasing contribution from knowledge. This framework is presented by Petrusson (2010) and will be introduced under Theoretical Framework in this thesis. Many knowledge based businesses such as the automotive industry is moving towards a position where knowledge is playing an increasingly important role and intangible products are and services are considered more and more crucial to the businesses. This fits well in Petrusson's framework and derived from this framework it is clear that the issues surrounding transactions of knowledge and technology are utterly important aspects when entering a knowledge based economy. This has led this thesis to the focus of how transactions of knowledge and technology are structured in the automotive industry. The first and general question to this thesis is therefore:

1. ***How are transactions of knowledge and technology structured between OEMs in the automotive industry?***

To further specify the study of knowledge and technology transactions the second research question aims to give a more insightful view of the practical set-up of the deals:

2. ***What is being transacted and what form does it have?***

By asking about the form, the aim is to study what carrier that is being used in transferring knowledge or technology. The carrier of the knowledge then leads the work to the next focus area that concerns the control of the transacted objects. As being suggested by Petrusson's framework the control aspect fulfills new and increasingly important tasks in the knowledge based economies and this thesis therefore aims to answer:

3. ***What means for control are being used?***

Taking this one step further, the analysis more specifically aims to see how the control mechanisms are being used not to block or restrict transactions but rather how they are used in order to making transactions possible in the first place. The underlying theory is that if a seller does not feel secure in how a transaction of something other than physical products can be controlled, the transaction will not take place. The fourth research question will therefore be:

4. ***In what ways are these control mechanisms enabling the transaction?***

These four questions collectively aim to supply the reader with a view of the activities and solutions used when it comes to knowledge and technology transactions in the automotive industry.

5. Delimitations

There are four main delimitations of this thesis, they are:

1. This report aims to study the five cases and not the whole automotive industry
2. Only transactions between OEMs in the automotive industry will be included
3. This report does not aim to investigate how successful each deal was
4. This report does not aim to decide who the winner of each deal was or which party that mostly benefited from the deal

The first delimitation is a natural consequence of the choice of making a case study. If the aim was to investigate the industry at large the interviewees would for instance have been differently chosen to reflect a more general view. However, the method of using a case study will give indications of activities in the automotive industry at large even though it will not draw conclusions regarding it.

The second delimitation is used in order to include cases where there is a big potential of new and innovative ways to transact knowledge and technology. According to the theory of value networks (presented in chapter 7.1.2.4), deals on a vertical level in the value chain are usually structured more around the classic buyer-supplier relationship with a physical product. By only choosing cases on a horizontal level (OEM to OEM) it is more likely to be studying deals that are taking place in a knowledge based setting according to the framework.

The third delimitation is important since if the success of each deal was to be investigated, several other parameters would need to be included and defined. There have been many articles and books written about what determines the success of a knowledge or technology transaction and they include looking at parameters such as the buyers absorptive capacity, the sellers transfer capacity, “Not invented here syndrome” and other organizational issues. Those issues will not be analyzed in this thesis.

Finally, there will be no discussion regarding who the winner of each deal was. Firstly, deciding who the winner was does not help to answer any of the research questions. Secondly, making such an investigation would require interviews with both sides of each story and it would be much harder to get impartial information.

6. Methodology

The methodology chapter will go through the idea behind the set-up of this report and the methodologies used to reach the aim of the report.

The authors of this report did in June 2009 complete a bachelor in *Industrial engineering and Management* at Chalmers University of Technology and both attended in August the same year the master's program *Intellectual Capital Management* which is completed by this thesis.

The ICM master's program has supplied the authors with a general perspective on intellectual assets, control and protection of the same in trading and other means for value extraction. This has laid the foundation for the focus and idea behind this thesis while further literature studies have lead to a more specific focus and identification of lacking research.

6.1. Literature studies and shaping the aim

When initiating the work in approaching the automotive industry from a knowledge/technology transaction angle our first step was to choose and define the perspective from which we aim to study and analyze. As mentioned, the ICM master's program has given us a knowledge based view on corporate assets and we identified a need for defining this perspective further. The foundation for this thesis has therefore been the concept presented by Petrusson (2010) in which he conceptually describes the different levels of knowledge-based industries and what typical activities are within industries that are on different levels on the scale from raw material based economy to knowledge based knowledge economy. The starting point is then to identify and exemplify the activities that are taking place in the automotive industry on the knowledge based levels in this framework in terms of transactions of knowledge and technology.

In order to investigate this activity we then needed to decide on a research methodology to be able to collect data for such analysis. The two classical alternatives would be the quantitative and the qualitative methodologies. However, in their purest form neither would be perfectly suitable since the quantitative method would be limited in the level of specification and deeper analysis while the qualitative method would not be able to deliver data that presents a range of activities and examples. When aiming to present a palette of examples on activities, on the given level of knowledge based economy, a combination with quantitative as well as qualitative aspects have been chosen. Taking into account our delimitation and scoop of the case study the total number of such deals is not too great. In order to find a proper size for the sample to study, it was therefore needed to take into consideration that the sample should be small enough to enable for a bit of deeper analysis while still be large enough to represent a significant part of the deals made in this category in recent time. The final number of cases that is to be studied was then decided to be five. This should enable for some deeper analysis while still showing on a range of activities and solutions considering the total number of similar deals that have taken place in recent years.

In relation to this, it is important to remember that this sample size would not be appropriate if one for example would like to prove a specific behavior in the industry. However, the aim of this report is not to prove a behavior or recommend the most successful strategy but instead to show a palette of activities and solutions used on the knowledge based level in Petrusson's (2010) framework in regards to transactions of knowledge and technology in the automotive industry.

The next question is then which five cases that should be analyzed in order to show on this range of varying activities and solutions while still keep to the delimitations. The parameters that should be fulfilled are; the deals shall be between OEMs, it shall concern large systems or architectures and it shall have been conducted in recent time.

Before and to some extent in parallel with the case studies literature studies were conducted. The purpose of these studies was to gain better knowledge regarding what aspects to study and analyze in the cases. What questions are brought up in the literature as critical issues in knowledge and technology transactions and why are these considered critical? In order to understand the strategy and the actions taken in the studied cases we have therefore compared the cases with some of the theories that are found in the literature. At an early stage we studied mostly general technology management literature and licensing literature but after some time it was found more specifically applicable to study articles on subjects such as collaborative R&D or open innovation in order to get the perspective on protecting in order to enable transaction.

6.1.1. Choosing the cases

The process of choosing the cases took its standpoint in the parameters that needed to be fulfilled. They should cover deals between OEMs, we were not interested in vertical deals in the value chain since the horizontal deals conducted to generate more leverage for the business also generates more complex deals between competitors and are more likely to be considered as activities on the knowledge based levels in the framework (Petrusson 2010). In addition the deals shall concern large systems or architectures in order to make the complexity increase and by that also making it more likely that activities are taking place at the knowledge based levels instead of concerning regular off the shelf components. The deals shall also have been conducted in recent time in order to give a fair view of the situation as of today.

These three parameters (OEMs, large systems and recent times) all described similarities that we required but in addition we were also aiming for some level of diversification in order to receive a range of solutions. We have therefore chosen deals with different arrangements in the transactions and means for controlling the technology.

With the intention of finding suitable deals that could be subject to our analysis the first source of information were the online newspaper Automotive News, similar online news reporters and blogs. In this way we could get access to potential deals that could be interesting to investigate further. When we had identified a collection of deals that could be suitable for analysis the final selection criteria was for which cases we could get access to good information and persons willing to participate in interviews. For this process a heavy mail correspondence with the involved companies were carried out to find persons that had strategic insight into the deals and that were willing to participate.

The exemption in using interviews is the case of Lotus and Tesla where they declined to participate in interviews but we still decided to include the case. That decision was based on our apprehension of having enough data surrounding that specific case to base the analysis on even without any interviews. This data would come from the reports published by the American Securities and Exchange Commission due to Tesla being a public American company. These reports are quite extensive even on strategic issues surrounding the company and together with the Tesla blog that

include several posts by executives we believed that we could get a fairly good view of the structure of the deal.

6.2. Execution and presentation

After having identified and selected the suitable cases to study, it was needed to find the right people to interview. This process took far more time than expected while still we feel that we were treated with a welcoming and helpful attitude in most companies, this even though we were interested in issues that in many cases contained sensitive information. The interviews were conducted over conference phone and lasted for typically one hour. The interviews were held with a template as guideline and this template had been sent to the interviewee before the interview. The structure of the interviews was individualized for each interview with regards to the nature of the deal that it was to cover while still focusing on the same issues for all deals. As being two persons conducting the interview, one person took main responsibility for handling the interview while the other took thorough notes from the content. Most interviews have also been followed up by a few additional questions via email.

Below you will find a list of the interviewed persons and their roles.

Interviewee	Actor	Title	Actor role
Carapezza, Angelica	Fiat	Coordinator, Business Development & management of alliances	Seller
Collins, Nick	Ford	until recently: Head of Business Association Group	Buyer
Gendraud, Pierre	PSA Group	Head of IP	Joint venture partner
Johansson, Gunnar	SAAB Automobile	Senior engineer	Seller
Stanger, John	Ford	Director Product Planning	Buyer
Thunes, Owen	Nissan	Senior Project Engineer, Electric, Hybrid & Fuel Cell Vehicles	Buyer
Timoney, Charles	PSA Group	Head of Licensing and Litigation	Joint venture partner

Table 1. The interviewed persons and their respective roles

The material in this report will at first be presented as objectively as possible as our interpretation of the interviews with additional data from other sources and without further discussions. Then, in the analysis chapter, we apply the literature presented in the theoretical framework chapter on to the cases in order to understand the underlying reasoning and implications of the actions. Finally, some conclusions will be drawn from the presented material and analysis of the same. However, these conclusions are, as mentioned before, not aiming to provide recommendations for a more successful behavior or prove a certain pattern of activities but instead to show a range of activities that are taking place in terms of knowledge and technology transactions in the automotive industry.

6.2.1. Presentation of relative contributions

In order to communicate our findings as clearly as possible to the reader we have chosen to use figures that describe the different components and their contribution to the deals in the case study and figures that describe the different control mechanisms and their contribution to the control position in the analysis. These figures aim to provide the reader with a sense of the relative amounts each component or mechanism has contributed with since this is important when understanding and comparing the different cases.

As the amounts in most cases are impossible to quantify through numbers they have been quantified using our impressions, experiences and, when possible, also numbers that has been acquired throughout our case studies. The figures and the relative amounts then represent the authors' interpretations of these.

For the figures describing the components of the deals in the case study the percentages represent the value each component had to the buyer in the deal if 100% was the total amount of what was transacted. The total amount of the transacted objects has been compared to the total compensation and from informally having discussed the relative values in the interviews, together with other sources of information, an interpretation of how the buyers have perceived the relative values of the different objects in the transaction have been developed.

For the figures describing the control positions in the analysis a similar approach has been used. In this case the 100% is not a perfect or complete control position but instead represents the total control position that has been achieved in each case. This also means that 100% represents different amounts of control in each case which has to be considered when comparing them. When determining the relative contribution between the different components their enabling effects to the deal have been considered. As being discussed in this thesis, certain amounts of control enable a transaction by making both parties feel secure in the deal. The question that has been translated in the figures has therefore been; to what degree have each control mechanism contributed to the enabling of the deal?

6.2.2. Model and focus

Taking a standpoint in Petrusson's framework for knowledge based economies it is clear that two of the most critical issues and differences are the type of carrier of the knowledge and the means for controlling the knowledge. Other literature on for example intellectual asset management and collaborative R&D suggests similar views on the demands of deals with knowledge. However, no perfectly applicable tool for analysis has been found when it comes to transactions of knowledge. This has resulted in an analysis solely based on keeping a tight focus on the carrier of the knowledge that has been transacted, what means for controlling that knowledge that has been used and in what way this control has enabled the transaction.

6.3. Credibility discussion

The literature for the theoretical framework is in most cases scientific articles collected from renowned scientific magazines. In cases where possible to choose, articles with more citations have been chosen and these articles should be considered relatively credible as these magazines generally are seen as widely accepted sources with very high demands on the author's and their sources.

When discussing the sources behind the case studies, the interviews, blogs and online newspapers such as automotive news, the credibility issue is slightly more interesting. Both the interviewed persons and company blogs clearly may have an interest in communicating a certain message. Even online media may have such interests even if these may be more difficult to identify. However, our intention has been to use the interviews to get hard facts and controllable data. In case there are opinions and interpretations included from the interviewed persons this has been stated. Furthermore, the interviewed persons have also been aware of the fact that the intention was to interview both sides of the deal. Even though we did not get the opportunity to interview both sides in all the deals it is likely that this have limited the interviewees possibility to communicate a one sided picture.

Concerning the blogs and the online newspapers the reasoning is, like for the interviews, that we mainly used hard and controllable facts. This type of data is more unlikely to be skewed due to its controllable nature.

For the Lotus-Tesla case two additional types sources are being used. Firstly, there are the so called 10-K reports from The Securities and Exchange Commission with descriptions on strategy and activities both for the past and the future written and supplied by Tesla. Secondly, there is the agreement between Lotus and Tesla that has been published due to the fact that Tesla is a public American company. It can also be found on The Securities and Exchange Commission's homepage.

7. Theoretical Framework

The purpose of this theoretical framework is twofold. Firstly there will be a part of introducing character that aims to put the reader into the context and mindset of this report on a relatively aggregated level discussing the literature and concepts surrounding the knowledge economy and knowledge based business. Secondly the two focus areas of this report will be thoroughly anchored and described according to the relevant literature existing today.

7.1. The Knowledge Based Economy and the Intellectual Capital Management movement

During the last 20 or 30 years there has been a significant change in the view of a firm's valuable assets. This change has shifted the management's view of what the key assets of the company are from the structural capital and other tangible assets towards knowledge and other intangibles. This shift has not only taken place among consultancy and service companies but also to an increasing degree in various capital intense heavy industries. As a new era and a new view of what the most important ingredient in the firm's value creation is, it has sometimes been referred to as the "ICM movement" (Sullivan 2000).

7.1.1. What is the Knowledge Economy?

Naturally there are several different interpretations of the term Knowledge Economy but the foundation of the term was laid by Drucker (1966) when describing the difference between the manual worker that worked with his/her hands in order to produce goods or services and the knowledge worker that worked with his/her head in order to produce ideas, knowledge and information.

A further developed framework and description of the Knowledge Economy is the one presented by Petrusson and Heiden (2010) illustrated below. This framework will lie as a foundation for this thesis and the approach this thesis takes to the Knowledge Economy in relation to the automotive industry. It will provide the context and frames of what is intended to investigate and analyze in the automotive industry.

