FACTORS AFFECTING RESEARCH AND DEVELOPMENT (R&D) COLLABORATION OF MULTINATIONAL ENTERPRISES (MNEs) AND THEIR LOCAL PARTNER FIRMS: A CASE STUDY OF TURKISH AUTOMOTIVE INDUSTRY

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Abstract

This thesis focuses on disclosing the factors that affect the Research and Development (R&D) collaboration between Multinational Enterprises (MNEs), and their Turkish partner firms, in the automotive industry. Following the literature review and pre-test interviews with the experts from the industry a number of different factors were identified. The methodology of the research was "Case Study" in order to provide an in-depth exploration of the factors. There are three case studies namely: Tofaş-Fiat, Ford Otosan-Ford and Hyundai Assan-Hyundai. The primary data was collected from 40 respondents (R&D/production managers and employees) by in-depth face-to-face interviewing.

Findings yield that the most important factors affecting R&D collaboration for the local companies were production, innovation & R&D capabilities and then absorptive capacity of the local companies. The most important factor affecting MNE's R&D location decisions was the main R&D policy of the MNE (criteria for possible R&D collaboration, openness to R&D collaboration and strategic goals). Another factor, competition between other R&D departments in different countries, and other R&D department's competency were found as moderate level of importance.

R&D Managers of Fiat, Ford and Hyundai found the Turkish government's R&D incentives very attractive, and found that Turkey's infrastructure, socio-economic conditions and cheap but skilled labor force were appropriate for undertaking R&D collaborations. Social factors (mutual trust, level of commitment and cultural conflicts) were found to be an important influence in MNE's R&D location decisions. The findings are expected to contribute to the R&D efforts and innovativeness of the Turkish Automotive Industry.

ÇOKULUSLU FİRMALAR VE YEREL ORTAK FİRMALARININ ARAŞTIRMA VE GELİŞTİRME (AR-GE) İŞBİRLİĞİNE ETKİ EDEN FAKTÖRLER: TÜRK OTOMOTİV ENDÜSTRİSİ ÖRNEĞİ

Özet

Bu tez çalışması, Türk otomotiv endüstrisinde faaliyet göstermekte olan çokuluslu firmalar ile yerel ortaklarının araştırma ve geliştirme (Ar-Ge) işbirliğine etki eden faktörlerin bulunması üzerine odaklanmıştır. Literatür taraması ve sektör çalışanları ile yapılan ön görüşmeler sonucunda yerel firmaya ve çok uluslu firmaya ait birçok faktör belirlenmiştir. Araştırma yöntemi olarak vaka analizi metodu kullanılarak faktörlerin önem dereceleri sorgulanmıştır. Bu araştırma Tofaş-Fiat, Ford Otosan-Ford ve Hyundai Assan-Hyundai'den oluşan üç vaka analizini içermektedir. Birincil veriler, toplam 40 kişiyle (Ar-Ge/üretim müdürleri ve çalışanları) derinlemesine yüz yüze mülakat metoduyla elde edilmiştir.

Bulgulardan ortaya çıkan sonuçlar şu şekilde özetlenebilir: Ar-Ge işbirliğini etkileyen en önemli faktörlerin başında yerel firmanın üretim, Ar-Ge ve yenilikçilik kabiliyetleri ve ardından özümseme kapasitesi gelmektedir. Çok uluslu firma tarafından bakılacak olursa, çok uluslu firmanın temel Ar-Ge politikasının ne olduğu ve stratejik amaçları arasında Ar-Ge'de işbirliği yapmak var olup olmadığının, Ar-Ge işbirliklerine doğrudan etkisi olduğu anlaşılmıştır. Bir diğer faktör olan, çok uluslu firmanın diğer ülkelerdeki ortaklarının izlediği Ar-Ge politikası (aralarındaki rekabet ve Ar-Ge yetkinlikleri), Türkiye'deki Ar-Ge işbirliğini orta derecede etkiler görüşü ortaya çıkmıştır.

Fiat, Ford ve Hyundai'nin Ar-Ge müdürleri Türk hükümetinin Ar-Ge teşviklerini olumlu bulduklarını ve Türkiye'de Ar-Ge yapmak fikrini doğru bulduklarını belirtmişlerdir. Türkiye'nin altyapısı, sosyo-ekonomik durumu ve ucuz ama eğitimli işgücüne sahip olmasının da Ar-Ge işbirliği yapmaya uygun olduğunu belirtmişlerdir. Ayrıca Ar-Ge projelerindeki karşılıklı güven ve uyumun, tarafların taahhütlerinde bulunması, kültürel anlamda sorun yaşayıp yaşamadıkları ve kültür çatışması olup olmadığı da önemli sosyal faktörler arasında yer almıştır. Sonuçların Türk ekonomisine ve otomotiv endüstrisine bir katkı yapması umut edilmektedir.

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To my parents

Serap Tuncay &

Prof. Dr. R. Nejat Tuncay

and my husband

Alper Çelikel

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List of Abbreviations

AMA	Automotive Manufacturers Association (Turkey)
CAD	Computer Aided Designs
CAE	Computer Aided Engineering
CEOs	Chief Office Executives
CIS	The Commonwealth of Independent States
CNG	Compressed Natural Gas
EC	European Commission
ECU	Electronic Control Unit
EU	European Union
EUREKA	European-Wide Network for Market-Oriented Industrial R&D and Innovation
FDI	Foreign Direct Investment
GM	General Motors
IS	Information Systems
IT	Information Technologies
İTÜ	Istanbul Technical University
JIT	Just-in Time
LPG	Liquid Petroleum Gasoline
MRC	Marmara Research Center
MCV	Mini Cargo Vehicle
MNEs	Multinational Enterprises
NPD	New Product Development
NVH	Noise Vibration and Harshness
ODTÜ	Middle East Technical University
OECD	Organization for Economic Co-operation and Development
OTAM	Automotive Technologies R&D Centre
PSA	Peugeot Citroën

SSK	Social Insurance Institute
TQM	Total Quality Management
TEYDEB	Technology and Innovation Support Programmes
TÜBİTAK	Scientific and Technology Research Council of Turkey
TTGV	Turkish Technology Development Foundation
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America (sometimes abbreviated as US)
TL	Turkish Lira
VW	Volkswagen

Chapter 1
Introduction

In today's very competitive and rapidly changing business world, to gain a competitive advantage companies should be innovative in developing new products, and making product improvements. Hence, companies' Research and Development (R&D) expenditures are increasing and national governments are providing incentives to promote firms' R&D activities. Thus, today being innovative and conducting correct R&D policies are more crucial than ever.

In its definition, R&D refers to "standard research and development activity devoted to increasing scientific or technical knowledge and the application of that knowledge to the creation of new and improved products and processes" (OECD, 2005). In the last 20 years, there has been an internationalization of R&D movement and a significant increase in R&D collaborations throughout the world in which companies are making R&D collaborations via strategic alliances, joint ventures, mergers and acquisitions or contracting (OECD, 2002). Hagedoorn (2001: 1) defined R&D collaborations as "parts of a relatively large and diverse group of inter-firm relationships that one finds in between standard market transactions of both related and unrelated companies".

Nowadays, Multinational Enterprises (MNEs) which have significant financial resources, especially prefer R&D collaborations in order to decrease their costs of R&D as well as to develop competitive products. R&D collaboration can be made with partner firms, suppliers, and universities/research institutes and even competitors who make R&D collaborations since they need each other's experience in developing new technologies.

It is widely accepted that, if MNEs and their local partner firms have R&D collaboration, generally the aim of this collaboration would be to share the costs and the benefits of this collaboration. This thesis will try to highlight the factors affecting the R&D collaboration of MNEs and local firms in the Turkish Automotive Industry.

1.1 Significance of the Research

This subject of "R&D Collaboration" is important because R&D collaborations have a positive impact on the capability development of local firms and on the prosperity of local economies. Most of the R&D activities contain embedded knowledge which is tacit and related to the experience of R&D engineers. It is generally difficult to transfer this embedded knowledge. If the local firm is able to acquire this new knowledge and then assimilates it, the local firm's R&D capability increases. Afterwards, the local firm can perform R&D projects and can take some of the intellectual property rights related to the products which are a direct impact of R&D collaborations.

1.2 Objectives of the Research

The main objective of this research is to explore the factors that influence MNEs' decisions for R&D collaboration with a developing country's firms. Thus, the aim of this study is two fold; first, to understand the factors related to the local partner firm, and second, to understand the factors affecting MNE's R&D location decisions.

1.3 Original Contribution

The literature indicates that R&D collaborations of MNEs with their suppliers, MNEs with local universities/research institutes and MNEs with their rival companies have been investigated. However, it also indicates that MNEs with their local partners is a subject that has not been explored so far.

Furthermore, there are few studies concerning R&D collaborations in developing countries including Far East Asia, China and India in literature. Therefore this study in Turkey is an original contribution and is unique in terms of exploring R&D Collaboration between MNEs and Turkish partner firms.

1.4 Outline of the Research

This study is composed of two main parts and nine chapters. In Chapter 1, the research topic, the significance and objectives of the research are introduced.

The **first part,** entitled “The Background of the Study”, contains three chapters which present the Literature Review, the Methodology of the Research and the Automotive Industry respectively.

The second chapter presents the literature review concerning factors that affect R&D collaboration including “capabilities” (production, innovation and R&D) and the absorptive capacity of the local partner firm and the MNE’s R&D locations decisions. The current state of the automotive industry, both international and domestic, is discussed.

The theoretical perspectives and methodology, as well as the conceptual model explaining the factors of R&D collaboration on MNEs and local partner firms, which the study is based on, is presented in the third chapter.

Chapter four “The Automotive Industry” provides industry related literature and information. Updated numerical data about the Turkish Automotive Industry such as production, sales, export and workforce figures is presented.

Chapter five “Macro Environment of Turkey” examines Turkey’s socio-economic conditions, labor costs, foreign relations, quality of life and living standards, government incentives, the new R&D Law, infrastructure, communication, energy and transportation.

The second part of this paper presents three case studies namely; Tofaş-Fiat, Ford Otosan-Ford and Hyundai Assan-Hyundai which are found in chapters 5, 6 and 7. These chapters include the findings obtained from in-depth interviews on above mentioned MNEs and their local automotive industry partner firms. Analyses of the three cases are presented in chapter eight.

Each chapter is devoted to clarifying the factors that affect R&D collaboration between MNE's and their local partners. Finally, the findings and conclusions are presented, followed by a discussion on the limitations of the research and directions for future research.

Part 1
Background of the Research

This section covers the background of the research and, in separate chapters, includes a literature review, the theoretical framework, the methodology of the research and some general information about the automotive industry.

Chapter 2
Literature Review

In today's rapidly changing and highly globalized world economy, firms must be innovative in order to gain competitive power in international markets. In this respect, the increased role of technology has become more crucial than ever. Especially, the role of the MNEs in which they own or control added value activities in more than one country and engage in foreign direct investments (FDI) is becoming more important (Dunning and Lundan, 2008: 3).

As well, conducting research and development (R&D) activities has become very important. Firms produce innovative products or develop innovative solutions very rapidly. The importance of knowledge has become important and knowledge based economies are developing which are directly based on the production, distribution and the use of knowledge and information (OECD, 1996).

2.1 Theoretical Framework

Innovation has been studied from different perspectives. Academicians and practitioners, consultants and researchers have extensively discussed the process of innovation and breakthrough concepts and products which are considered innovations. In addition, government and policymakers have looked for the keys to innovation as a source of national growth and prosperity.

2.1.1 Definition and Types of Innovation

Various definitions have been developed to explain innovation. The word ‘innovation’ means new ideas, processes and products. Briefly it means a forward thinking attitude to newness (Kuczmarski, 1995). According to the European Commission (2002), innovation policy is defined as “a set of policy actions to raise the quantity and efficiency of innovation activities, whereby innovative activities refer to the creation, adaptation and adoption of new or improved products, processes or services”. According to this wide definition developed by the European Union, it can be clearly seen that innovative activities only occur when a new product, a new process or a new service is created or an already created product, process or service is converted into a new version.

Myers and Marquis (1969: 69) stated that “innovation is a complex activity which proceeds from the conceptualization of a new idea to a solution of the problem, and then to the actual utilization of economic or social value”. Zaltman, Duncan and Holbek (1973: 10) argued that known concepts are combined in a unique way to produce a new configuration not previously known for innovative activities. Porter (1990: 780) emphasized innovation as a new way of doing things that is commercialized. Innovation is not just the conception of a new idea, nor the invention of a new device, it is the development of a new market even cutting costs, putting in new budgeting systems, improving communication, or assembling products in teams are considered examples for innovation (Kanter, 1983: 20).

Innovations have different types (product, process, service, administrative, ‘radical versus incremental’). Product innovation was defined by Schumpeter (1911) as “the introduction of a new good or a new quality of a good” whereas process innovation was defined as “the introduction of a new method of production or a new way of handling a commodity commercially” (as cited in Shionoya 1994: 7). Administrative innovations contain changes in organizational structures and administrative processes, and service innovations include new or improved systems in the service sector. Radical innovation occurs when there is exploration of new technologies in which the emphasis is on the development of new businesses, products and/or processes, that transform the economies of a business. Incremental innovations deal with exploitation of existing technology, which means that the knowledge required to offer a product builds on existing knowledge (Afuah, 1998: 15).

Although there are various definitions of innovation, it is acknowledged that innovation occurs when a business or research institution introduces a new product or service to the marketplace or it adopts new ways of making products or services. The concept may refer to technical advances in how products are made, or shifts in attitudes to the way in which products and services are developed, sold and marketed.

2.1.2 Definition and Forms of R&D

Research is defined as the systematic approach to generate new knowledge. In fact research may involve both new science and the use of old science to produce a new product. It is sometimes difficult to determine when research ends and development begins. "Research and Development" has traditionally been regarded by academicians and industry alike, as the management of scientific research and the development of new products; this was soon abbreviated to R&D (Trott, 2005: 243).

The concept of R&D refers to "the standard research and development activity devoted to increasing scientific or technical knowledge and the application of that knowledge to the creation of new and improved products and processes" (OECD, 2005). R&D is the purposeful and systematic use of systematic knowledge to improve information even though some of its manifestations do not meet with universal approval (Hagedoorn, 2001: 1). However, recently the term R&D sometimes used as "Research and Technology Development" (RTD) which has been also adapted by European Union, and from its definition it includes research, innovation, technology development and new product development.

R&D takes various forms: basic research, technology development, product development and sustainability in engineering. While basic research is mainly undertaken by the public sector, the other two forms are central to the competitiveness of most firms. In the early stages of technological activity enterprises do not need formal R&D departments (World Investment Report 2005: 95). On Table 2.1, Nobelius (2002) and Trott (2005) adapted terms about the forms of R&D.