In his framework, Petrusson describes a four step process for the development of a Knowledge Based Knowledge Economy. The process is on a highly aggregated national economy level but will be useful for the understanding of how this thesis will study the automotive industry. The process includes the following four steps:

1. **Raw material based economy**
2. **Production based economy**
3. **Knowledge based industrial economy**
4. **Knowledge based knowledge economy**

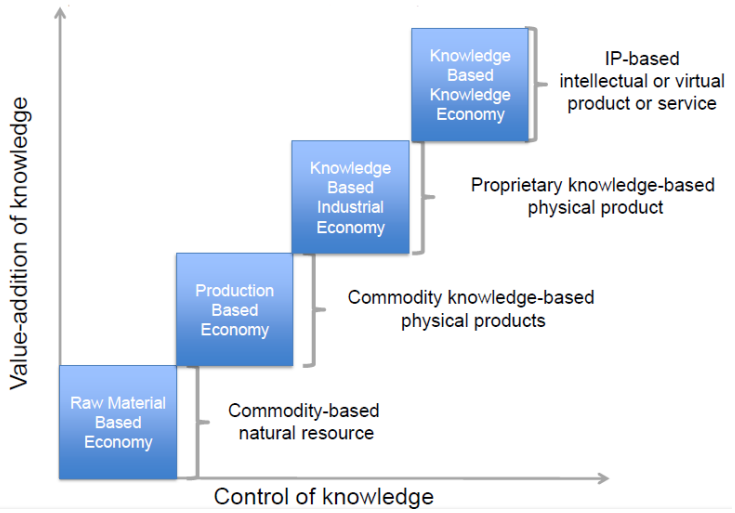

Figure 1. The different levels of the development to a knowledge economy (Petrusson and Heiden 2010)

In the raw material based economy the success of the business lies in the access to raw materials and land. The role of knowledge lies in how and what natural resources to use.

In the second step the focus for the business is to gain access to labor and capital, putting the factory and its efficiency in focus. The knowledge is here focused on how to produce and develop the factory. Applied on the automotive industry this would for instance have been the development of Henry Ford's factory with assembly lines.

In the knowledge based industrial economy the product that is being transacted is still a physical product but its success lies in the knowledge behind it. Examples of this would be the modern pharmaceutical, car, or electronic industries. The role of knowledge is here as input to develop and refine the products in order to put a more competitive product on the market.

In the last step the product has also become intellectual and the traded object is knowledge that has not gained a physical implementation. The role of knowledge is in this case both the input as well as the output. To summarize the difference between the two last steps one can say that in the knowledge based industrial economy the knowledge is a tool to create a product while it in the knowledge based knowledge economy it is a product in itself.

The distinctions between the different steps, though on an aggregated level, will be important for our analysis. This since the analysis of the report will focus on the activities in the automotive industry in relation to the different theoretical steps towards the Knowledge Economy. The automotive industry today is an industry that is a classic example of a knowledge based industrial economy in the way that knowledge is being used to develop and refine products to be competitive in the market. However, it has during the last years shown more and more signs of partly moving into the knowledge based knowledge economy, for example when it comes to the use of specialized

engineering firms (e.g. Lotus Engineering, Porsche Engineering, Saab Engineering Services etc.) and different kinds of horizontal collaborations. It is therefore interesting to see which kind of activities in the industry still relates to activities found in the third step in the framework above.

An important distinction between the steps and an area this report will focus on is the use and role of Intellectual Property in the different levels of Knowledge Economy. On the first and second level it has no or if any, it is solely being used for protecting the product. On the third and fourth level it is a bit more interesting. In the knowledge based industrial economy the role of IP is to control as much as possible with the goal of excluding competitors in order to get as large market share as possible. However, in the knowledge based knowledge economy the IP is used in order to share, create and price. The IPRs and other means of control are in this case seen as the enablers for cooperation and transactions. These differences are crucial for the rest of this report and for any analysis of transactions in businesses that has elements of both knowledge based industrial economy and knowledge based knowledge economy.

This is why it is important to make a distinction between deals that only include components found in the industrial economy and deals where there are components only found in the knowledge economy since the varying form of the transacted object and how knowledge is being used requires very different means of control and management. This is also the reason for this report's intense focus on the form of the transacted object and the means used to control it.

7.1.2. New concepts of the Knowledge Economy

In this section there will be a brief discussion on some key concepts used in the report. This is important since a number of them probably are new to some of the readers of this report and others have many different definitions depending on who you ask. To avoid misunderstandings the definitions used in this report will therefore be described.

7.1.2.1. Intellectual Capital, Intellectual Asset and Intellectual Property

Intellectual capital is the widest concept of the three including all "*knowledge that can be converted into profit*" (Sullivan 2000) and includes everything from inventions, ideas and general knowledge to processes, creativity etc. This definition makes no distinction between what is protected or not nor what knowledge is realized to be of value.

The intellectual asset on the other hand is realized, it is codified, tangible or in other ways a physical description of specific knowledge. This means that the company can assert ownership rights and the knowledge has a more tradable form. Examples of this are technologies, inventions, data, software etc. These are typical assets that have the potential of obtaining intellectual property rights.

In the last category, the intellectual property (IP), the legal system has identified the intellectual asset through five (six in the US) different protections enforced by the law. (Levin 2007)

1. **Patents –** For technical solutions and methods
2. **Design protection –** For esthetical shaping.
3. **Trademark protection –** For names and symbols used in marketing
4. **Copyright –** For the right of artistic works including literate works and software code
5. **Trade Secrets –** For confidential information.

In the US there is also specific protection for Semi-conductor masks. However, there are several other intellectual assets that could be desirable to control in business deals, but are not covered by any of the above. One of the main areas for such assets is the less specific forms of knowledge. Different ways of controlling and transacting those assets will be further investigated in this report.

7.1.2.2. The Three Arenas

A helpful model in order to understand the implications and distinctions between the different control measures is to think in terms of three different arenas on which the company acts; the administrative, the judicial and the business arena (Petrusson 2004). The administrative arena has actors such as patent attorneys and patent and registration offices and is the arena where intellectual assets can be registered as property. Those registered assets can be taken into the judicial arena by actors suing each other for infringements in a court of law where the court is the fundamental structure of the judicial arena. Actors can use the tools provided in the administrative and judicial arena (IPRs, legal actions etc.) when working in the business arena with various negotiations or business deals. The model of the three arenas will be used in this report when analyzing the different ways of controlling and transacting knowledge.

7.1.2.3. Codified Knowledge vs Tacit Knowledge and Know How vs Know Why

When analyzing knowledge transactions in a knowledge based knowledge economy it is important to be aware of the difference between tacit and codified knowledge. The tacit knowledge is as the name implies not easily defined hence not easily transacted. For the holder of the tacit knowledge it may also be hard to know what tacit knowledge he or she holds and therefore even more difficult to transact and control. Codified knowledge on the other hand is realized knowledge that is possible to write down or in other ways make a physical representation of. This makes it easier to transact and control (Sullivan 1996).

Other concepts in relation to this that may be good to clear out before the analysis of this report is the two different sorts of know-how. It will show that it is important to be aware of the difference between “know how” and “know-why” as two different aspects of the more generally used term “know how”. The terms indicate the meaning quite well, “know how” is a general awareness of how something works, what the specifications are and what it can be used for. “Know-why” on the other hand is a deeper understanding on why something works as it does, why the specifications are as they are and what the implications would be if it was modified. (Sullivan 1996)

The two different classifications of knowledge can be analyzed in a two-by-two matrix as seen below in Figure 2. Most knowledge can be categorized as belonging to quadrant one or three (shadowed below). This since knowledge that is of a deeper *know-why* character it is usually very difficult to codify while know-how most often is codified or has the potential to be codified in the form of specifications, drawings, instructions etc. When know-how and *know-why* is mentioned in this thesis it is in other words in order to specify what kind of knowledge that is intended.

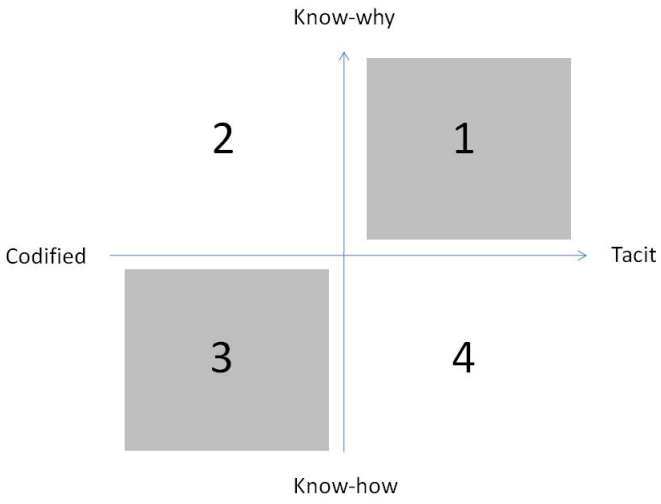

Figure 2. Matrix describing different kinds of knowledge.

7.1.2.4. The value network

When moving from the raw material based and the production based economies to the upwards right in figure 1, the flow in the value chain has to an increasing degree also included knowledge and information. This flow has in many cases not followed the old channels of the tangible goods and the concept of the *Value Network* is sprung from this development. Allee (2003) defines the value network as: "Any web of relationships that generates both tangible and intangible value through complex dynamic exchanges between two or more individuals, groups or organizations. Any organization or group of organizations engaged in both tangible and intangible exchanges can be viewed as a value network, whether private industry, government or public sector." This indicates a view of the company's environment that is moving away from the linear flow of goods in the value chain to a more complex view of the company as the hub of a network of actors connected by flows of both tangibles and intangibles.

The concept of the value network is important when understanding why the parameters that were used when deciding which cases to investigate in this report were chosen. It is for example the reason why it is more interesting to look at deals between OEMs, which can be considered to be in a value network, instead of buyer – supplier relationships that generally originate in the value chain model.

7.1.3. Markets for knowledge

This report will investigate which knowledge and technology that was transacted between the firms and there is a strong reason to believe that there will be other carriers for this than tangible products. Since this is the case it is interesting to give a short introduction to the problems identified by the literature today when dealing with knowledge instead of physical products.

When moving from the industrial economy where the knowledge is packaged into products and sold on a market for products, towards a position where knowledge is transferred and packaged in IP and contracts and ultimately where also tacit knowledge is being transferred (up-right in figure 1), the complexity of the transactions is heavily increased but so is the value potential (Granstrand 1999). The increasing complexity is mostly due to the fact that institutional frameworks built up for the market is created for physical goods while supporting institutions for the identification of the product as well as identification mechanisms for the market opportunities when dealing with knowledge is

lacking (Teece 1981). It is easy to put a physical product on the market where you advertise its characteristics and advantages, but how do you go about when your product is knowledge? The problems include describing what is being offered without giving it all away as well as finding the infrastructure (distributors, retailers etc.).

Another important aspect is the markets' valuation of the knowledge. This, since a given set of knowledge will generate heavily shifting value depending on the receiver's complementary assets and prerequisites. In other words the context in which the knowledge will be used determines its potential value for the buyer and by that also the buyer's perceived value and willingness to pay. A common comparison for this is that of the real estate market. The value of a real estate is to only a small extent determined by the configuration of the real estate in itself, it is rather determined by which context it is situated – its location. The similarity to knowledge market is obvious when trying to put a price tag on a real estate without knowing where it is situated. (Heiden 2011)

Going further with the value of knowledge, even though the difficulty of valuation increases, the potential value for the seller will increase as well. This is because even though knowledge might be expensive and difficult to create, it is often cheap and easy to duplicate. Due to its intangible and replicable form it is also, if managed correctly, possible to have the cake and eat it too. (Granstrand 1999)

7.2. The Transaction and Control perspective of Knowledge- and Technology transactions in the automotive industry

In this section the two focus areas of this report will be further described. By looking at the available literature in those areas it will give a deeper understanding of those two areas; the type and form of the transacted object and the aspect of control.

7.2.1. The transacted object

Transacting knowledge in the industrial economy is conceptually relatively simple. Knowledge is developed and put into a product. That product is then sold and generates value both for the customer and the seller. It is more common in the industrial economy to have the knowledge patented in order to exclude others from producing and selling the same product instead of transacting or selling it. Deals on a horizontal level, between actors on the same level in the value chain is therefore, if generalizing a bit, not common in the industrial economy as IP is seen as a mean to exclude as much/many as possible and not as a mean for enabling transactions. (Petrusson 2004)

The interesting aspects of knowledge transactions occur when moving along the sliding scale towards the knowledge economy. In Figure 3 below you can see how Granstrand and Sjölander (1990) illustrate a basic view of the possibilities the firm has when it comes to transacting and thereby creating value from its knowledge or in this case, its technology, both as the input and output. Granstrand and Sjölander mean that the further down the list, the higher is the degree of openness. This can also be seen as a drift on the scale towards the knowledge economy since a higher degree of openness is the opposite of using patents and other IPRs as a mean of excluding others. In this report there will be examples of a joint venture as well as technology purchasing and selling.

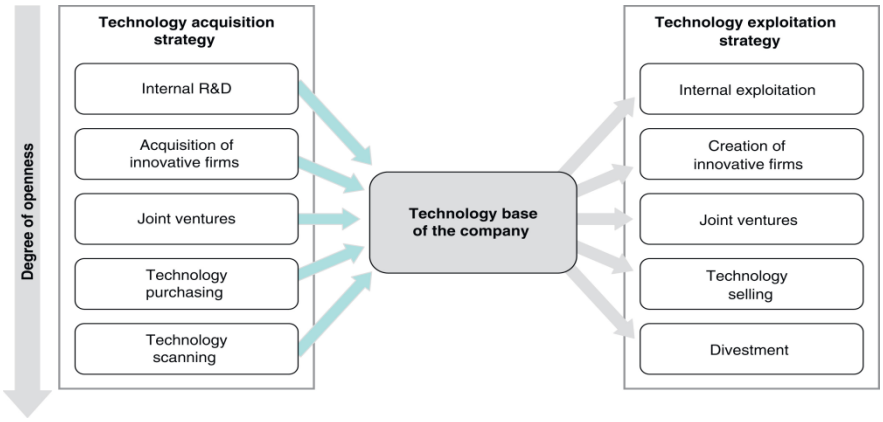

Figure 3. Generic strategies for acquisition and exploitation of technology. (Granstrand & Sjölander 1990).

When discussing the increased complexity of transactions it is important to remember that the difference from the industrial economy does not automatically lie in the complexity of the knowledge or technology per se but instead in how the knowledge or technology is handled and transacted. As being obvious from Zhao et al. (2005) there are, in the knowledge economy, a vast number of potential carriers when transacting knowledge. These are, among others, consultancy hours, documentation, training, employees, licenses and the more informal such as "looking over the shoulder". Zhao et al. (2005) concludes that the carrier used heavily affects the result of the transaction in terms of speed, control and completeness of transfer. Another aspect of the carrier for the knowledge is presented by Balconi et al. (2007) as well as Teece (1981) where they state that the choice of carrier used to transfer the knowledge has to be dependent on the level of codification. Really tacit, inherently uncodifiable knowledge does, if at all possible, require a lot of human interaction and imitation of a master to be transferred. On the other side of the scale knowledge codified in a standardized way can be transferred without human interaction through tools where the knowledge is inscripted. Somewhere in between lies the knowledge that is tacit but articulated which can be transferred through verbal communication. The conclusion is that the less codified the knowledge is, the harder and thereby more costly it is to transfer (Teece 1981).

As we have showed from the available literature on the knowledge economy and its differences from the industrial economy one of the major distinctions lies in what is actually transacted. One could argue that in both the knowledge based industrial economy and the knowledge based knowledge economy the traded object is knowledge. However, the carrier of that knowledge is very different, in the industrial economy it is a physical product carrying the knowledge while in the knowledge economy it is often traded in a less tangible form. In order for us to study and draw conclusions regarding knowledge and technology transactions in the automotive industry from a knowledge economy perspective we will therefore put our main focus on studying what form the transacted object has. Based on the literature we have studied on the knowledge economy it is evident that the form of the knowledge is an utterly important aspect from a control and management perspective. The first of our two focus areas for the study is therefore, as mentioned before in research question number two: *What is being transacted and what form does it have?*

7.2.2. The control aspect

The second part of our focus or tool for analysis is to follow up on the transaction perspective by analyzing how this transacted technology or knowledge is being controlled by the seller.