Table 2.1 Forms of R&D

Basic Research (fundamental research):	Nobelius (2002) defined basic research as "experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying phenomena and observable facts, without any particular application or use in view". Trott (2005) stated that basic research is also referred to as fundamental science and is usually only conducted in laboratories and large organizations".
Technology Development (applied research, advanced engineering):	Technology is defined by Roussel *et al* as "the application of knowledge to achieve a practical result." (as cited in Trott, 2005: 243). Nobelius (2002) has defined technology development as "investigation undertaken in order to acquire new knowledge, though directed primarily towards a specific practical aim or objective, developing ideas into operational form". Trott (2005) defined applied research as "the use of existing scientific principles for the solution of a particular problem. It may lead to new technologies and include the development of patents. This form of research is typically conducted by large companies and university departments".
Product Development:	Nobelius (2002) defined product development as "a systematic work drawing on existing knowledge gained from research and practical experience, directed towards producing new materials, products and devices and towards installing new processes, systems and services". Trott (2005) stated that "product development is similar to applied research in that it involves the use of known scientific principles, but differs in that the activities center on products. Usually the activity will involve overcoming a technical problem associated with a new product. It may also involve various exploratory studies to try to improve a product's performance".
Sustainability in Engineering (product engineering, technical services):	This R&D work is called "Engineering" (product engineering, technical services) by Nobelius (2002) as "a systematic work directed towards improving already installed processes, systems and services, or produced materials, products and devices". The same R&D work which is called "Technical Service" by Trott (2005) as "focusing on providing a service to existing products and processes. This frequently involves cost and performance improvements to existing products, processes or systems".

Source: This table includes the definitions of Nobelius (2002) and Trott (2005).

After World War II (1945), R&D played an important role in providing firms with competitive advantage. Technical developments in various industries such as chemicals, electronics, automotive and pharmaceuticals led to the development of many new products, which produced rapid growth. For a while, it seemed as though technology was capable of almost everything. The tradition of R&D has therefore been to overcome genuine technological problems, which subsequently leads to business opportunities and competitive advantages over one's competitors. The forms of R&D can be viewed as an "R&D Continuum" and represented in graphical form by Trott (2005) which is shown in Figure 2.1.

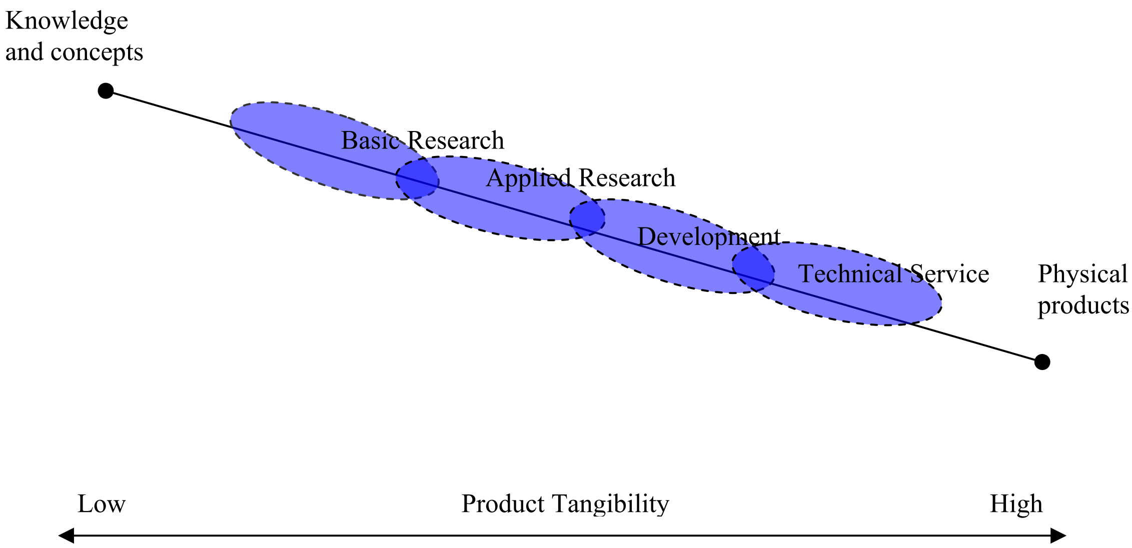

Figure 2.1 The R&D Continuum

Source: Trott, P. (2005) Innovation Management and New Product Development. Third Edition, p. 244, Prentice Hall, UK.

Especially in basic research, and some parts of applied research, relating to the knowledge and concepts, the developed product is less tangible in these phases. On the other hand, development, technical service and some parts of the applied research relates to (physical) products in a highly tangible manner. Traditionally, it has been viewed as a linear process, moving from research to engineering and then to manufacturing.

2.1.3 New Product Development Process and R&D

New product development (NPD) is a strategic decision taken by the upper level managers of the companies who prefer to handle the organizational aspects of the NPD in several ways. MNEs often establish a new product department, whose major responsibilities include generating and screening new ideas, working with the R&D department, carrying out field testing and commercialization (Kotler, 2003). The typical "theoretical" (NPD) decision process has the following eight stages:

1. **Idea Generation:** NPD process starts with the search for ideas. The ideas can come from interacting with various groups such as customers, scientists/engineers, competitors, employees, channel members, and top management, and from using creativity generating techniques. The R&D department liaises with these groups.

2. **Idea Screening:** After ideas are generated, they should be screened by the R&D department, and some of them will be eliminated. In this respect, a company should motivate its employees through rewards to submit their new ideas to an idea manager whose name and phone number are widely circulated. Ideas should be communicated each week by an ideas committee. The company then sorts the proposed ideas into three groups: promising ideas, marketing ideas and rejects.

3. **Concept Development and Testing:** Attractive ideas must be refined into testable ‘product concepts’. A product idea is a possible product that the company might offer to the market. A product concept is an elaborated version of the idea expressed in meaningful consumer terms. Concept testing involves presenting the product concept to appropriate target consumer groups and getting their reactions. The NPD decision making process is based on managers’ decisions and is also an investigation of whether or not the concept will be attractive to the customers. The R&D department is then informed about customer reactions to the new model.

4. **Marketing Strategy Development:** Following a concept test, the NPD will determine a preliminary marketing strategy plan for introducing the new product into the market. The target market's size, structure, and behavior; the planned product positioning; and the sales, market share, and profit goals must be clarified. There is no direct role for the R&D department in the marketing strategy development.

5. **Business Analysis:** After management develops the product concept and the marketing strategy, it can evaluate the proposal's business attractiveness. Management needs to prepare sales, costs, and profit projections to determine whether they satisfy the company's objectives. If they do, the concept can move to the development stage. There is no direct role for the R&D department in the business analysis.

6. **Product Development:** Up to this stage, the product has existed only as an idea, a drawing or a prototype. At this stage, the managers and the R&D department will determine whether the product idea can be translated into a technically and commercially feasible product. Following this decision, the flowchart in Figure 2.2 is implemented by the R&D department, and the new product is developed. A series of extensive tests are applied to the new product to verify whether this product is in incompliance with international standards.

7. **Market Testing:** After management is satisfied with the functional and psychological performance, the product is ready to be dressed up with a brand name and packaging, and put into a test market.

8. **Commercialization:** If the company goes ahead with commercialization it will face its largest costs to date. The company will have to contract for the manufacture of the product, or build or rent a full scale manufacturing facility. In addition, another major cost is marketing. The company must decide where and to whom the product should be produced.

Figure 2.2 shows the eight stages of the above mentioned NPD decision process. In every stage, there is an option to move forward to the next stage or ‘drop’, which means to not develop the new product. If the idea can move to the last stage, then the new product can be developed.

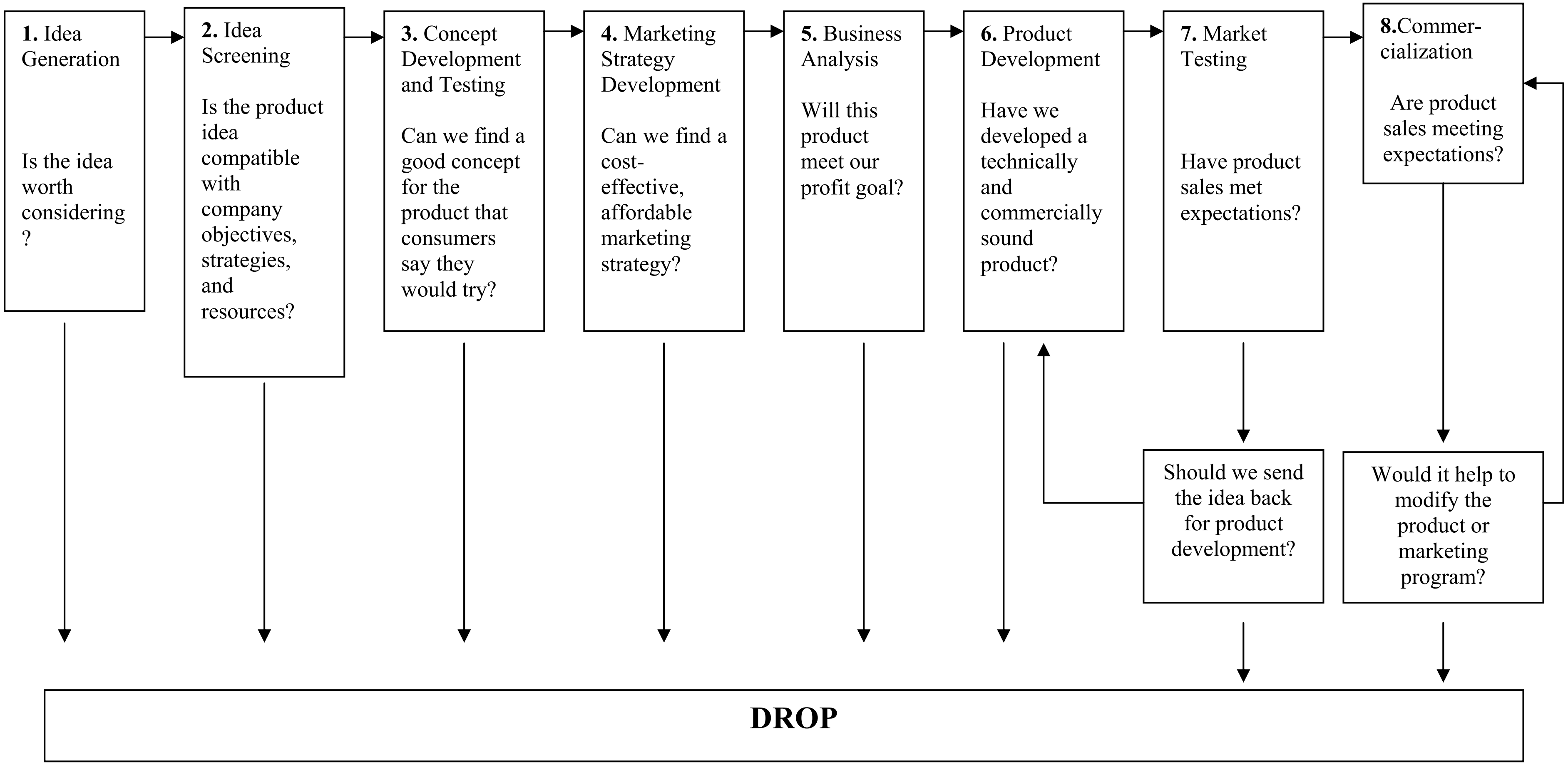

Figure 2.2 New Product Development Decision Process

2.2 R&D Collaborations

Starting with the definition of R&D collaborations, this section examines the types of R&D collaborations, motivation, the negative aspects and the risks of R&D collaborations.

2.2.1 Definition and Types of R&D Collaborations

In the literature, "R&D collaborations" are also called as R&D partnerships/co-operative agreements or R&D networks, and they are defined as the specific set of different modes of inter-firm collaboration where two or more firms, that remain independent economic agents and organizations, share some of their R&D activities. In a broad sense it includes joint research among institutions, licensing agreements, and other various types of strategic alliances. Hagedoorn (2001: 1) defined R&D collaborations as part of a relatively large and diverse group of inter-firm relationships that one finds in between standard market transactions of both related and unrelated companies. Hayashi (2004: 107) refers to the networking of R&D specifically to joint research.

Hagedoorn (2001: 3) mentioned that R&D collaborations are primarily related to two categories; contractual collaborations (non-equity based) such as joint R&D pacts and joint development agreements and equity-based joint ventures. Generally R&D collaboration takes place in strategic alliances including joint ventures, licensing etc. Strategic alliances are developed intra-industry or inter-industry. Intra-industry refers to the alliances within the same branch of industries where as the inter-industry refers to the alliances between different branches of industries. For example, three US automobile manufacturers have formed an alliance to develop technology for an electric car. This is an example of an intra-industry alliance. On the other hand, the UK pharmaceutical giant GlaxoSmithKline has established many inter-industry alliances with a wide range of firms from a variety of industries; these include companies such as Matsushita, Canon, Fuji and Apple (Trott, 2005: 214-219). In Figure 2.3, summary of the types of R&D collaborations is shown.

Contractual (Non-equity based) collaboration	**Equity based collaboration**	**Mergers and Acquisitions**
• Licensing • Supplier Relationships • R&D Consortia • Industry Clusters • Innovation Networks • University cooperation • International R&D projects	Joint ventures	Maximum integration and R&D collaboration

Figure 2.3 Types of R&D Collaborations

Research on collaborative activity has been hindered by a wide variety of different definitions. Types of R&D collaborations are explained below (Narula and Zanfei, 2003; Trott, 2005).

1. **Contractual Collaboration:** This is a non-joint venture type of R&D collaboration. The absence of a legal entity means that such agreements tend to be more flexible. This provides an opportunity to extend cooperation over time if so desired. A recent study by Hagedoorn (1993) established that non-equity, contractual forms of R&D collaborations have become very important modes of inter-firm collaboration, as their numbers and their share in total collaborations far exceeds that of joint ventures. These contractual agreements cover technology and R&D sharing between two or more companies in combination with joint research or joint development projects. Such undertakings imply the sharing of resources, usually through project-based groups of engineers and scientists from each parent-company. The costs for capital investment, such as laboratories, office space, equipment, etc. are shared between the partners. However, compared to joint ventures, the organizational dependence between companies in an R&D partnership is smaller, and the time-horizon of the actual project-based collaborations is almost by definition shorter.