The main area for control, in addition to that control or protection that is acquired by IP, is know-how. Know-how, as more loosely defined knowledge, is generally difficult to protect by IP while still being very valuable to the owner. The nature of know-how as being "leaky and sticky" (Slowinsky et al 2006) also makes it very difficult to protect. Know-how is "fun to talk about and once you hear it, you remember it". Taking this into consideration, if certain know-how is valuable to the business it is essential to develop a strategy to control it if one wants to engage in any collaboration or transaction of technology. (Slowinsky et al 2006)

When trading technology, for example in the form of patents, there is often a need to also transfer know-how since the technology may be broader than the patent(s). To the buyer this surrounding know-how may be very valuable since it is expensive and complicated to recreate. This applies especially when the knowledge bases for the companies have no overlap since the licensee then needs the surrounding knowledge in order to benefit from the deal. If both parties are on the same level in terms of knowledge on the area in question, then the need for control may be less since often little surrounded knowledge is included. The transacted object is limited to the right to use one or more patents and by that the control issue is covered by IPRs which makes the seller comfortable in making the transaction. (Forslund 2010)

When the deal extends outside IPRs, problems for the seller includes that it is often difficult to define its obligations and also in many cases requires extensive human interaction to be transferred. The fact that knowledge is "leaky and sticky" as well as difficult to define and requires human interaction is a great problem to the seller but as discussed earlier it is also a great opportunity as it is very valuable to the buyer. The problems for the buyer build to a large extent on the fact that it is very difficult to buy something when you do not know what you are buying. The problem of defining what know-how that is included in the deal may be a great problem to the parties. However, it is an even greater problem taking it one step further and making it that clear enough so that a third party, for example a court, can judge if the agreed know-how has been transferred or not. This problem of being able to take a potential contract extending outside pure patent licenses into the judicial arena has big effect on a seller's willingness to include know-how in business deals. (Arora et al 2001)

This is where patents and clear contracts can generate an open and innovative atmosphere due to both parties being clear about who has rights to what. (Bogers, 2011) This is an example of how control can enable and improve the outcome of a transaction or collaboration. Bogers (2011) further speaks about so called tension fields between the parties and how they decrease with different sorts of protections and embodiments such as IPRs. The tension fields can be seen as a result of insecurity and fear for opportunism in the transactions or collaborations.

Both Bogers (2011) and Arora et al (2001) mean that another way to solve this is to not engage in technology transacting activities unless you have had a long reliable relationship with that partner. The transfer is then built on trust instead of control. However, this is more a case of business integration and the need for control has decreased. This is not the interesting aspect then since this method heavily restricts the potential partners, buyers or suppliers of the technology and knowledge to those that one has a close relationship with. The interesting aspects arise when trading knowledge with those who you do not trust. According to Arora et al (2001) the underlying problem in knowledge transfer is double-sided opportunism. This means that both sides are looking for possibilities to get more or other know-how than agreed upon or to give less or other know-how. The

cure for this is control over the transfer. The means used in order to control is numerous and only the creativity among the managers set the boarders for what is possible. However, there are a few classic examples suggested. First of all there is payment by royalties. This avoids the seller from not gaining in proportion to the value created for the buyer. This is not a mean for controlling the transfer of the know-how in itself but instead a mean to ensure that the seller is getting paid for all the know-how and thereby increasing its willingness to transfer. Secondly there are different ways of "hostage-taking". This implies that the seller has a "hostage" that can be "killed" if the buyer misuses the know-how. In practice this could for example be a license for a patent crucial for the transferred technology. The seller or licensor can then withdraw the license making the know-how more or less useless for the buyer or licensee. The bundling of know-how with the more tangible IP enables the seller to also have better control over the more loosely defined know-how. This implies a reinforced contractual control where one is not dependent only on interpretations and judgments of contracts. Other ways of keeping a "hostage" from the buyer's point of view includes keeping parts of the payments until the transfer is complete. (Arora et al 2001)

There are naturally several other means for control and in our cases we will study what means are being used and how industry handles control. Our second focus area is therefore, as mentioned before in research questions number three and four: *What means for control are being used and in what ways have they enabled the transactions?*

8. Case study

In this section the cases will be presented and described with the interviews as the main source of information. A summary of the cases including which companies that are involved can be seen in Table 2 below.

Type of deal	Companies involved
Joint Venture around production of small cars	TOYOTA ⇔ PSA PEUGEOT CITROËN
Supplier agreement of hybrid driveline	TOYOTA ⇒ NISSAN
Single sale of tools, IP, tools and various technical documentation	SAAB ⇒ BAIC Group
Contract manufacturing and development of small car	FIAT ⇒ Ford
Contract manufacturing and development of electric sports car	LOTUS ⇒ TESLA MOTORS

Table 2. A summary of the five different cases included in the case study.

8.1. Toyota – PSA group – manufacturing Joint Venture

This case is a 50-50 Joint Venture (JV) between Toyota and the PSA Peugeot Citroën group. The JV is called TPCA (Toyota Peugeot Citroën Automobile) and its main asset is a factory in Kolín, Czech Republic where all the three models Toyota Aygo, Peugeot 107 and Citroën C1 are manufactured on the same line. (TPCA 2011)

The Companies		
	Toyota	**PSA**
Employees (2010)	318 000	198 000
Revenue in US $ (2010)	228 billion	75 billion
Origin	Japan	France
Summary of the deal		
Type of deal	50-50 Joint Venture	
Timeline	Deal signed: 2002 First car produced: 2005 Ongoing (2011)	
Scope	JV regarding one factory in Czech Rep where 300 000 units of three different models are produced annually.	
Intended market	Europe	
Main source for study	Interview with Charles Timoney (Head of licensing and litigation, PSA) and Pierre Gendraud (Head of IP, PSA)	

Table 3. Short facts about the companies and the deal

8.1.1. Background

The situation for PSA at the beginning of the 00s was that they had two car models in the supermini class (Citroën Saxo and Peugeot 106) which shared several components. Especially the Peugeot which, in different versions, had been on the market since 1991 needed a replacement. As for Toyota, who where in the process of establishing a manufacturing base in Europe, they had no car on the European market in this supermini segment but had goals for expanding their business in Europe. (Timoney & Gendraud 2011)

In 2001 the first cooperation agreement between PSA and Toyota was signed with the intention of collaboration in developing and building a small car for the European market. Production was started in February 2005 and the factory now produce 330 000 cars per year with a distribution of 1/3 of each model. The factory in Kolín is the only one where those three models are produced and 99% of the volume is for export. There is no common marketing or sales organization, the JV only revolves around the manufacturing of the cars. (TPCA 2011)

Incentives for the collaboration could naturally be found in economy of scale. The cars where targeted to be among the cheapest on the market and the higher the volumes, the lower are the fixed costs for each produced car. However, Timoney and Gendraud (2011) explained in the interview that the different competence profiles of the companies created further incentives. Toyota is well known for their creation of new production processes ("the Toyota way") and factory set-ups. PSA on the other hand, as the second largest European automobile manufacturer (World ranking 2000), had a big supplier network and was very familiar with purchasing, price levels and negotiation culture in Europe (Timoney & Gendraud 2011).

In 2002 the Joint-Venture agreement was signed and the construction of the factory in Kolín was started the same year. The first cars were produced in 2005 and most components are shared for all three models. The difference between the vehicles does not include any basic technologies but lies in different visual components to make the cars distinguishable for the customers. (TPCA 2011)

8.1.2. The set-up of the deal

The basic thought behind the set-up of the deal is to take the most advantage of each parties contributing competence. This resulted in that Toyota was responsible for setting up the factory and developing the technologies for the cars. Basically, the idea was to build a copy of Toyota's other factories and implement essentially all Toyota principles with the goal of making the factory as efficient as possible. Since the keys for success with this JV were efficiencies and economies of scale, much came down to Toyota making the factory as good as possible. In the interview Timoney and Gendraud (2011) explains that Toyota's manufacturing processes were implemented and that Toyota could not retain technology since that would limit the efficiency of the factory which would affect Toyota too. It was taken to the extent that much of the tools and factory equipment was sourced from Toyota's suppliers in Japan and some argue that this factory in fact was as good, if not better, as the Toyota's other factories (Automotive News 2005). PSA on the other hand was responsible for sourcing the supplier network and negotiating all the supplier relationships to the TPCA factory (Timoney & Gendraud 2011).

The compensation structure was constructed in order for both companies to be equally compensated for their contributions. This since the basic foundation was that even though they contributed with different competencies it was a 50-50 JV and Timoney and Gendraud (2011) are

clear on that equality was very important. Toyota naturally had more licensing fees for patents from the JV since they were in charge of both the production techniques as well as the proprietary technologies implemented in the cars (the two IP-intense components of the deal). However, this was equalized by PSA receiving the same amount as a "rent for their commercial arrangements with the suppliers". (Timoney & Gendraud 2011)

8.1.3. Knowledge and technology transacted

When talking about transactions in this case it is important to be clear about what transactions are being discussed. The focus is the transactions from PSA and Toyota respectively to the JV. When later discussing the control mechanisms the focus is naturally to control or limit transfers of information from the JV to the parent companies or directly between the parent companies. The different transactions are illustrated in the figure below.

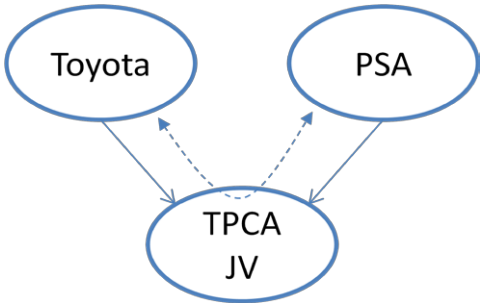

Figure 4. The different transactions between Toyota, PSA and TPCA

The two tables below shows what objects were transferred from PSA and Toyota to the JV respectively and what relative contribution the different objects had. The transacted objects are then described further.

Transacted Objects from Toyota to JV

Transacted objects	Relative contribution	Description
Production system		Toyota supplied the whole production system
The cars		Toyota developed all three cars produced
Licenses to manufacturing IP		Toyota grants the JV licenses to their manufacturing IP
Licenses to car IP		Toyota grants the JV licenses to IP included in the cars
Total	0% 100%	

Table 4. Toyota's transactions. Table describing the transacted objects and the authors' interpretation of their relative contributions to the total deal.

Transacted objects from PSA to the JV

Transacted objects	Relative contribution		Description
Supplier relations			PSA is responsible for sourcing all components
Experience on business praxis in Europe			PSA handles all negotiations with suppliers
Total	0%	100%	

Table 5. PSA's transactions. Table describing the transacted objects and the authors' interpretation of their relative contributions to the total deal.

How Toyota transacted their production system was explained in the interview with Timoney and Gendraud (2011). It was transacted by Toyota taking the decisions on how the manufacturing should be arranged and which practices should be implemented. Furthermore, these decisions were executed by Toyota employees with experience from Toyota factories who were transferred to the factory in Kolín. Toyota themselves were also going to produce cars in this factory which meant that all improvements or lack of improvements would affect them too, a factor that made Toyota more willing to transfer all their production technologies to the jointly owned factory in Kolín (Timoney & Gendraud 2011). The organization of the factory was set up in accordance with the 50-50 Joint Venture mindset. All aspects of the management and decision making had to be equal between the two parties. The result was that the general workforce was a mix of employees from PSA and Toyota together with local human resources. The managerial position was on a rolling schedule with 6 months intervals. This was true for both the manager as well as the vice manager since when one position was held by one of the companies, the other was held by the other. This arrangement only concerned senior management "…and was implemented due to equality reasons" (Timoney & Gendraud 2011).

The other competence Toyota brought to the JV was that of developing the cars. However, this competence in itself was not transacted to the JV but the result of it was put into the cars produced there. In the interview Timoney and Gendraud (2011) states that Toyota conducted all the development work but no development is conducted within the JV. More specifically, the development expertise and *know-why* behind the technologies used in the cars was kept in-house at Toyota even though the resulting know-how was transacted to the production line or its suppliers, codified in components, drawings and specifications.

PSA's contribution was transacted to the JV by having a group of people that handled the suppliers and managing purchasing. The competence in this group was around the way to do business in the automotive industry in Europe. Besides the specific knowledge of price levels, previous relations and best practices, Timoney and Gendraud (2011) mean that this was also knowledge of cultural issues on how to do business in Europe. The way to do business with suppliers in Europe was transacted to TPCA but only by being used by the PSA-employees who worked with this. (Timoney & Gendraud 2011)

8.1.4. Means for control

In this case there are three main aspects of the control positions Toyota and PSA have towards each other and one additional circumstance that contribute to the control position.

1. **Contractual control:** In terms of the restrictions of using technologies protected by IPRs in the JV contract.
2. **Control by IPR:** In terms of the patents covering various production methods and technologies included in the cars.
3. **Control by secrecy:** In terms of sharing know-how regarding the technologies (documents and specifications) needed to produce the cars but keeping the *know-why* (deeper understanding) inside the parent companies.

(4.) Control by contextual value: In terms of the transacted knowledge not being valuable in a context outside the collaboration and by that limiting the need for control.

The main control measure that enabled the transactions made by the two companies was the contract that framed the Joint Venture. The contract specified how each company was allowed to use technologies that were covered by IPRs. These were not allowed to be transferred out of the JV to any other facility than the TPCA factory (Timoney & Gendraud 2011). However, this was only true for patents granted in the country where the contract was written, the Czech Republic. Patented technologies used in the TPCA factory but not granted in the Czech Republic were not regulated by the contract. Know-how that was not covered by patents was not included in the contract and therefore had no mechanism regulating how the companies could transact this to other parts of their businesses. According to Timoney and Gendraud (2011) the contract had holes since it lacked paragraphs on how to treat non-patented knowledge.

The second way in which control was handled was by IPRs. Timoney and Gendraud (2011) explained that the typical patents that were subject to this were patents on Toyota's production system. There were also several patents covering technologies included in the cars while no IP was owned by the JV, all was under license from the parent companies. In the event of any developments or improvements that could obtain patent protection within the activities in the JV, those were assigned to the parent company that the inventor originally belonged to. The potential inventions would initially therefore only be communicated to the parent company in question. (Timoney & Gendraud 2011)

Secrecy was used in cases where only the basic know-how was needed, for example to manufacture the cars while the *know-why* behind it was kept within the companies. One example of this would be licenses to patents on components of the cars where the background knowledge on why the components looked like they did (the knowledge surrounding the patent) was not transacted. According to Timoney and Gendraud (2011) Toyota brought ready developments (specifications and components) to the JV while no development was conducted in the JV.

A final circumstance that is related to the control issue is regarding PSA's contributions. Timoney and Gendraud (2011) stated that PSA saw no obvious way to control their transacted supplier relations or insights to the business culture in Europe . Furthermore, PSA saw no obvious need for controlling this since they did not see the benefit it would make for the rest of the Toyota organization. Hence, PSA were willing to make this transaction anyway. (Timoney & Gendraud 2011)

8.2. Toyota – Nissan – supply of Toyota's hybrid driveline for the Nissan Altima

This case is the most IP intense of the cases that are handled in this report. It concerns Nissan's licensing of the Toyota HSD (Hybrid Synergy Drive) driveline for their Altima model on the US market.

The Companies		
	Toyota	**Nissan**
Employees (2010)	318 000	176 000
Revenue in US $ (2010)	228 billion	81 billion
Origin	Japan	Japan
Summary of the deal		
Type of deal	Supplier agreement	
Timeline	Deal signed: 2002 Car introduced: 2007 Ending: 2011	
Scope	Toyota supplying Nissan with access to Hybrid Driveline to implement in the Altima model. 34 251 (March 2011) Nissans produced.	
Intended market	9 states in the US	
Main source for study	Interview with Owen Thunes (Senior project engineer, Electric, Hybrid & Fuel Cell vehicles, Nissan)	

Table 6. Short facts about the companies and the deal.

8.2.1. Background

The state of California has always been in the forefront when it comes to putting up strict emission policies and other regulations in the US that aims to benefit the environment. In the last few decades it has also become increasingly difficult to meet the US federal air quality targets without putting emission limits on cars in California due to the population density. With this background, Thunes (2011) described in the interview how Nissan saw the need for a hybrid car with low emissions especially for the Californian market and started development of a hybrid driveline during the early nineties. In the late nineties when the development reached a point where a few prototypes were produced Nissan had to realize that it was too expensive to become an attractive car for the consumers. Simultaneously Nissan were financially not in a position where it was possible to push the development forward. Nissan needed a quick and cheap way to put a hybrid car on the market. (Thunes 2011)

At the same time Toyota, that had developed their HSD driveline for the Prius since the eighties and spent very large amounts of money on that development, suffered from difficulties of covering the development costs with the Prius' that were sold. Based on the fact that Toyota needed more revenues to cover the development costs of the HSD, the regulatory environment in California that made other car manufacturers willing to pay for access to a hybrid driveline and the fact that the HSD was heavily patented was contributing factors for Toyota to go into a licensing model for the HSD system (Thunes 2011). A contributing factor for Nissan becoming a partner where more or less the whole system (not only parts of it) was licensed is that Toyota launched the Camry in 2007 with HSD. This made it easier to adapt it to the Altima thanks to the many similarities between Camry and Altima. Other actors, like Mazda and Subaru, have licensed parts of the system and Toyota Executive Vice President Takeshi Uchiyamada said in an interview that the latest deals are in line with the

company strategy and Toyota "will consider requests from other companies to supply our hybrid technology," if asked (Auto Observer 2010).

8.2.2. The set-up of the deal

Nissan licensed the second generation of the HSD system from Toyota which was the same system as Toyota put in the Camry model during the same period. The deal was structured around licenses granting Nissan access to Toyota's suppliers that manufactured the parts included in the HSD system and software for controlling the HSD. All parts except for some commodities were sourced directly from Toyota suppliers and were delivered as plug-in solutions to Nissan USA where they were assembled into the Altima in the Nissan factory in Tennessee. The adaptation process of the system in order for it to function for the Altima was carried out by Nissan engineers for both the physical system and the software. Support from Toyota for this adaptation process was not included as a part of the deal. (Thunes 2011)

The compensation consisted of one initial upfront fee that allowed Nissan to build a certain number of cars and continuous payments for the parts. (Thunes 2011)

8.2.3. Knowledge and technology transacted

The table below visualize how much of each of the five components that are part of this deal. It is worth noticing that supplier employees and knowledge in informal support was not intended to be part of the deal initially but was transacted nevertheless. Each of the components will be further described below.

Transacted object	Relative contribution	Description
Licenses to use Toyota's supply network		Components needed for a hybrid driveline
The source code		Control code for hybrid system
Supplier employees		"A handful employees" (Thunes 2011)
Informal support		"A few unofficial phone calls" (Thunes 2011)
Fixed programming parameters		Limits for software adaptation to Altima
Total	0% 100%	

Table 7. Table describing the transacted objects and the authors' interpretation of their relative contributions to the total deal.

The technology to be transacted in this case is the technology needed for the HSD system. Formally, this could be perceived as a pure licensing deal (and is often spoken and written about as such) but in practice it works more like a supplier relationship since the adaptation process was handled by Nissan and the different components are delivered to Nissan through Toyotas supplier network as plug-in solutions. The technology was delivered in ready-to-use products and the knowledge required to put the system in the car was fairly low, "Everything that is subject to a Toyota patent comes from a Toyota supplier" (Thunes 2011). The know-how and especially the *know-why* surrounding the HSD-technology was therefore only transferred to Nissan to a very limited degree due to the plug-in nature of the components.

Apart from the licenses to suppliers and the supply of physical products Nissan received the source code for all the systems related to the hybrid. This code is written in C and more or less open source which makes it possible for Nissan to study, interpret and adjust it. Since the code for such a system is rather extensive it required much understanding and studying to be adapted to the Altima. However, Nissan did not receive support or *know-why* related to how it worked or how it should be adjusted. In the interview, the arrangement was illustrated by: "Toyota said: Here's the code for all the systems, now go away." (Thunes 2011). Thunes further explained that the major part of the knowledge that Nissan has gained from the transaction is a result of the self-generated learnings that has been a consequence of the adaption process that Nissan carried out without any significant assistance from Toyota.

In order to complete the adaptation process and to speed up the learning process around the HSD system some employees were hired from Toyota's suppliers. Furthermore, there was some interaction between Nissan and Toyota engineers and there have been "a few unofficial phone calls" on some specific questions during the adaption process. None of these were part of the original deal with Toyota (Thunes 2011).

The final part of the transaction was also in connection to the source code. Toyota put up boundaries or parameters in the software code that Nissan needed to keep within in their adaptation process for the warranty still to be valid. The boundaries were a result of Toyota's knowledge on the functionality of the system and how to make it work properly which is why it can be said to be a transaction of knowledge. The warranty was included as a regular supplier responsibility for the supplied components. (Thunes 2011)

8.2.4. Means for control

In the deal between Toyota and Nissan five means of control used by Toyota has been identified.

1. **Control by IPRs:** In terms of the patents covering the transferred technology.
2. **Control by managing the supply chain:** In terms of only enabling sourcing of parts from Toyota supplier network.
3. **Technical control:** In terms of keeping the knowledge hidden within technical solutions and components (black-box solution).
4. **Control by secrecy:** In terms of only transferring physical parts and software. Deeper understanding (*know-why*) via human interaction has only been transferred to a very limited degree.
5. **Contractual control:** In terms of the supply contract binding the deal together.

The HSD system is covered by a large number of patents which forms the foundation for Toyota's control position in this case. The second generation of HSD, which is the one Nissan uses, is covered by approximately 370 patents (Lloyd et. al 2009).

A closely related aspect to the IPRs is that of the supply of components. In this case Toyota controls Nissan's supply of components by only making it possible for them to source from Toyota's closely incorporated suppliers. Licenses to the patents are only granted to Toyota's suppliers. Nissan holds no patent licenses since they purchase the components ready to be plugged in (Thunes 2011). This makes it more like a normal buyer-supplier relationship.

The consisting components of the HSD system are delivered as black boxes and plug-in solutions (Thunes 2011). This makes it more difficult to explore and learn from the technology that is inside these components. This limits the risk for Toyota that know-how or *know-why* is transferred to a greater extent than what was intended. This way of hiding the knowledge in a closed technical component is builds up the technical control.

Apart from these three aspects of control used by Toyota, the secrecy concerning the know-how and *know-why* further emphasizes the boundaries of the scoop of the deal. By avoiding interaction between employees of Nissan and Toyota and instead only supplying Nissan with components and source code Toyota further limits the risk of transferring know-how or *know-why*. Some interaction and support have taken place (Thunes 2011), but the overall theme of this deal was to transfer a technical solution and not knowledge of that solution.

Finally, there was of course a supply contract written between the parties. This did not contribute with any further aspects of the control position for transacted knowledge but is included since it was a way of tying the deal together and taking care of other business aspects and promises from both parts.

8.3. Saab – BAIC – Sale of tools and documentation for discontinued models

This deal is simple in the way that it is very clear what was transferred. The buyer, BAIC, was willing to pay for the tools and technical documentation needed to build discontinued versions of the Saab car models 9-3 and 9-5 in their facilities in China (Johansson 2011).

The Companies		
	Saab Automobile	**BAIC**
Employees (2010)	3 500	N/A
Revenue in US $ (2010)	1,1 billion	N/A
Origin	Sweden	China
Summary of the deal		
Type of deal	Single sale	
Timeline	Deal signed: 2009 Execution: 2009-2010	
Scope	Saab sold IP, documentation and tools needed for the production of three different car models and received $200 million.	
Intended market	China	
Main source for study	Interview with Gunnar Johansson (Senior engineer, Saab)	

Table 8. Short facts about the companies and the deal.

8.3.1. Background

In 1990 General Motors (GM) bought 50% of the shares in Saab, included in that deal was an option for the remaining 50% which was exercised in 2000 making GM the sole owner of Saab. In connection with the financial crisis in 2008, GM's business was at a loss and one of the announced measures to reverse the trend was to put Saab under review. The main option considered was to do a so called-carve out of the company from GM and to make Saab a stand-alone company. Several potential buyers declared interest in buying the company and one of them was the Swedish company Koenigsegg Group. Along with Koenigsegg came Norwegian investors and contacts to the Chinese car manufacturer BAIC (Beijing Automotive Industry Holding Ltd). When the deal with Koenigsegg fell through, Saab went into plans for liquidation since the resources reserved for the carve-out from GM was running out. Cash was quickly needed and even though the deal with Koenigsegg had fallen through, the discussions between Saab and BAIC continued. (Johansson 2011)

BAIC was interested in the possibility to build cars for the Chinese market based on technology from Saab since they previously only had acted as a contract manufacturer and therefore did not have a BAIC-developed platform to build their own cars. For Saab, the incentive was their big need of cash in order not to go into default (Johansson 2011). This lead to that it in December of 2009 it was announced that BAIC would buy the tools, technical documentation and some patents to three car models. The models were the 9-3 version which was taken out of production in 2003, the first version of the 9-3 launched in 2004 and the 9-5 sedan that was taken out of production in 2009.

8.3.2. The set-up of the deal

Johansson explained in the interview (2011) that BAIC paid Saab with cash for the tools, all technical documentation and some patents surrounding the three car models in order for them to produce and sell those models, with some modifications, on the Chinese market. The modifications had to be

big enough for the car not to be confused with a Saab and BAIC had no rights to use Saab's trademarks.

Saab would not provide assistance with implementing the technologies or in building the factory needed for the production. They would however provide some assistance in sorting out what was what in the massive amount of technical documentation that was transacted (Johansson 2011). As compensation for the content of the deal Saab received roughly $200m (Reuters 2009).

8.3.3. Knowledge and technology transacted

The table below illustrates the different components of the deal and their relative contribution to the total deal.

Transacted object	Relative contribution	Description
Technical documentation		Drawings, test files, reports, instructions etc.
Tools		Physical manufacturing tools with very high acquisition costs
IPRs		≈ 25 patents. Some with shared ownership
Consultancy hours		≈ 5 people for 8 weeks in total
Total	0% 100%	

Table 9. Table describing the transacted objects and the authors' interpretation of their relative contributions to the total deal.

The most tangible part of this deal was the tools needed to produce parts for the cars. The other, more interesting parts were the different kinds of documentation. Among other things there were technical demand specifications, drawings, CAD-data, report sheets from computer simulations, test reports, different kinds of instructions and directions for assembly, a list of suppliers and a cost book with cost positions for the different parts (Johansson 2011). The documentation was transacted in both digital form on a hard drive and on paper. All these components included vast amounts of know-how in relation to how to recreate the cars as they were built in Sweden (Johansson 2011). It also included know-how on which suppliers that were used for the production in Sweden and what those suppliers had been paid for the different components to the extent Saab was permitted to disclose such information.

In a few rounds, Saab employees visited BAIC in China and performed some consultancy services. Those services where almost exclusively related to helping BAIC's employees finding their way in the documentation provided. This was a necessity considering the extent of the documentation – full containers of paper and a hard drive with thousands of computer files (Johansson 2011).

One important distinction in what was transacted is that all different kinds of report sheets, drawings and instructions were on how the finished car behaved and looked like. It did not include the documentation generated during the development leading up the finished car. In Johansson's opinion (2011), this results in that although Saab sold and transacted the know-how to build the cars, they did not transact the *know-why* in relation to why the cars have the specifications they do or

know-how on how to develop them. In other words they transacted how to build these cars but not how to develop or improve them. (Johansson 2011)

8.3.4. Means for control

In this case Saab used three main control mechanisms in order to enable the deal.

1. **Control by secrecy:** In terms of keeping the *know-why* behind the specifications and know-how regarding the development in house and only transacting the specifications and instructions on how to build the specific models.
2. **Contractual control:** In terms of restrictions on how the cars were allowed to look and in which other ways BAIC was allowed to exploit the transacted technologies.
3. **Control by IPRs:** In terms of patents in order to define the scope of the deal and design rights in order to control the way BAIC was allowed to make the cars similar to Saab's.

The main tool Saab had for controlling this transaction was their ability and possibility to make distinctions between what they had that was know-how, which they were willing to share, and what was *know-why*, which they were not willing to share. One example of this that Johansson (2011) describes is keeping all the test reports leading up to the final one secret which he means meant that they could transact the specific information needed for different kinds of governmental approvals but still keep the *know-why* on how to reach that result.

The second tool was contractual in the contract written between Saab and BAIC. This contract enabled Saab to regulate how BAIC could use the transacted technology (i.e. "how to build the cars"), included limitations on how the cars could look like and that Saab's trademarks could not be used (Johansson 2011). Naturally, this was a security measure to minimize the potential confusion between the brands on the Chinese market. Furthermore it regulated the ways BAIC could exploit the transacted technologies so that it did not fall into, for Saab, unexpected hands (Johansson 2011).

Finally the transaction included some IPRs in the form of patents and design rights. The ownership of the patents was transferred to BAIC (Johansson 2011). They therefore did not increase the possibility to control the technology but it did increase the possibility to define it. The design rights were included in the contract as something that BAIC was not allowed to infringe (Johansson 2011). This further strengthened the possibility to control the way the cars looked in order to minimize confusion on the market.

8.4. Fiat – Ford – contract manufacturing and development

This is a collaboration where both the Fiat 500 and Ford Ka are based on Fiat Panda's architecture. Fiat 500 was introduced on the market in 2007 and Ford Ka one year later in 2008. Both cars are built in Fiat's factory in Tychy, Poland, where they also manufacture the Fiat Panda. The 500 and the Ka have the same architecture which forms the base of the relationship. The cars differ very much in the visual appearance since basically nothing of the "top hat" (the visible components that forms the design of the car) is shared.

The table below gives a quick introduction to the companies and the deal.

The Companies		
	Fiat	**Ford**
Employees (2010)	138 000	164 000
Revenue in US $ (2010)	48 billion	129 billion
Origin	Italy	USA
Summary of the deal		
Type of deal	Contract manufacturing and development for shared architecture	
Timeline	Deal signed: 2004 First car produced: 2007 (Fiat 500), 2008 (Ford Ka) Ongoing: (2011)	
Scope	Fiat developed and produces both the Ford Ka and their Fiat 500 in their factory in Poland. Manufacturing concerns ≈ 100'000 Ford Ka and ≈ 150'000 Fiat 500/year.	
Intended market	Europe	
Main source for study	Interviews with Nick Collins (Global Product Manager for Small Cars, Ford), John Stanger (Director Product Planning, Ford) and Angelica Carapezza (Business Development & Strategic alliances, Fiat)	

Table 10. Short facts about the companies and the deal.