1.1. **Licensing:** It is a relatively common and well-established method of acquiring technology. It may not involve extended relationships between firms but increasingly licensing another firm's technology is often the beginning of a form of collaboration. There is usually an element of learning required by the licensee, and frequently the licensor will perform the role of teacher. While there are clearly advantages to licensing, such as, speed of entry to different technologies and reduced costs of technology development, there are also potential problems, particularly the neglect of internal technology development. Licensing enables firms to enter the new growth industry of the time. But these firms can continue to develop their own technologies in other fields.

1.2. **Supplier Relations:** Many firms have established close working relations with their suppliers, and without realizing it may have formed an informal alliance. These are usually based on cost-benefits to a supplier. Lower production costs might be achieved if a supplier modifies a component so that it fits more easily into the company's product. Reduced R&D expenses are based on information from a supplier about the use of its product into the customer's application. Improved material flow can be accomplished due to changes in delivery frequency and item sizes.

1.3. **R&D Consortia:** A consortium describes the situation where a number of firms come together to undertake what is often a large-scale activity. The rationale for joining a research consortium includes sharing the costs and risks of research and pooling scarce expertise and equipment. In addition, Evan & Olk (1990: 38) stated that R&D consortia have emerged since the early 1980s as an inter-organizational alternative to licensing arrangements, acquisitions and joint ventures. R&D consortia include direct competitors in which R&D collaboration is handled between rival firms. In the literature, this process is referred to as pre-competitive research.

1.4. **Industry Clusters:** Micheal Porter (1998) identified a number of very successful industry clusters (Trott, 2005: 214-219). Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers and associated institutions in a particular field that are present in a nation or region. It is their geographical closeness that distinguishes them from innovation networks. Clusters arise because they increase the productivity with which companies can compete.

1.5. Innovation Networks: The use of the term network has become increasingly popular. It is the new form of organization offering a sort of virtual organization. For example, a car manufacturing company owns and manages its brand and relies on an established network of relationships to produce and distribute its products. It does not own all the manufacturing plants or all the subsidiaries in which its products are sold. It sometimes undertakes research, design and development or delegates to its partners or suppliers. It has networks of manufacturers in all over the world. Similarly it has a network of distributors in all the countries in which it operates (Trott, 2005: 214-219). An example of an innovation network is shown in Figure 2.4.

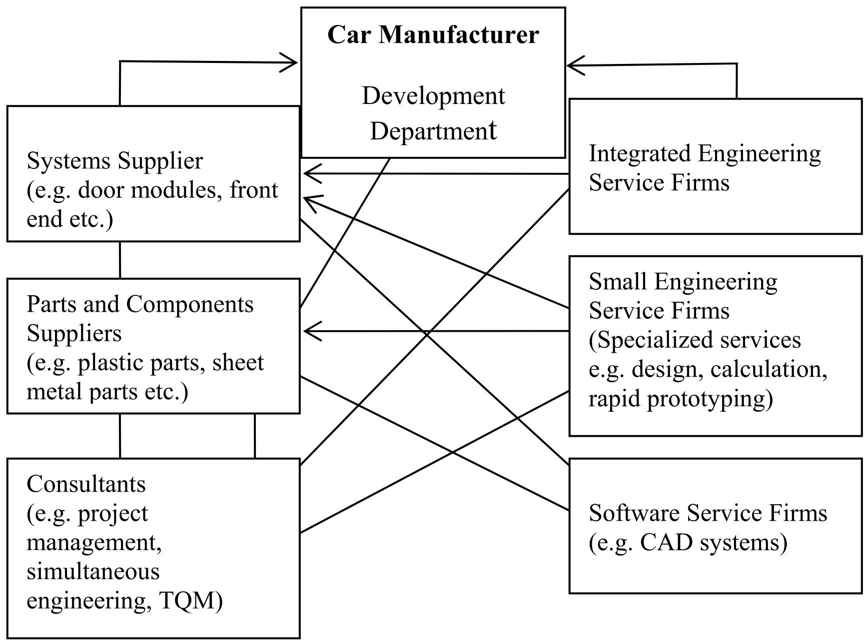

Figure 2.4 Innovation Network for Car Development

Source: Jürgens, U. (2003) Characteristics of the European Automotive System: Is There a Distinctive European Approach? Discussion Paper SP III 2003-301, Wissenschaftszentrum Berlin für Sozialforschung, pp. 29-30, Berlin, Germany. (Bernd Rentmeister (1999).

1.6. University Cooperation: This includes thesis work, sponsored research, a university with a research consortium, university professors, a specific institution, and a faculty or university institute (Finne, 2003: 1-2).

- Thesis work consists of a single person, such as a master's, diploma or doctorate thesis. An example of this would be engineering students who, at the end of their studies, may write their diploma work for a research laboratory in a large enterprise. Sometimes this research student joins the R&D department of the company after graduation.
- In a sponsored research model, a university's activities could be supported by the donation of the resources necessary to allow the procurement of important research equipment. There are many types of consortia, e.g., a collaboration project which includes a university, the enterprise, two companies functioning as subcontractors and a national research institution. The management of large consortia may be especially complicated.
- In some countries, university professors can be financed if they are the clear, key researchers in the area in question. In this category, professors can get resources through their university for doing research on an area of their expertise.

1.7. International R&D projects: They are projects financed by the European Union (EU). EU-financed projects in R&D and in the area of information technologies (IT) are large, usually have several participants and run in several European countries. The participants are mostly universities, enterprises, research institutions, collaborators and interest organizations. EU projects usually have specific contractual obligations that must be considered and included in the legal agreements of the collaboration (Finne 2003: 1-2).

2. **Equity Based Collaboration (Joint Ventures):** It is usually a separate legal entity with the partners to the alliance normally being equity shareholders. With a joint venture, the costs and possible benefits of an R&D research project would be shared. They are usually established for a specific project and cease on its completion. For example: Sony-Ericsson is a joint venture between Ericsson of Sweden and Sony of Japan. It was established to set design manufacture and

distribute cell phones. The intention of establishing a joint venture is generally to enable to organization to "stand alone".

3. **Mergers and Acquisitions:** When two firms merge or when one firm makes an acquisition of another firm, they become one legal entity. So this new entity has two company's R&D infrastructure and staff. In theory, these two different companies should begin R&D collaboration when they first merged or acquired.

2.2.2 Motivation behind R&D Collaborations

The management literature typically analyzes collaboration from a transaction costs' framework (Cassiman and Veugelers 1998). This theory holds that companies should seek the lower costs between performing R&D internally or contracting another party to handle it for them (Daniels *et al*, 2007: 489).

When expanding internationally, firms have always needed to adapt technologies locally to successfully sell them in the host countries. Hence, R&D strategies and the international location decisions of MNEs have changed substantially. In many cases, some internationalization of R&D has been necessary to accomplish this. MNEs are setting up R&D facilities outside developed countries that go beyond adaptation for local markets; increasingly, this take place in some developing countries, South-East European and within the CIS (The Commonwealth of Independent States) including countries from the former Soviet Republic (Hagedoorn, 2001: 6).

Baranson (1971: 2) argued that the motivation behind R&D collaborations are related to customer needs, market opportunities for firms, technology changes, reduced R&D risks and costs (Ansal and Soyak, 1999: 2), broader product range, improved time for marketing, responding to competitors, responding to a management initiative, in order to be more objective in product development, the need to conform with standards, due to a collaborative corporate culture, the need to achieve continuity with prior products and responding to key supplier needs.
Hagedoorn (1993) stated that capturing a partner's tacit knowledge of technology is emphasized as the main motivation for R&D collaboration. Tacit knowledge was

defined by Polanyi (1962) as knowledge that is nonverbalizable, intuitive, and unarticulated. Under this definition, the experiences of people are purely tacit knowledge. Routines (business work schedules) are most likely tacit knowledge (Nielsen 2005:1194-1204). In their paper, Miotti and Sachwald (2003) called the same factor "the need for knowledge access". In addition, they argued that the complementarities of the partners serve as the one of the main motivations for R&D collaboration. Campagni (1993) *et al* stated that collaboration activities also reduce uncertainty (Bader, 2006: 18-19).

2.2.3 Managing R&D Collaborations

Anderson and Weitz (1989) *et al* stated that the early stages of R&D collaboration are known to be the crucial period during which the quality of working relationships is established. Ring and van de Ven; and Parkhe thought that trust reduced the risks based on transaction costs, enabled conflict resolution and may help in adaptation to changes. (as cited in Bader, 2006) On the other hand, previous experience such as prior agreements in R&D activities and previous agreements with the same partner is a determining factor in the success of R&D cooperative agreements between firms and research organizations and is also a very important factor for the early stages of R&D collaborations (Mora-Valentin *et al*, 2004: 17-40). In Figure 2.5, managing R&D collaborations is illustrated.

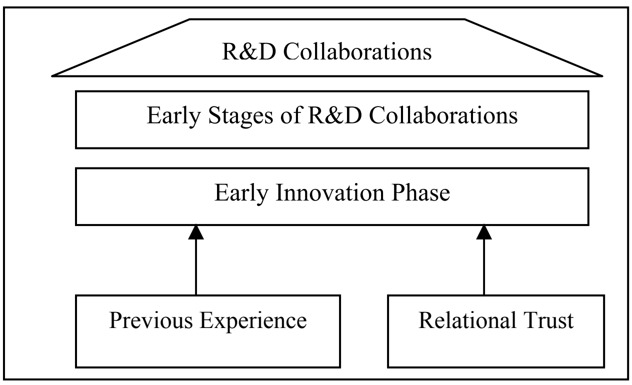

Figure 2.5 Managing R&D Collaborations

Source: Bader, M. A. (2006) Managing Intellectual Property in Inter-firm R&D Collaborations: The Case of the Service Industry Sector, Ph.D. Dissertation No: 3150, University of St. Gallen, pp. 15-23, Switzerland.

In the literature, the early innovation phase is often described as “the fuzzy front end of innovation” and it presents the best opportunities for improving the overall innovation process. Kim and Wilemon (2002) defined the early innovation phase as the period between the points of the first consideration of an opportunity until such time when an idea is judged ready for development. The outcomes are categorized into product definition, time, and people dimensions, and these outcomes develop a framework which illuminates performance factors. Rice (2001) *et al*; and Walls stated that the initiation of radical innovation projects seems to be especially difficult (Bader, 2006: 20). The early innovation phase may be characterized by:

- A low structural level, although this is in an experimental phase and often involves individuals instead of multifunctional teams;
- Revenue expectations that are often uncertain, and predicting precise commercialization dates is often impossible;
- Funding that is usually disordered;
- Results that often end up incorrect, and do not achieve a planned milestone.

Kogout (1989) *et al* mentioned that the ability of companies to succeed in inter-firm collaborations depends significantly on their experience with collaboration processes. Park and Ungson (1997) argue that the wider the experience, the better the ability to extend existing collaboration relationships and to enter into further future collaborations, i.e. knowledge about how to select a suitable partner, the right moment to enter and how to administer a collaboration. Powell (1997) *et al* mentioned that due to increasing internal skills, companies can improve their reputation and attract better partners through these collaborative efforts (Bader, 2006: 20). While managing R&D collaborations, partners’ reputation, geographic proximity such as geographic distance between the partners and time wasted in travel, degree of conflict are all determining factors in the success of R&D collaboration (Mora-Valentin et. al, 2004: 17-40).

2.2.4 Partner's Alignment in R&D Collaborations

Partner's alignment is an important topic in the formative stages of collaborative new product development. According to Emden, Calantone and Droge (2006: 330–341) technological alignment of the partners is the most important factor affecting R&D collaborations. This phase was followed in order, by the strategic alignment and relational alignment phases. These later phases were as important as the initial phase in ensuring the transfer and integration of critical know-how and in creating product value through collaboration. In Figure 2.6, the partner's alignment and selection in R&D Collaborations is shown.

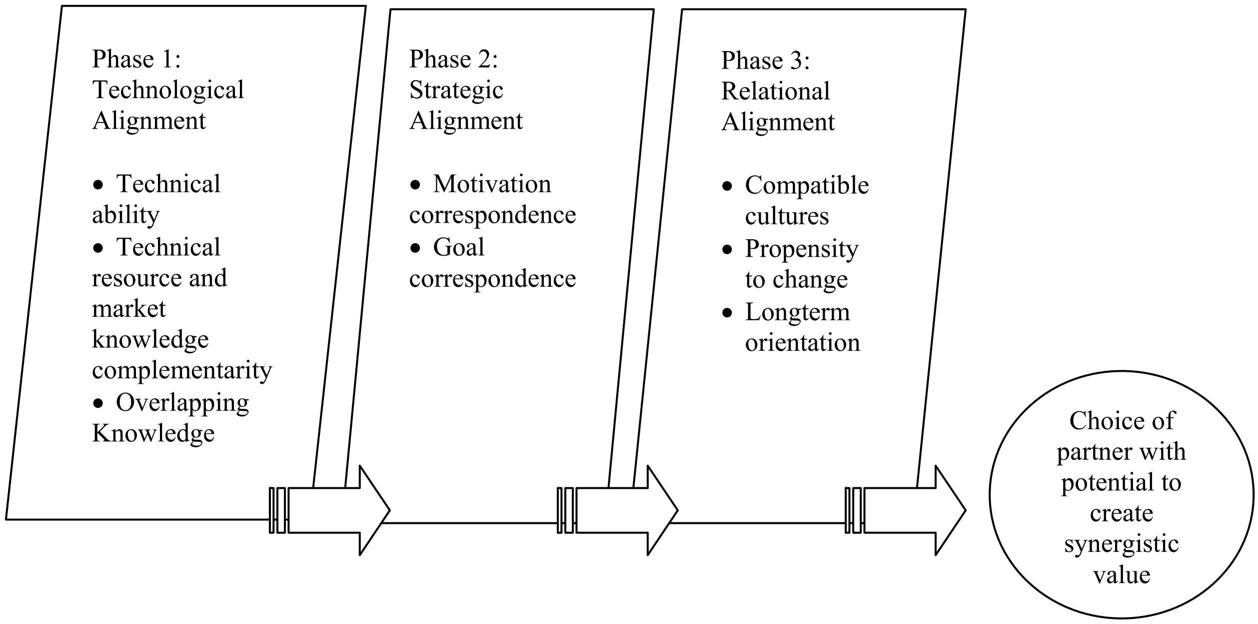

Figure 2.6 Partner Selection in R&D Collaborations

Source: Emden, Z. Calantone, R. J. and Droge, C. (2006) Collaborating for New Product Development: Selecting the Partner with Maximum Potential to Create Value. Journal of Product Innovation Management, 23, pp. 330–341.