8.4.1. Background

In the time of 2003-2004 Fiat, that had developed the Panda platform earlier, was looking for a partner to share development and production costs with for a new A-segment car based on that platform. Ford was simultaneously looking for a replacement solution for their increasingly outdated KA model. According to Carapezza (2011) it would have been a very costly route to start from scratch with the development and instead Ford signed the deal with Fiat in November 2004 on shared development and manufacturing costs for the two models.

As for all small city cars aimed to have a relatively low price tag, volumes and gaining economy of scale is the key to success and profitability. Both Fiat and Ford could therefore gain on collaborating on the manufacturing of their small cars in order to boost the volumes. In order to make such collaboration possible and successful the cars had to share a large amount of components while still maintain two separated vehicles with their respective brand identities. Hence, as Stanger & Collins (2011) said in the interview, the task was to quickly and cheaply develop two cars with as much synergies as possible while still appearing in line with their respective brands and manufacture these in large volumes.

8.4.2. The set-up of the deal

At an early stage the Fiat Panda architecture was found to be suitable for building the 500 and the Ka. To keep it simple the parties therefore agreed to let Fiat who held the knowledge in relation to the Panda architecture handle the whole development for both the 500 and the Ka. To "keep it simple" was according to Stanger and Collins (2011) lead words in this collaboration. What Ford contributed with was so called "specific target developments". This meant that Ford conducted testing and evaluation in order to find the parameters and specifications that needed to be changed in order to make it "drive like a Ford" (Stanger & Collins 2011).

Both cars are manufactured in Fiat's factory and Fiat is solely responsible for the manufacturing without the involvement of any Ford employees. For required improvements (regarding e.g. new regulations and emission requirements) during the lifecycle of the cars there is a small group with Fiat and Ford employees that together define what needs to be improved. The development regarding required improvements is then carried out by Fiat engineers alone. (Stanger & Collins 2011)

There were three main components of the compensation to Fiat. Fiat received one initial sum for the investments they had made in the Panda platform. All developments made by Fiat were then covered by separate agreements and finally there were compensations to Fiat for the manufacturing of the cars. (Stanger & Collins 2011) (Carapezza 2011)

8.4.3. Knowledge and technology transacted

In the table below the transacted values are illustrated with their relative contribution to the total deal. It is important to remember that in this deal technology and knowledge was not transferred as in most of the other cases studied in this report. In this case technology was transferred in the shape of ready end products, the cars. The table does therefore communicate the values that have been transacted instead of the specific objects of technology or knowledge.

Transacted values	Relative contribution	Description
Access to platform		Fiat's mini platform
Manufacturing		≈ 100 000 cars per year
Adaptation development		From the Panda to the Ford Ka
Total	0% 100%	

Table 11. Table describing the transacted values and the authors' interpretation of their relative contributions to the total deal.

This is not a case where knowledge or technology has been transacted in its purest form, it is more a case where technology has been transferred in the shape of end products. The interesting aspect in this case however, lays in the way measures have been taken not to transact anything between the two companies.

Even though Fiat handled all developments and already had most of the knowledge in form of the Panda platform, Ford needed to adapt the car in order to distinguish it from the Fiat 500 and make it more "Ford-like" through so called "specific target developments" (Stanger & Collins 2011). Stanger and Collins (2011) explained that the development efforts were made in-house at Ford's facilities and transacted in the form of new specifications to Fiat. Since the engineer did not work side by side they

did not transact any knowledge apart from the new specifications. The strategy of not transacting any of Ford's knowledge was taken to the extent that there according to Stanger and Collins (2011) were several occasions where Ford had a finished solution or improvement that successfully could have been implemented in the cars but they chose to pay for new developments instead of transacting that technology to Fiat.

Fiat also kept all their development efforts in-house where Ford's engineers did not have access (Carapezza 2011) and transacted only technology in the form of the finished cars. This meant that Ford did not get more access to Fiat's knowledge than any other actor with the possibility of buying the cars and disassemble them.

To conclude, there was not much knowledge or technology transacted between the firms other than implemented into physical products or specifications as the result of independent developments.

8.4.4. Means for control

There are two aspects of the control position in this case. However the secrecy aspect is the ever dominating aspect in this case.

1. **Control by secrecy:** In that the parties did not share any *know-why* with each other and kept all developments independent.
2. **Contractual control:** In terms of by contract structuring the deal and regulating other business aspects.

The main mean for control here has been to not have any interaction or collaborative development efforts. Each company has kept their knowledge in-house and the collaborative elements have been limited to defining what actually needs to be developed and modified. The modification itself has then been handled by one set of engineers from Fiat. Stanger and Collins (2011) describe the work from Ford's side as telling Fiat that component X, Y and Z should have the values A, B and C. This means that the specifications have been of a know-how nature in that Ford have only approved technical solutions and supplied desired properties. As for Fiat, who according to Carapezza (2011) only delivered finished physical products, no *know-why* has been communicated.

The contract naturally plays an important role in structuring and defining the deal; business aspect such as production levels, time plans and similar are controlled by the contract. However, in this thesis the interesting aspect to study is how both parties have followed a clear strategy of keeping the two companies apart and not engage in any collaborative development where knowledge can be transacted. In this sense the contract did not contribute with major enabling aspects.

8.5. Tesla Motors – Lotus Cars – Development and manufacturing of the Tesla Roadster

In this case California-based Tesla Motors bought the development and great parts of the manufacturing of their all electric sports car Tesla Roadster from British sports car manufacturer Lotus Cars' consultancy division Lotus Engineering. Lotus based the development to a large extent on their previously developed model Lotus Elise.

The Companies		
	Lotus Cars	**Tesla Motors**
Employees (2010)	1000-5000 (Private company)	900
Revenue in US $ (2010)	N/A	117 million
Origin	Great Britain	USA
Summary of the deal		
Type of deal	Contract manufacturing and development	
Timeline	Deal signed: 2005 First car produced: 2008 Ongoing: (2011)	
Scope	Lotus develops architecture (excluding driveline) and manufactures the Tesla Roadster electric car. As of today (2011) roughly 1700 cars have been produced.	
Intended market	Worldwide	
Main source for study	No interviews conducted due to corporate policy to not give interviews on this area. Instead, 10-K reports and the supply agreement are main sources.	

Table 12. Short facts about the companies and the deal.

8.5.1. Background

Tesla Motors was founded in 2003 by a group of engineers and entrepreneurs in Silicon valley, California. The founders had hardly any experience from the automotive industry but they were driven by the belief that electrical propulsion was the future for cars. In a very early stage they involved the South African entrepreneur Elon Musk who both had a strong environmental commitment as well as a good financial position that could finance the early work. Musk had a clear strategy for the company to start with a sports car in order to attract the early adopters and to follow that up with more affordable family cars and compacts (Tesla motors blog 1).

The technology for their first model, the Tesla Roadster, had to be sourced in one way or another since development from scratch would have been too timely as well as costly. The core competence Tesla had in the Roadster project was the electrical powertrain technology (10-K report 2010) which means that the key technology area that Tesla needed to get access to was general platform technology, frame, suspension etc. This is where Lotus turned out to be the collaboration partner after a selection process where more specifically the Elise technology was found to be well suited to derive a foundation for an electric sports car (Tesla motors blog 2).

Lotus Cars, famous for their lightweight sports cars, have been one of the first OEMs to develop a consultancy service aimed for providing development services to other OEMs. This is in Lotus' case offered through Lotus Engineering. Lotus Engineering has a clear record of developing on demand

through reuse of previously developed Lotus technology. As for the Tesla Roadster, Lotus had earlier used their Elise model to develop the Opel Speedster in 2000.

8.5.2. The set-up of the deal

The deal between Tesla and Lotus consisted of an order of development of the Tesla Roadster architecture as well as manufacturing of the cars in Lotus' facilities in the UK (The agreement 2005). The cars intended for the US market are manufactured without its powertrain, so called "gliders", and shipped to Tesla's facilities in Menlo Park, California where they are fitted with the electrical powertrain (Tesla 10K report 2010). The cars aimed for markets outside of the US are also fitted with electrical powertrain in Lotus' facilities with an additional pre delivery inspection at a small Tesla facility in the UK (Tesla 10K report 2010).

The development process and the adaptation of the Elise technology to the Roadster were conducted by Lotus engineers in cooperation with the Tesla staff that was present and for which Tesla leased office space at the Lotus facilities (The agreement 2005). Formally, Tesla's presence was based on a need for quality control of the development (Tesla 10K report 2010). In addition to the engineering, styling and the contract manufacturing of the cars there were licenses of some IP covering various structure and safety technology used in the Roadster (Tesla motors blog 3).

8.5.3. Knowledge and technology transacted

The table below includes the three different values that were transacted from Lotus to Tesla and their relative contribution. The development efforts and manufacturing were included in the supply agreement as objects Lotus received compensation for.

Transacted objects	Relative contribution	
Contract development		Access to Elise architecture and adaptation to Roadster
Manufacturing		So far ≈ 1700 cars in total
Tacit knowledge and experience		A few employees and through interaction
Total	0% 100%	

Table 13. Table describing the transacted objects and the authors' interpretation of their relative contributions to the total deal.

According to the agreement between Lotus and Tesla (2005), this deal was to a large extent an order of a physical product (contract development and manufacturing of the car) and to a very low extent a purchase of knowledge on car development. Naturally some know-how would be transferred since it to some extent was a joint development with engineering interaction but it was not part of the payment (The agreement 2005). To be sustainable as a consultancy firm Lotus would not have been aiming to transfer the *know-why* connected with the technology included in the Roadster since this in the long run would erupt their source of business.

For the tacit knowledge and Lotus' experience it is difficult to judge to what degree know-how or *know-why* was transferred and if it was transferred to a greater extent than was originally planned. However, it is known that several employees at Lotus were hired by Tesla during the development phase of the Roadster and that Tesla in July 2006 saw them as a significant part of their collective car

development capabilities (Tesla Motors Enthusiasts blog 3) (Tesla Motors Enthusiasts blog 4). It is also known that Tesla during the whole development period leased office space at Lotus facilities and attended the work with a physical presence (The Agreement 2005). Such interaction between engineers is according to Teece (1981) a prerequisite for the transaction of tacit knowledge which in this case could be Lotus' deeper understanding and experience of the Tesla Roadsters' qualities (the *know-why*).

8.5.4. Means for control

There have been three main means for control used by Lotus in this deal.

1. **Control by secrecy:** In terms of selling know-how instead of *know-why*.
2. **Contractual control:** In terms of paragraphs in the agreement that limits Tesla's potential use of knowledge or technology.
3. **Control by IPR:** In terms of having parts of the technology that is included covered by IPRs.

As most other consultancies, regardless of the industry, Lotus Engineering uses the idea of selling services that gives the customer no more insight in their competencies than the specific know-how that is the result of their efforts. In the Tesla Roadster case, according to the supply agreement between Lotus and Tesla (2005), the idea is that Tesla develops criteria for the vehicle while Lotus' task is to translate these criteria into technical specifications. Lotus are not obliged to communicate why a certain specification is set as it is and by that not obliged to deliver the *know-why* connected with the Elise technology that is the foundation for the Roadster.

The second control aspect used is paragraph 3.10 in the supply agreement (2005) which states:

"TESLA shall only use the Product for the purposes set out in this Agreement to create the TESLA Vehicle. For the avoidance of doubt, TESLA shall not design, develop or manufacture any other vehicle from the Product without LOTUS' prior written consent. The Parties acknowledge that nothing in this Agreement shall prevent TESLA from designing, assembling or manufacturing other vehicles provided that such vehicles are not derived from any LOTUS Background."

This limits the possibilities for Tesla to extract considerably more value from the Lotus collaboration than what Lotus have been compensated for. However, the results of the development and the background leading up the results are free for Tesla to use in other purposes related to their business according to 13.12:

"LOTUS hereby grants to TESLA a non-exclusive, royalty-free, worldwide licence to Use the Bespoke Background in connection with the Bespoke Foreground for the purposes of TESLA's business, which licence shall become perpetual, sub-licensable and assignable on the date on which LOTUS receives payment in respect of the Bespoke Work in which such Bespoke Background subsists pursuant to clause 7.12."

The last aspect of the control Lotus use is the IPRs that cover parts of the technology that were included, Lotus holds roughly 50 patents on various chassis technologies (Thomson innovation). Which of these that were subject to this deal is impossible to say but since part of the payment is for Lotus' IP it is reasonable to assume that at least some was included (The agreement 2005).

9. Analysis of the control mechanisms enabling the deals

In this chapter, we will go through the cases once more and this time more deeply study and analyze the means for control the actors used and how those means acted as enablers of the deals. According to the literature presented earlier in this report, actors aiming to engage in collaborations or transactions of knowledge needs to apply a certain amount of control to the set-up of the deal in order to dare to share. In this section we will go through which these means has been and what the literature has to say about the chosen means in relation to the situation and the aim of the deal.

9.1. Toyota – PSA

This deal was besides achieving economies of scale and efficiencies also about taking advantage of each other's competencies in purchasing and production techniques respectively. This meant that the solution executed in the Ford-Fiat case where one part takes on all the responsibility for development as well as manufacturing was not possible. Much more interaction and collaboration was needed. The solution was to set up a joint venture where knowledge and technologies could be shared. However, this also required much more elaborated mechanisms for control in order for the parties to be willing to share their core competencies to a joint venture that included a party that on other areas was each other's competitors.

There are control mechanisms on two different levels in this deal. Firstly there is the solution with a joint venture which enables the parties to control what knowledge and technology to include in the deal in the first place. Secondly there are the mechanisms that enable them to control the knowledge and technology once it has been transacted to the joint venture. Even though the company has chosen to transact a technology to the JV it might be a crucial aspect for the company not to transact that piece of technology to the other company's business outside of the JV (see Figure 4). The setting in which this deal takes place where competitors chose to collaborate on one small part of their total business while still being competitive on the other parts, makes this aspect particularly crucial.

The table below illustrates the components of the control position and there relative contribution to the total control position.

Control mechanism	Relative contribution	Description
The JV construction		Enabling collaboration while keeping parent companies separated
IPRs		Toyota holds > 500 patents on production technology[1]
Contractual control		Structuring and limiting the use of transacted objects
Secrecy		Toyota's R&D capabilities not transferred
Total	0% 100%	

Table 14. Table describing the different control mechanisms enabling the deal and the authors' interpretation of their relative contributions.

[1] Thomson innovation. Searchstring: DWPI title: production OR organization, Assignee: Toyota

9.1.1. Control by the JV construction

By creating a third entity which from the beginning has no assets and no background knowledge, it is easier to make active choices on exactly what to include. The alternative to have all the functions and competencies in and around the collaboration by using one part's already existing assets would create a stronger tension field (Bogers 2011) since the issue of controlling which assets to include or not would be much more difficult. One example would be the different components of Toyota's production techniques. Since a new company was created with a new factory both parties could have chosen not to include parts with an especially high competition advantage and that they felt that they did not have a high enough degree of control of. However, an aspect that incentivized Toyota to include all improving production technologies was that 1/3 of the produced cars was Toyota's which meant that all improvements in efficiency and quality would affect them directly in the cost of the cars.