2.2.5 Negative Aspects and Risks of R&D Collaboration

According to Finne (2003: 2-3), for a successful R&D collaboration project, it is necessary to have a large number of checkpoints (a list of items to complete) for before, during and after the project's completion. Checkpoints for R&D collaboration are shown on Table 2.2 as follows:

Table 2.2 Checkpoints for R&D Collaboration

1.	Identifying the partner where R&D collaboration is needed.
2.	Defining the parts that can be or must not be subcontracted.
3.	Identifying all the partnership alternatives and combinations of products or services that might meet the project's needs.
4.	Completing a thorough audit and assessment of the collaborator, including finances, security, personnel, product(s), strategy, processes and ownership of the company.
5.	Taking into account the collaborator's overall technology strategy.
6.	Maintaining financial controls in the project and the collaboration project.
7.	Checking the various types of billing, such as hour based and module based.
8.	Ensuring that the external person signs the nondisclosure agreement, which is completed by the project manager.
9.	Surveying for, assessing and finding the most suitable collaborator.
10.	Completing time scales which should be detailed in the project plan.
11.	Setting and following realistic and achievable quality standards.
12.	Completing the selection based on technical and business reasons.
13.	Checking the availability and management of access to information and information systems.
14.	Completing the contract drafting process, including proposal request, and the contents of the contract. When a contract draft has been made and the collaborator's comments received, the enterprise has to, with regard to the comments from the other party, decide which proposed changes are acceptable or unacceptable. For large collaborators with which an enterprise has a long-term cooperative agreement, it may be advantageous to make a memorandum of understanding (MOU). An MOU is a mutual understanding by the parties to work together in the future.
15.	Making the final decision whether to use the collaborator in question.
16.	Completing negotiations and contract signings, including practical arrangements, such as the location to sign the contract, who will sign the contract and the rights to sign it.
17.	Setting project checkpoints, including the financial situation of a project.
18.	Setting up a project and collaboration project library, which includes minutes, materials, change requests, reports, plans, etc.
19.	Setting reporting procedures internally and externally.
20.	Remembering that mutual respect and commitment are crucial for successful R&D collaboration.
21.	Taking into account that a large enterprise may have to advise and support the collaborator and help it to develop and grow.
22.	Continuing to manage the collaboration project.
23.	Testing the deliverables.
24.	Carrying out the R&D collaboration in a legal and ethical way, with full respect to all parties, countries, companies, employees, organizations, legislations, ethical principles and cultures involved.
25.	Following up, that includes questioning if the project's good and bad points have been recognized, documented and communicated in a constructive manner, both internally and with the collaborator.
26.	Storing the project and R&D collaboration project's materials in a secure and systematic way for security, audit trail and legal reasons.

Source: Finne, T. (2003) R&D Collaboration: The Process, Risks and Checkpoints. Information Systems Control Journal, Information Systems Audit and Control Association, vol. 2.

In R&D collaboration, there are likely a few thousand risks because of the magnitude and interdisciplinary nature of the area in question. R&D collaboration involves areas such as finance, sourcing, legal, tax, intellectual property rights, contract management, project management, planning, security, information systems, controls, risk management, engineering, human resources, quality and reporting. Further, the risks in R&D collaboration are not only a question of risks in the collaboration itself but also, among others, the general risks in the business environment. There should be replacement strategies, procedures and plans in the event that something should go wrong with the collaborator and the cooperation. There is no such thing as a typical, standard R&D collaboration case, but every single project has its specific risks and checkpoints.

Risks may occur if there is inadequate communication between two collaborating parties. One reason for this may be differences in corporate cultures. Also, inadequate reporting procedures can constitute risks, for example, a subcontractor may not use the same tools (for project management, reporting, etc.) as an enterprise. Multiple changes to original agreement may cause problems. This is especially problematic if changes are left undocumented, or documentation is done carelessly. A lack of awareness among the steering group and project group of the importance of risk management is also a risk. Additionally, a steering group should meet regularly for, among other reasons, to check that budgets, timetables and quality requirements are kept. All these aspects make up some of the risks of R&D collaborations.

In today's world, there is a risk that an enterprise is the target of industrial espionage. For example, there is a risk that collaborators may be used to getting access to the enterprise's information, such as breakthrough R&D results. For legal and contract reasons, among others, there should always be an audit trail. If quality requirements are inadequate, or non-existent, then there is a risk that the product will be of low quality. Because of this, a systematic quality control process is important. Ignorance of risks, information security, processes, sub processes, policies and supporting materials are always a risk, and finally, the largest risk of all is, not knowing what the MNE wants from the R&D collaboration project (Finne, 2003:2).

If a company does not manage risks, the collaboration may entail many drawbacks including significant economic losses to the enterprise, inefficient R&D collaboration, missed deadlines, wrongly used resources, damages to the brand, missed business opportunities and information security breaches. R&D collaboration usually starts with small projects when mutual trust increases, the collaboration may deepen. This possible development process may take several years.

Finne (2003) argued that the negative aspects of R&D collaboration include:

- Areas that are of significant strategic importance should not be subcontracted mainly because of security reasons.
- There are risks involved in relying too heavily on one collaborator, especially in strategic R&D.
- Many concerns arise when using subcontracting, such as what will be subcontracted and to whom, why subcontractors will be used, what the expected results are, and how the results will be linked to and integrated into the whole project.
- There is a risk that the collaborator's level of information, security, risk awareness and risk management is not adequate.
- The organization may lose the opportunity to gain important strategic knowledge that may be necessary in the future.

As an example of the negative aspects of R&D collaboration, in the automotive industry developing an automobile with competitors may save development costs and expand sales opportunity, but it may introduce product characteristics that are incompatible with the company's corporate identity.

2.3 MNEs’ Role in R&D Collaborations

Traditionally MNEs have centralized R&D in their home countries. One of the main competitive advantages of MNEs is their ability to create and transfer knowledge internally. However, during the past two decades, an increasing number of MNEs from North America, Europe and Japan have expanded their R&D presence abroad. It is evident that R&D has undergone a process of internalization, and that the less-advanced economies are becoming increasingly involved in this process. According to the United Nations Trade and Development (UNCTAD) Survey (2005-2009), China was the most attractive foreign location for MNEs over other developing countries such as India, Korea, Singapore, Malaysia, Thailand, Brazil, Mexico, Morocco, South Africa, Tunisia and Turkey.

Some examples of MNEs' role in R&D collaborations include the following: Motorola established the first foreign owned R&D lab in China in 1993. General Electric's Indian R&D activities employ 2,400 people in areas as diverse as aircraft engines, consumer durables and medical equipment. Pharmaceutical companies such as Astra-Zeneca, Eli Lilly, Glaxo Smith Kline, Novartis, Pfizer and Sanofi-Aventis all run clinical research activities in India. General Motors in Brazil competes with other GM affiliates in the US, Europe and Asia for the right to design and build new vehicles and carry out other core activities for the global company (Serapio and Hayashi, 2004).

2.3.1 Supplier Relations

Especially in the development of the automotive industry, supplier industries are mentioned as being crucial. Involving suppliers into the new product development process has been widely recognized by automotive manufacturers as an efficient way to be agile and lean (Ge and Fujimoto 2006: 236). A key feature of many lean production systems is that a relatively small number of suppliers are used. In traditional production, companies often deal with hundreds or even thousands of suppliers. In traditional systems, a supplier does not know the other suppliers or how they perform. Each supplier works to specifications provided by the manufacturer. In contrast, lean production companies may employ a tiered approach for suppliers: they use relatively few first-tier suppliers who work directly with the company, or supply major subassemblies.