9.1.2. Control by IPRs

The fact that Toyota had patents on many of the production techniques brought into the JV and that they were granted in many of the countries where PSA have factories, was a very strong control mechanism enabling Toyota to transact those technologies to the JV. Since the technology they transacted was both defined and registered in the administrative arena it would have been a relatively easy process of activating a third party such as a court if the technology was used in ways not authorized by Toyota. On the other hand, there might have been considerations anyway due to the widely discussed nature of patents on production technologies. Since the production technique used most often do not leave any recognizable imprint on the finished product, the only way to in practice control whether the patent is infringed or not require access to the factory where the infringement takes place. Such access can be enforced by courts but is quite unusual and demands a strong evidence situation. One way of solving this and to strengthen the enabling control position for Toyota in order to maximize the efficiency of the factory would have been to include such permission under certain circumstances in a contract between the parties. According to an interview with PSA (2011) this was however not done in this case. Whether such a clause would have made Toyota transact more of their production technology or not is impossible to say but the literature suggests it might since it would made the control mechanism stronger (Arora et al 2001).

9.1.3. Contractual control

The main usage of the contract in this relationship was to regulate who in the JV that would be responsible for what. It also regulated the value of each party's contribution to the JV since it specified that there would be an equal compensation in the form of royalties for the licenses to the IP that Toyota transacted to the JV and the work PSA did regarding the supply –and purchasing structure. (Timoney & Gendraud 2011) This defined each party's contribution more specifically and gave securities that what was being transacted would be compensated accordingly, both of which enabled the transaction. This since, as in all market transactions, the product needs to be defined and priced before it can be transacted and this was one of the roles of the contract.

Furthermore, the contract is often used as a way to regulate aspects of the knowledge surrounding included IPRs. The IPRs themselves are registered in the administrative arena which makes them enforceable in the judicial arena and thereby also a tool in the business arena. The knowledge surrounding them is however not registered in the administrative arena and therefore not

enforceable in the judicial arena. This is where the contract could have been used as a tool enforceable in the judicial arena and by that affecting the business arena.

However, the interesting aspect with the deal between Toyota and PSA is that know-how was not regulated by the contract. Why this was the case, Timoney and Gendraud can in our interview (2011) only speculate about. One possible reason they identify could be that the lawyers writing the contract were not patent attorneys and could therefore not see the need for such considerations. How this affected the joint venture is also very hard to say but logically this lack of control would make Toyota, if aware of it, extremely careful with how they transacted technologies that was not covered by any IPR since there then was nothing enforceable stopping PSA from transacting this further to their other factories (where there are activities competing with Toyota's other business). This potential for opportunism could, at least partly, be solved by constructing the contract so that also non-IPR protected knowledge is included (Slowinsky et al 2006). According to Aurora et al (2001) it does however not completely solve the problem due to the difficulty of proving a case of misuse for a third party, making such a control mechanism weaker. The solution they suggest with a complementary as a hostage could perhaps have been applied in this case since there were some patents covering parts of the valuable knowledge. On the other hand, when it as in this case is mostly production patents there is again the problem of proof as discussed in the section above.

9.1.4. Control by secrecy and contextual value

As in several of the other cases, one measure that acts both as a limiter in the need for control towards the other party as well as a control measure in itself, is how the companies have been able to separate between the know-how and the *know-why*. It enables the transaction of certain parts of the technology since for example Toyota could transfer much know-how in form of the specifications of the parts used in the produced cars without transferring their *know-why* in how to develop those parts. Know-how regarding how the parts look can be acquired by anyone willing to buy a car, it is the knowledge behind why it looks as it does that car makers considers to be valuable (Johansson 2011). If the parts instead would have been developed together with PSA in the JV, much interaction between the firms would have been needed and Toyota would probably have been much more restrictive in what assets they used when interacting with PSA. As discussed in the theoretical framework, such interaction would have had the possibility to transfer more of the hardly controllable tacit engineering knowledge from Toyota's R&D department. Assuming there were no other mechanisms of control, such a joint development where Toyota do not feel safe in that they can control the use of transferred knowledge would probably have resulted in less of Toyota's knowledge being used.

The contextual value of the knowledge is put forward from PSA as one of the main reasons for them being willing to transact one of their key assets to this JV. Even though it would have been possible for Toyota to further transact the supply channels, knowledge on price levels and negotiation culture to their other business, it would not have been very attractive for Toyota. This since the value of this know-how is completely different in another market and there is no benefit in using it outside the TPCA JV. PSA therefore felt secure in sharing their knowledge with Toyota and the contextual value acted as an enabler of the transaction.

9.2. Toyota – Nissan

This deal was a result of Nissan being in a position where they needed a hybrid car for the US and especially the Californian market quick, while at the same time not being able to finish the development of the in-house developed hybrid system due to both time and financial issues. Nissan turned to Toyota in order to get access to a technical solution. It is important to remember that this deal was not about collaborating on development or in other ways sharing knowledge. It was a case of buying a technical solution. The fact that Toyota found it safe to give a competitor access to one of Toyota's edge technologies indicates that Toyota felt that they were in a strong control position secure enough to enable this transaction.

A number of facts indicate a consciously developed strategy aimed specifically on how to share the HSD technology. Since potential buyers are likely to be competitors it requires a secure control position over the technology in order for Toyota to be willing to supply it. As Toyota communicates the idea of spreading the technology to whoever wants it they clearly feel confident in this being the case. Furthermore, at the time when the HSD was first developed, it was a new area of knowledge (Hybrid technology may not have been new as a technology but at least new as a commercially viable technology). It was an area where Toyota had knowledge that was going to be valuable to others due to evolving regulations and market demands. This together with the fact that Toyota covered the HSD technology in a vast patent thicket rarely seen in the automotive industry (Lloyd et al 2009) is unlikely to be solely coincidental.

The interesting question is then how such strategy enabled the transaction and what parts of it filled what purpose? The table below summarizes the different control mechanisms and estimates their relative contributions.

Control mechanism	Relative contribution	Description
IPRs		Technology covered by ≈ 370 patents[2]
Supply Chain		All patented and crucial parts came from Toyota's suppliers
Technical solutions and secrecy		Hardly any *know-why* about the system was transferred
Contractual control		Used to regulate other business aspects of the deal
Total	0% 100%	

Table 15. Table describing the different control mechanisms enabling the deal and the authors' interpretation of their relative contributions.

9.2.1. Control by IPRs

The heavy patenting that Toyota had carried out during the development of the HSD technology had led to a solid patent thicket covering not only the system supplied to Nissan but also to a large extent surrounding technology. In an interview with Thunes (2011), he states that it would be almost impossible to develop a hybrid system without infringing on any patents owned by Toyota. Naturally, this heavy patent portfolio with protection even outside of the scoop of the licensed technology

[2] Lloyd et. al (2009), The 2nd generation Prius claims more than 370 patent

enabled Toyota to feel secure that they would not give the buyer a shortcut to Toyota's level of knowledge in Hybrid technology. A buyer of the technology would still, if at all possible, have to conduct heavy research to go around the Toyota patents and offer an own system.

9.2.2. Control by managing the supply chain

The fact that the HSD deal between Toyota and Nissan in practice was more of a supplier-buyer relationship than a licensor-licensee had significant effect on the control position. Another way of handling this could have been to supply Nissan with licenses on the patents covering the technology and letting them manufacture and source the parts for the system. Instead, Toyota licensed the patents upstream to their closely integrated suppliers to manufacture the components. What was granted to Nissan was a permission to buy the components from the Toyota suppliers through Toyota. In this way Toyota ended up in the middle of the transaction and was able to control the flow of technology, also controlling the flow and exchange of knowledge. By this arrangement Toyota limits the risk of Nissan exploring and acquiring more know-how from the manufacturing or sourcing than what Toyota have been compensated for. A new manufacturer of the parts would have needed a much greater transaction of know-how than was needed by using already existing suppliers. Furthermore, those suppliers are integrated in the Toyota organization to a high degree, much due to the "Toyota-way" of manufacturing. The high level integration reduce the need for other control mechanisms since there are other factors such as win-win and a high level of trust.

9.2.3. Control by technical solutions and secrecy

The two last components of the control position are the technical solutions and the secrecy aspect. They are analyzed together since they are very closely related. The aim of these aspects is to limit the knowledge being transferred and instead making sure that what is being transferred is the technical solution and nothing more. The enabling aspect of this control mechanism is that Toyota by this ensures that the deal will be fair in terms of not ending up in a position where Nissan pays for one definition of "the technology" and ends up receiving a far greater (with surrounding know-how). This control is enabled by making the deal containing more or less only codified knowledge and very limited amount of tacit. Taking into account that the theory (Teece 1981) suggests that tacit knowledge only can be transferred by human interaction and combining that with what Slowinsky et al (2006) suggests about it being "leaky and sticky", it is evident by avoiding human interaction is possible to prevent uncontrolled transfer of tacit knowledge. This means that if, as for the HSD case, the agreement only concerns a transfer of codified knowledge it will be an enabling factor for the deal to avoid human interaction. The selling party would most likely not feel secure in creating a fair deal if the agreed compensation does not include compensation for tacit knowledge but still involves human interaction.

The strategy of avoiding transfers of tacit know-how or *know-why* by secrecy showed some limitations in the fact that a few employees from Toyota suppliers was hired by Nissan. This is the main source for the *know-why* that was transferred. It is an interesting question is if such unregulated transfer of knowledge would restrict the possibility to pursue similar deals in the future. Will the seller feel secure in their control of the knowledge if employees carrying the tacit knowledge can be hired by the buyer and by that conduct such transfer that the aim was to avoid? Discussing issues around retaining skilled employees is, though an interesting one, not part of this thesis and it will therefore not be further discussed.

9.2.4. Contractual control

This is a very small portion of the total control position since it did not bring any further possibilities to transact knowledge or technology. It was an enabler of the deal itself since it regulated other business aspects such as delivery dates, volumes, prices etc. but it did not function as an enabler for Toyota to transact more knowledge.

9.3. Saab Automobile AB – BAIC

The components of this deal mostly concerned technology that Saab no longer intended to use. The control aspect was therefore not as important when it comes to regulating the know-how surrounding the technology of the included models. Even though BAIC got every detail of how to build the cars in the deal, it did not get them closer to the new models which, in Saab's mind, are what matters. What was important though was to control exactly what was being transferred so that Saab's knowledge regarding car development stayed in house, to make sure that Saab's brand would not be negatively affected and to regulate the competition with Saab's cars.

First of all it should be clear that this sale was not about transferring knowledge or technologies that, as in the case with the Toyota HSD, was as cutting edge and crucial to their business. This made a big difference in what control mechanisms that were needed for the deal to be realized and how they were used.

The table below illustrates the different control aspects of the deal and an indication of their relative contribution to the control position.

Control mechanism	Relative contribution	Description
Secrecy		Saab's R&D capabilities and experience not transferred
Contractual control		Limiting use of transacted technology
IPRs		≈ 25 patents defining the scope of the deal
Total	0% 100%	

Table 16. Table describing the different control mechanisms enabling the deal and the authors' interpretation of their relative contributions.

9.3.1. Control by secrecy

Saab would have been much more reluctant to make the deal if they did not feel that they were able to keep, in their opinion, their core capabilities separated from the deal. Their core capability is knowledge on how to develop cars that drive and feel like Saabs. If they thought this capability would have been transferred to BAIC the deal would probably not have gone through. The strategy was then to keep the know-how on building the cars separated from the *know-why* on how they were developed and refined. Such knowledge is very complex and not possible to codify which makes human interaction necessary in order to transfer it (Teece 1981). By avoiding such interaction and only include codified material in the deal they felt safe that Saab core capabilities stayed in-house (Johansson 2011).

9.3.2. Contractual control

The contract was in this case used as a tool in order to control that the Saab brand was not affected in a negative way. If BAIC had built cars that looked exactly like Saabs there would have been confusion on the market and even worse, if there for example had been quality issues with BAIC's cars those negative associations could affect the Saab brand. The contract gave Saab the possibility to regulate that the cars would not look like Saabs and that Saab's brand would not be misused. If there is any misusage Saab could use the contract and bring it to the judicial arena where they could force BAIC to end the undesired activities taking place in the business arena.

The contract also functioned as a way to control that the technology transacted and the cars built using that technology did not pose too great competition for Saab since such situation would make Saab back out of the deal. It controlled on which markets BAIC could sell the cars and that the technology could only be used by BAIC for the purpose of building the cars. This meant that BAIC's cars would not be sold on markets very important for Saab and the technologies would not be used by other manufacturers present on those markets.

To conclude, the contract in a way regulates the value of the transferred technologies since it regulates how they can be used and where. Another common way of regulating the value of sold knowledge is to share the profits it generates (Arora et al 2001). This usually includes some kind of royalty construction where the buyer pays the seller a certain percentage or fixed amount per sold product where the knowledge has contributed. This would have been a very viable solution in this case if Saab would not have needed the money directly. One of the reasons for the deal was that cash was needed in order for Saab not to go into default and a royalty solution usually means cash in the future why it did not work in this case (Johansson 2011).

9.3.3. Control by IPRs

The IPRs in this deal were not a very important part of the control mechanisms. Since Saab did not intend to use the technology transacted they did not have the need to keep control over those technologies. They were however used for defining the scope and as a tool when negotiating the price.

Saab has identified the importance of the design of the car in terms of the risk of confusion on the market and in keeping the value of the Saab brand. In order for them to sell more or less all technology to a model, even though it was a discontinued one, they needed to feel secure that it would not end up in a product that was confusingly similar to a Saab. Apart from the contractual tool, another mechanism used in this deal to enable such security was registered design rights which both enabled a relatively clear definition of what was protected as well as the possibility to take an infringement to the judicial arena.

9.4. Fiat – Ford

This case builds on the foundation that Fiat had a suitable architecture as a starting point for small cars such as the Ka and the 500 and that the marginal income for small cars is very low compared to the development and set-up costs. These facts make collaboration efforts profitable since development costs can be reduced and economies of scale can be achieved. Comparing with the Toyota-PSA collaboration the big difference here is that very little interaction took place since there were no intentions of gaining from each other's competencies; one party had the required competencies needed. This is why they could use the competence base of Fiat with the solution that Ford paid them for their efforts instead of contributing with equal amounts of Ford's knowledge, which was the structure of the Toyota-PSA case.

Since there were almost no intentions of sharing knowledge, there were also almost no control mechanisms enabling a transfer of knowledge. The control mechanisms were rather focused on creating walls between the competence bases of the companies in order not to transfer anything else but the products.

According to Stanger (2011) there were several reasons for not optimizing the cars by using both companies knowledge. Firstly they did not want to put together teams with engineers from different companies and with different cultures since that historically had proven to be very difficult for Ford. Secondly, they did not think it was enough to gain from it since the technology in these cars is relatively basic and both companies on their own more or less had the required knowledge. Thirdly, since the Ford Ka represents a very small part of Ford's total product portfolio they did not see enough benefits in implementing Ford core technology in this model compared to the risk of that technology spreading throughout the entire Fiat organization. One should remember that apart from this collaboration, Fiat and Ford are very much competitors on several products and markets.

The first reason concerns organizational and cultural issues and are therefore not interesting to this report since it falls outside of the scope. The second and third is interesting though. Even though the technologies in those cars were not cutting edge, suggesting that Fiat on its own had the required knowledge, there were according to Ford several occasions where Ford's technologies would have benefited the end result. Those Ford core technologies could for example have been in the areas of quality and cost control. (Stanger & Collins 2011) Both would seem highly interesting for the success of small cars on competitive markets with low margins. This means that there were occasions when the decision whether to transact the technology or not came down to if Ford felt they could control both the transfer and spread of their technologies. Since they on those occasions did not feel secure enough to do so, the transaction never took place and useful Ford technologies were left out of the cars. What control mechanisms that would have been needed to enable the transactions is of course hard to say but one can again compare this case to the others.

Compared with the Toyota-Nissan case, where Toyota transferred core hybrid technology to a competitor who also tried to develop its own system and therefore ran the risk of spreading the technology throughout the Nissan organization, the difference may be found in the strength of the patent portfolios surrounding the technologies. Discussions regarding patents came up in the interview but the interpretation was that Ford did not consider patents to be a strong enough or suitable way of protecting the *know-why* behind those technologies.

The table below illustrates the control mechanisms used and their relative contribution to the control position.

Control mechanism	Relative contribution	Description
Secrecy		More or less no knowledge apart from products transferred
Contractual control		Enabling through regulating other business aspects
Total	0% 100%	

Table 17. Table describing the different control mechanisms enabling the deal and the authors' interpretation of their relative contributions.

9.4.1. Control by secrecy

The main control mechanism working in this deal was secrecy. Each company kept their knowledge to themselves and shared only end results. This was no enabler of transactions since secrecy more or less acted as walls blocking any knowledge or technology transfer other than implemented in the finished products. However, it was an enabler for the deal itself since the parties probably would not have entered the deal if they did not feel they could keep their core intellectual assets in-house. To conclude, this case can be looked at as an example of how deals are constructed and carried out when there are not enough control mechanisms enabling transactions of knowledge or technology without a physical representation.

9.4.2. Contractual control

In addition to the secrecy that was the overall theme of this deal, there are naturally control aspects arising from the contract. The contract has not been available as a source for this report but one can assume it regulating issues such as time plans, manufacturing capacities, payments and similar. This of course adds to the enabling aspects by limiting risk and defining the scoop of the deal. However, in this report where the focus is on the transaction of knowledge and technology the contract has in this sense played a minor role in the controlling of how knowledge and technology are transacted since this is handled by the secrecy and the idea of keeping the two companies totally apart.

To conclude, this case can be looked at as an example of how deals can be constructed and carried out when there are not enough control mechanisms enabling transactions of knowledge or technology. It is interesting from the perspective of making a deal possible even though one is not willing (or able to) share important assets under controlled forms. From a strict knowledge and technology transaction view this case may not have too many aspects to analyze. However, it is interesting as an example where the dangers of collaborating closely without proper means for control have been identified while not having found a suitable solution for controlling the close collaboration in a cost efficient way except avoiding the interaction totally.

9.5. Tesla Motors – Lotus Cars

The background of this deal was that Tesla, being a young company in the process of developing their first product, needed to gain access to car platform technologies in a quick and cost efficient way. Lotus Engineering, that conducted the development, based the construction on their previously developed Lotus Elise platform. In addition to the development Lotus also carried out the manufacturing of the cars in their facilities in the UK. The idea behind the deal was very much an order of a physical product, development and manufacturing and very little a transaction of knowledge. However, one can argue that it is likely that know-how and *know-why* was transferred to a relatively large extent.

As discussed in the theoretical framework regarding consultancy services, the control mechanisms needed and used depends on whether know-how or *know-why* including experience is sold. In this case both types of transactions have been observed and an analysis around the mechanisms used therefore becomes very interesting. The three different mechanisms used are summarized in the table below with their relative contribution to Lotus' control position.

Control mechanism	Relative contribution	Description
Secrecy		Lotus sold technical specifications (know-how, not *know-why*)
Contractual control		Limits Tesla's potential use of the technology
IPRs		Lotus holds ≈ 50 patents excluding drive train [3]
Total	0% 100%	

Table 18. Table describing the different control mechanisms enabling the deal and the authors' interpretation of their relative contributions.

9.5.1. Control by secrecy

The development part of this deal was to sell the service of translating criteria regarding desired properties of the car set by Tesla to technical specifications, a work that implies applying *know-why* in order to deliver know-how. This is the classical way of consultancy work, the experience and tacit knowledge will be kept within the company in order to be able to extract valuable know-how several times from the same source. If this is correctly managed it is an example of Granstrand's (1999) identified knowledge characteristic of having the cake while eating it too.

In addition, Lotus handles the manufacturing of the cars in their own facilities which further increases the control by secrecy since this arrangement limits Tesla's involvement in handling and developing the technology. Such involvement would give Tesla the potential to get access to deeper technological understanding. According to the literature where it is stated that tacit knowledge is transferred by human interaction and the fact that know-how is "leaky and sticky", transfer of tacit knowledge is not only possible solely through human interaction, it is also certain that it will occur if there is human interaction (Sullivan 1996), (Slowinsky et al 2006), (Teece 1981). Taking this into account, it is surprising that Lotus allowed for Tesla to supervise and take active part in the development work with physical presence in their facilities. According to the theories in the literature this weakening of the secrecy would risk *know-why* to be transferred. The fact that Tesla

[3] Thomson Innovation. Assignee: lotus cars, Text clustering tool used to exclude patents

later also hired a number of employees from Lotus may also be a result of Tesla being able to observe and identify key personnel while being on site.

9.5.2. Contractual control

As a compliment to the secrecy mechanism, Lotus used a contract in order to define the scoop of the delivered technology. This was a "Supply agreement for products and services based on Lotus Elise technology" (The agreement 2005). Tesla's future potential use of the transferred know-how was limited which would make Lotus more confident in them being fairly compensated in proportion to the delivered value and that Tesla would not spread transacted technology outside what was intended. The contract could in such case have been a tool taken to court in order to stop Tesla. In this way the contract had an enabling effect on the deal.

9.5.3. Control by IPRs

In addition to the control established by secrecy and contracts Lotus delivered technical solutions that partly were covered by IPRs. It makes Lotus more confident that they will not supply Tesla with a platform that they can use for several other models since it requires a certain amount of work to circumvent the patented solutions. How strong this control is depends on the patents included. Ideally they would cover key solutions instead of single components making inventing around difficult. Since interviews have not been possible in this case, the strength of the IPR control mechanism in this case cannot be deeper analyzed.

9.6. Summary of analysis

In the figure below the different cases and their control mechanisms are organized in one diagram in order to summarize and compare them. It is important to keep in mind that even though all cases reach 100% in the figure, this does not mean that any of the companies have reached a complete control position or that all cases have the same level of control. The interesting aspect in not to compare the amount of control that each case have had, it is to see to what extent each case have relied on respective control mechanism.

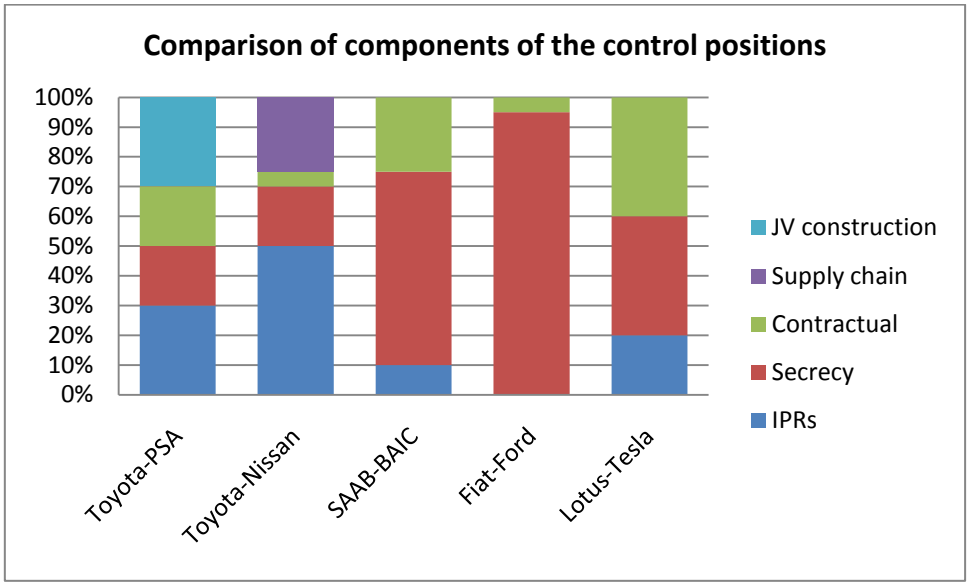

Figure 5. A comparison of the control positions and their different components.

As seen in the figure, secrecy has been an enabler to different degrees in all cases. This is not very surprising since no secrecy would mean opening up the company or the technology completely to the other party and would require an extreme control position acquired from other mechanisms to enable the deal. However, the relatively high reliance on secrecy is an interesting observation. Fiat – Ford and SAAB – BAIC are the most obvious cases where there has been much reliance on secrecy. This has resulted in that the companies have not been willing to transact much other than physical goods or non-core technologies. Secrecy has been used as an enabler of the deal but the reliance of it as the main mechanism has at the same time blocked a collaboration where deeper knowledge has been transacted.

Especially when IPRs are used as a strong mechanism it can be observed that there is less need for secrecy. Taking the Toyota-Nissan case as an example, the HSD technology was so intensely patented that a similar system could not be developed without infringing Toyota's patents. This reduced the need for secrecy since Toyota could be confident that the transacted knowledge could not be used without Toyota either having the possibility to block the behavior or benefiting from it through licenses using the surrounding IPRs. It is interesting to compare with the Lotus-Tesla case, where there are much less patents (≈ 50 compared to ≈ 370) and those patents cover general chassis technologies compared to the more specific HSD technology. The hybrid system was in a new technology field where fewer patents existed and this might have been a factor enabling a heavier patenting than in the case of established chassis technology. Furthermore, enabling a technology transaction built on IPRs requires a general corporate strategy for patenting since building control

through patenting is an expensive and time consuming process. As being clear from this thesis and supported by several other sources (e.g. Lloyd et. al 2009) Toyota has to a greater extent than most other OEMs in the automotive industry built their strategy on a heavy patent portfolio. In the figure above it is clear that IPRs is a strong control mechanism in both deals Toyota are involved in compared to the other deals studied.

Contractual control has been present in all cases but used in two different ways. In Toyota – PSA, SAAB – BAIC and Lotus – Tesla it has been used to control the knowledge and technology transaction and thereby enabling a more extensive transaction where more intellectual assets have been included than what had been possible without the contract. This is visualized by the contract's higher relative degree of contribution to the control position. The other way, observed in the cases with Toyota – Nissan and Fiat – Ford, the contract has been used to enable the deal itself, which include more than knowledge and technology, by regulating other business aspects. It has however not been used as a tool in order for knowledge and technology to be transacted. In the case with Fiat – Ford it has even been used to prevent knowledge and technology to be transacted at all. This way of using the contract has therefore contributed to a very small degree to the type of control position this report looks at.

10. Conclusions

This section will draw conclusions regarding the research questions based on the case study and its analysis. The purpose of this thesis is to exemplify and show on a broad range of solutions and structures for knowledge and technology transactions. The conclusions are therefore not aimed to be universal but instead observations in regards to the research questions and the sample used.

The cases for the study were chosen so they had varying structures and set-ups and this has also shown in the end result. It is difficult to see any patterns in the set-up of the deals and the only observation in this direction is the widely used secrecy aspect. In most of the five cases studied the control position is to a large extent relying on the secrecy aspect. Transactions have in general been structured around physical products and secrecy have been used not to include the *know-why* while the physical product have been the carrier of the transferred know-how. In the cases of Toyota-Nissan and Lotus-Tesla there are however combinations of IPRs, secrecy and control over supply chain (manufacturing in Lotus' case) that are building a control position which enable more openness between the parties while still being able to obtain control over proprietary knowledge or technology.

In terms of the carrier of the knowledge and technology it is clear that the actors in a few cases have taken consideration to the codification of the knowledge and the carrier used to transfer it while some cases may have done mismatches concerning the desired transfer, the codification of the knowledge and the carrier used to transfer it. In Toyota-Nissan, Ford-Fiat and Saab-BAIC there have been an extensive amount of tacit knowledge that potentially could be transferred and the actors have therefore avoided human interaction to large extent. In Lotus-Tesla and Toyota-PSA there has been a significant degree of human interaction and the question is if the complementary control mechanisms have been sufficient to control the transfer of tacit knowledge in these cases. It is naturally impossible to say and also not necessarily the most interesting aspect to investigate. The interesting aspect is instead to reflect around the potential outcome of this lack of control and what a more structured and controlled transaction would have enabled.

Concerning Petrusson's and Heiden's's framework (2010), where this thesis took its standpoint, it is clear that there are activities in the automotive industry on the knowledge based levels where knowledge is transacted. However, only in a few aspects of the cases studied in this report there are ways the parties truly use the IP in order to enable the transaction and openness between the companies instead of blocking and restricting.

To summarize, the following conclusions can be drawn regarding the studied cases:

1. **The OEMs has to a large extent relied on secrecy as an enabler.**
2. **The transactions have been structured around physical products.**
3. **There has not been a clear pattern in how IPRs are being used.**
4. **No clear strategies on how to control the tacit knowledge has been identified.**

11. Discussion

The aim of this section is to give a broader picture of certain parts of the study where the authors' opinions and thoughts will be included.

The first interesting aspect we would like to discuss is that of the difference in how the companies have used IPRs. In our view we can only see one case where there has been a clear strategy of using IPRs as a mean to share, create and price. This is when Toyota allowed Nissan to use their HSD system. In this case Toyota supplied one of their main competitors with one of their core assets. Furthermore, Nissan was a competitor who at the same time also tried to develop a similar and competing system of their own. Would that have been possible without the strong control in form of IPRs that Toyota had acquired? When comparing to the other cases, the interesting aspects of this case is that the sale concerns one of the sellers most core assets and at the same time the buyer would benefit enormously from being able to copy it. We believe that this is almost a perfect case of how IPRs can be used in a knowledge based knowledge economy where the aim is not to exclude others but rather to enable transactions of knowledge and technology. How to enable a transaction in this environment by creating a strong patent protection through a long-term IP-strategy should be a valuable insight for most OEMs on the market. It is hardly coincidental that this case is by far the most patent intense. We think it is a result of hybrid technology being a new field of research for Toyota (and the industry) which makes it easier both to patent new inventions as well as to realize the value of patenting as a first mover. When moving outside the regular knowledge profile of the company we believe it might be easier not to trivialize the value of what is being developed. The conclusion and key take-out is that, in order to replicate the control situation acquired in Toyota's HSD-case, a long-term IP-strategy as well as early understanding for what of the companies R&D that will be valuable to others is needed.

In relation to the discussion of knowledge profiles, we believe that the deal between Lotus and Tesla was affected by the fact that the companies had completely different knowledge profiles. Assuming that Tesla in the end received more *know-why* than the original plan from Lotus' side, it is interesting to discuss whether Lotus was aware of this risk. To Lotus, this kind of platform technology is base technology that most of their regular customers have on their own in one way or another, but to Tesla this was new technology that they desperately needed. One could argue that this made Lotus underestimate the value of their *know-why* to Tesla. As described in the theoretical framework, the value of knowledge should be considered highly context dependant which could have made Lotus underestimate the value to Tesla. On the other hand, one could also argue that it was a deliberate strategy from Lotus to invite the Tesla staff to their office in order to learn from their expertise on electric drivetrain and integration. However, this seems very hard to succeed with considering Tesla's well developed IP-strategy concerning their core technology. The knowledge acquired from Tesla's employees would be difficult to exploit due to the extensive patent coverage by Tesla (10-K report 2010).

The other case where we could argue for that more knowledge has been transferred than originally intended is the Toyota – PSA deal. This deal contained a relatively large amount of patents but the lack of contractual control over know-how and the rotating management together with the practical difficulties for any party to observe if the other party have spread any knowledge from the JV to the rest of their respective organization makes us believe that it would be unlikely if not knowledge was

spread between the two parent companies through the JV. Our interview also gave indications pointing in that direction.

Our next comment concerns the Fiat – Ford case. As discussed previously this case distinguishes itself from the others in that control mechanisms (mainly secrecy) were not used to enable a transfer of knowledge and technology but rather to prevent any transfer of knowledge. In other words the whole issue of transferring knowledge was avoided by clearly keeping the two companies apart. This is naturally a viable solution and in our opinion a good example when showing on the range of solutions used. It is likely to be the least complex transaction from a control perspective but also, in our view, the one with the lowest potential when it comes to the refinement of the end product but also when it comes to the economic result. The problem with using secrecy as a control mechanism is that it lies in the nature of secrecy to prevent transfer. It is therefore blocking the transfer instead of enabling it and the leverage potential of selling knowledge is thereby not utilized. Other control mechanisms such as IPRs or contracts can define and restrict the transfer to desired amounts while at the same time enabling it.

The wider observation of the issue of secrecy is that in the cases studied there has in most cases not been either:

a) enough obvious benefits to the involved parties in controlling the transferred knowledge or technology by more refined control mechanisms
b) a lack of assets that can be used in building a more refined control position, e.g. an extensive patent portfolio

If both of those aspects would have been fulfilled, the possibility to create a more refined deal where the true leverage potential in selling knowledge and technology instead of physical products could have been fully utilized. To achieve this and fully benefit from the potential of selling or sharing knowledge, the control mechanisms need to be more refined and combinations of IPRs, contracts, sourcing, secrecy and possibly other means for control need to be used. This will enable openness between the parties and include sharing of intellectual assets instead of enabling the transaction of physical products while blocking transactions of other assets.

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13. Appendix

13.1. Template for interviews

Since the different cases have been varying in terms of set-up and aim, the interview questions have required to be specifically aimed toward each interview. However, a template has been used from which more specific questions to each interview have been derived. This template is presented below and forms the basis for each interview.

13.1.1. Incentives

- What was the background to the deal?
- What was the problem or situation that initiated the deal?
- Who initiated the contact?

13.1.2. Relationship

- What was the nature of the collaboration?
- Is it a long term or short term relationship?
- Is it a onetime deal or part of a wider collaboration?
- What degree of integration has been needed?

13.1.3. Transactions

- What were the different components of the deal?
    - Intellectual property?
    - Know-how and in what form?
        - Products, interaction, documentation?
    - Consultancy hours?
    - Manufacturing capacity?
    - Licenses to use supplier networks?
    - Products or parts?
    - Warranties?
- What was the relative contribution of each component?

13.1.4. Compensation

- What were the different parts of the compensation?
    - Monetary?
    - Equity?
    - Royalties or lumpsums?
- What was the ratio between compensation for tangibles versus intangibles?
- Has compensation been in any other form than economical? E.g. knowledge, brand values etc.

13.1.5. Control mechanisms

- What means for control has been used?
- Where and how was the usage of the transacted technology regulated?
- Why was the set-up of the deal chosen related to the control position?
- Was there any IPRs covering the transacted technology and how was that used?
- Is there a contract between the parties and what does that regulate?
- How is the ownership of potential future developments handled?

13.2. Summary of interviews

13.2.1. PSA

Interviewees: **Pierre Gendraud – Head of IP**
Charles Timoney – Head of Licensing and Litigation
Date: **Mars 8th 2011**
Interview conducted over conference phone

- This was only a plant that was common to Toyota and PSA, easier than other deals they have made for instance in China.
- Toyota manufacturing process was implemented in the manufacturing plant.
- Toyota cannot retain technology because if they would the speed, quality etc. of the plant would have been bad and that would have affected Toyota. They were in some way trapped, they had to transfer all of their technology to the factory.
- Toyota had patents on many things in their production process "even on organization more or less". However, many of those were not granted all over Europe and for example not in Slovakia and therefore not part of the contract.
- Because it was a common plant Toyota could not keep parts of the factory for themselves, it was completely open for PSA. According to Timoney they take you through closed corridors if you visit Japanese plants but here they couldn't do that since it was a common plant. "We could go everywhere"
- PSA brought relation with suppliers, negotiation, price levels in EU, better practice of the practices in EU and the relations with suppliers. This was why Toyota wanted PSA, Toyota thought they would have an easier road starting up a manufacturing plant in Europe. This knowledge they do not believe is easily transferable to Japan since they have completely different kinds of relations there, it is a question of culture. However, if they would start another factory in Europe they could benefit from this know-how, that was a risk PSA were willing to take. Where there no other means of controlling this? No patents on negotiation etc.
- In fact, in the contract there were holes, know-how was not protected! It was only forbidden to transfer technology if there was a patent.
- The persons who negotiated the deal were not patent attorneys, they were general law.
- Apart from the patented technologies there were no considerations on how to treat and protect the knowledge.
- A lesson was learned: Usually PSA only patents in France + 2-3 other countries, they had hardly any patents in Slovakia. This situation learned them that when you patent you must look very far ahead. If they had had technologies that were patented in Slovakia they could have been used in the negotiations. "They could have been brought to the table".
- Today with the PCT you can designate all of EU for the same price. If they had the Toyota deal today they would have been able to use 200-300 patents. It was the same for Toyota.
- The transaction of knowledge: There was a general workforce with PSA, Toyota and Slovakians. The managerial position was on a rolling schedule, 6 months each from PSA and Toyota. The vice manager was always from the other company than the manager. This was only for the senior managers. This solution was chosen due to equality reasons, 50-50.
- There were no activities outside of the factory.

- TPCA cannot have IP. It was only the parent company who could have this. If improvements or ideas came up they would go to the company "owning" that employee. The employee would only communicate this to his/her parent company.
- All IP in TPCA were under license from the parent companies. The JV pays royalties to the two parent companies. For the production most patents are Toyota's, however there is a "rent" for the commercial arrangements made by PSA that is equal to the production system royalty. A management agreement balances this out. They consider themselves as equals. Furthermore, tax reasons make them handle the compensation as royalties. Taxes for royalties are lower in France.

13.2.2. Nissan

Interviewees: **Owen Thunes, Senior Project Engineer, Electric, Hybrid & Fuel Cell Vehicles**
Date: **8th Mars 2011**
Interview conducted over conference phone

- Strict emission policies in California
- Federal air quality targets in the US. In California it is impossible to meet those req. without setting very strict emission targets for cars
- California dictates the development of vehicle emissions
- Manufacturers who sell more than 60000 vehicles per year in Cal. Are subject to the rules. A certain % of vehicles must meet the rules.
- Nissan was developing their own hybrid system in-house but in the late 90's they were financially not doing very well. Development cost for finishing this hybrid system in order to meet just one markets requirement was prohibited. They made 100 test vehicles with their own system but quickly needed to meet the requirements.
- Toyota saw the developments in the US and over a decade developed their system spending millions. Even per car basis the sums were huge and they needed to recover some of the investments, which is why they went into licensing.
- Supplier motivation: EoS makes them more profitable.

- Nissan licenses the second generation of the system (technically the third).
- Toyota put the same system it in the Camry-model (2007yr models). Similar models made it easy for Nissan to substitute the system for Altima.
- An upfront fee was paid which allowed them to build a certain number of vehicles.
- They sourced from Toyota suppliers in Japan. Shared components: The transmission, the battery the AC-DC inverter and variable other minor components such as a dc-dc converter. Many of those suppliers are spin-offs from Toyota.
- Everything that is subject to a Toyota patent comes from a Toyota supplier. They come as complete parts and just plug-in.
- Adapting the system to Nissan: Toyota provided the code for the HSD (written in C and sort of "open source" in the sense that it is understandable and modifiable by anyone). Many parts affected (e.g. climate control since it is an electronic compressor). This means that a lot of stuff needed to be adapted to the Altima.
- "Here is the code for all systems, now go away". The arrangement was that they had to figure it out themselves, officially there was no help. However, in special cases there were

probably unofficial contacts with Toyota. Owen doesn't know whether they were offered the possibility to receive help with the code.

- Toyota told them which parameters to keep within when programming in order for Toyota to supply them with some warranty.
- Car manufacturers always buy cars and disassemble them. When you adapt the system they learn what's efficient and what's not. Self-learning.
- Toyota has so many patents around this system that it is very difficult to come up with something similar without paying licensing fee, you have to come up with something completely different. This could be the reason why GM changed the planetary gears to function the opposite, still it is possibly infringing so they might have some licensing agreement.
- Nissan hired a handful of people from Toyota suppliers. "Go figure it out yourself" is a long answer so they hired some people for critical parts of the systems.

13.2.3. Saab

Interviewees: **Gunnar Johansson, Senior Project Engineer**
Date: **28th Mars 2011**
Interview conducted in a meeting

- In the reconstruction Saab needed more cash for their survival. In the beginning BAIC was interested as a buyer of Saab but of one reason or another they did not. The contact was initiated via Koenigsegg in order to finance part of that deal.
- The work of what BAIC could buy and what information that needed to be gathered started.
- Koenigsegg retreat from the deal but BAIC is still interested.
- Included and handed over was: computer files on hard drive, container of documentation, tools for the production of the cars.
- Documentation included various types of technical documentation (specified in the interview.)
- The Computer files were only given as latest versions, not the ones used during developments which meant that BAIC got information on how to build the systems but not the development knowledge. BAIC had only bought know-how regarding these models, they had not bought know-why (which would be Saab's competence as a car manufacturer). It was a very deliberate strategy only to sell final results, not knowledge on how to get there. The contract said they should get enough documentation and specifications to be able to manufacture the cars but not why certain things are done as they are or how they could be improved. This is of course a gray zone.
- They bought two types of 9-3 (status at a certain date), 9-5 sedan (status at a certain date), engines
- Some patents included (≈ 25). The patents were part of the requirements to be able to produce the cars but not on very revolutionary invention and thereby not of very high value.
- The big value is the documentation (the know-how to build the cars) and the tools.
- A timeline of the purchase was drawn
- A group of Saab-people visited BAIC 2-3 weeks at three different occasions. Helped BAIC to sort through all information and to identify what had been missed to include, not helping

them with initiating their project. This was compensated per hour as consultancy but a very small part of the deal.
- Saab has had one resident from supply and quality at BAICs facility during the last year both to learn about BAIC and to help them with operations.
- BAIC had previously only been a contract manufacturer for other OEMs. They have also built some trucks.
- No rights to Saab's brand included. Enough visual differentiation to not mistake the cars for Saabs was needed and driven as an important aspect from Saabs point of view.

13.2.4. Ford

Interviewees: **John Stanger – Director, Product Planning**
Nick Collins – Until recently Head of Business Association Group
Date: **Mars 1st 2011**
Interview conducted over conference phone

- Ford Ka is built in the same manufacturing facilities as 500 and Panda in Tychy Poland
- The panda platform forms the basis for both 500 and Ka
- Ford made early development work to define vehicle attributes that made it feel like a Ford
    - Not much data were transferred from Ford to Fiat or the other way, Ford worked with data in order to *define* to Fiat what they wanted them to deliver. Then Fiat went away and developed to specification with a small team of Ford people to make critical decisions.
- Cannot disclose whether there was any IP licensed one way or the other
- 3 components: Platform, power train and top hat (gives the car its visual identity)
    - Platform: a set of shared components (drawings, list of components and IP) forms the basis of the relationship.
- This project didn't come about because required know-how, it was all about EoS and efficiencies.
- "Specific target development" – took a fiat panda and tuned it in Ford development facilities, to make it feel like a ford. Define the elements they could carry over, tune and change and communicated this to Fiat in terms of hardware specification. Not a knowledge transfer, only a list of what needed to be changed.
- We were only after the sheer number of produced vehicles, there was nothing new with the Panda that we wanted to get access to.
- Development of e.g. suspension differences. Ford "fiddled" with the torsion stiffness in their development facilities and came back to Fiat with: instead of stiffness X we need a stiffness Y.
- Very small liaison that still works with Fiat to define what is needed to be improved when it comes to the small improvements needed over the lifecycle of the car (new emission regulations, new engines etc…). A small group doesn't point to anything in the future, it is only the phase they are in now.
- A very deliberate choice to use Fiat's engineers. Mixing a group of different engineers have proven very difficult in Ford's history, they wanted to keep this simple.

- On a number of occasions there are areas of expertise and know-how on both fords part and probably Fiats that they know would benefit the outcome of the car but they have chosen not to share it with Fiat (e.g. quality or cost reductions) and make it transparent since that would destroy their competitive advantage (this is one car of many). Question: is this something we want to keep to ourselves or do we want to point out to Fiat that if they do X, Y and Z it will improve e.g. the fuel economy. If they told them that they could go and do that on all vehicles of their fleet.
- A certain technique or process would be very difficult to control, a patent would be self evident but it is not something that can be generalized over, it is a case to case issue. Consideration around the risk of spreading throughout Fiat, this is a fairly small part of Ford's business
- Compensation model: some initial compensation for the investments from Fiat to the panda platform that they owned. Changes were covered by separate commercial arrangements. Focus on the facts that the deal should be discrete, simple and not complicated with links to other parts of the business. The more complicated it becomes the harder it is to keep over time and keep the same common objectives. That strategy is born from having multiple brands and the experience of that.

13.2.5. Fiat

Interviewee: **Angelica Carapezza, Business Developer & Manager of Alliances**
Date: **May 3rd 2011**
Interview conducted over conference phone

- Angelica works with new alliances and business development and coordinates those activities. We've spoken to Ford but want to clarify a few things why a short interview with Fiat was held.
- This deal was a product development and manufacturing agreement signed in November 2004. Fiat had developed the platform for the Panda earlier and searched for a partner to raise production volumes.
- Ford was also in need for a replacement for the Ka since it had been on the market for unusually long time. Both were looking for a partner for the A-segment. Ford had no suitable platform and to develop one from scratch is very expensive.
- After signing the deal Fiat conducted carry over work in order to shape the new platform based on the panda platform. The contract was for a "ready to use" product that ford directly could put on the market.
- Ford allocated a small team of engineers in Torino for about a year to approve and supply fiat with suggestions on tuning and specifications for the KA-model in order to make it have Ford characteristics. They were situated in another building, "no one would let competitors into their facilities".
- The payment was divided into three parts. 1. A down payment to get access to the platform (in this was some IP-royalties included). 2. the actual development work. 3. investments in the plant and a supplier base.
- Q: why not a JV such as TPCA? No other alternatives from manufacturing contract considered. Fiat did not want a collaboration partner in Ford, only volume sharing.
- Q: how many was involved? Normal size of the development team at fiats side and one coordinater with its team from each side. Small team of ford engineers on the Ford side.