The first-tier suppliers are responsible for dealing with second-tier suppliers who provide components for the subassemblies, thereby relieving the final buyer from dealing with large numbers of suppliers. Liu and Chen (2003) examined the literature on R&D internalization and globalization. Based upon this examination, they have emphasized the significance of “first-tier supplier advantage” in Taiwan. In Figure 2.7, Traditional Supplier Network Compared to Supplier Tiers is shown.

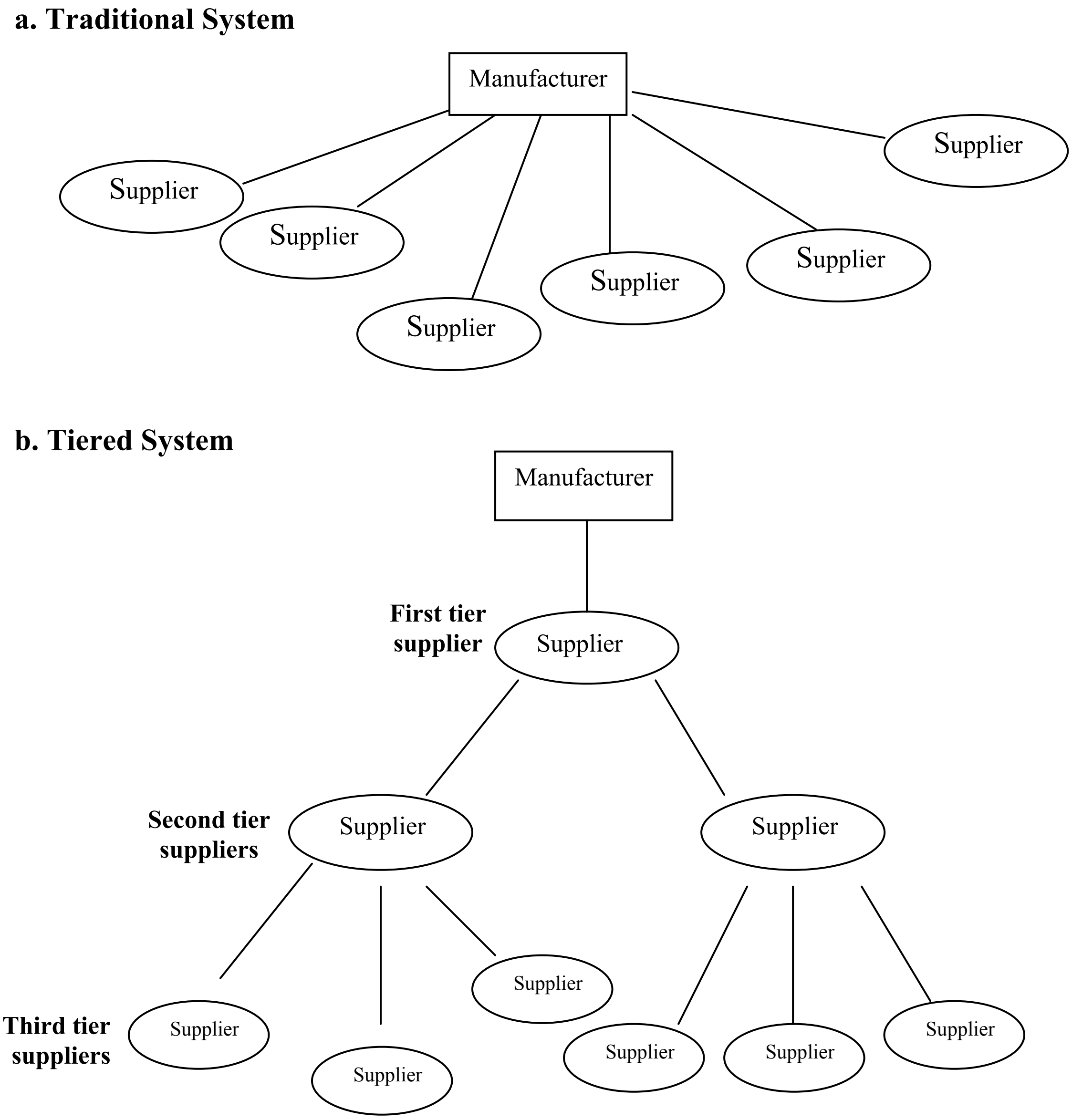

Figure 2.7 Traditional Supplier Network Compared to Supplier Tiers

Source: Stevenson, W. J. (1999) Production Operations Management. International Edition, Irwin /McGraw-Hill, p. 679, US.

2.3.2 Main R&D Policy of the MNEs

An MNE is considered to be a differentiated network, where knowledge is created in various parts of the MNE and transferred to several interrelated units (Hedlund, 1986; Bartlett and Ghoshal, 1989). Especially in a centralized R&D department of the MNE, knowledge is created by engineers. The MNE's main R&D policy will determine whether to transfer this knowledge to subsidiaries or partners or keep this knowledge inside the firm (Holm and Pedersen 2000; Minbaeva, Pedersen, Björkman, Fey and Park, 2003).

In the last decade, Gerybadze and Reger (1997) argued that there was a shift from centralized R&D to "balanced re-centralized R&D" as the main R&D policy of MNEs. Centralized R&D refers to establishing only one R&D center in the home country of the MNE without any R&D collaboration or transfer of R&D knowledge. On the other hand, "balanced re-centralization" refers to keeping many corporate functions and activities of R&D remaining geographically dispersed. Coordination and control of R&D and innovation, however, is increasingly kept within one center of opportunity. In balanced re-centralized R&D, an MNE collaborates with suppliers, partners or subsidiaries in R&D, but at the same time it keeps its centralized R&D center.

2.3.3 MNEs' Decision of Location

As Gerybadze (1997) has emphasized, in the 1960s and the 1970s MNEs firstly built up their sales, distribution and assembly operations in foreign countries. In later phases, efforts were directed towards supporting foreign subsidiaries with corresponding capacities in application engineering and applied R&D. Although initially, the tasks of R&D departments abroad were limited to adapt product and process technologies from the home country to local production and market requirements. There has been a clearly recognizable trend, since the late 1980s, towards strengthening R&D in foreign countries and extending the global competence portfolio. Increasingly, research became established at a high level in foreign locations. According to the World Investment Report 2005, MNEs were internationalizing R&D in developing countries and South-East European countries. MNEs' R&D is targeting global markets and is integrated into the core innovation efforts of MNEs.

According to Mora-Valentin *et al* (2004: 17-40), MNEs' location decisions are dependent on cost possibilities, knowledge embeddedness in the host country and the institutional quality of the host country. Steven (1999) argued that the potentially dominating location factors of MNEs usually include availability of an abundant energy and water supply and proximity to raw materials. Transportation costs were also stated as a major factor. Table 2.3 provides a summary of the factors that affect location decisions.

Table 2.3 Factors Affecting MNEs' R&D Location Decisions

Level	Factors	Considerations
Regional	Location of raw materials or supplies	Proximity, modes and costs of transportation, quantity available
	Location of markets	Proximity, distribution costs, target market, trade practices/restrictions
	Labor	Availability (general and for specific skills), age distribution of workforce, work attitudes, union or nonunion, productivity, wage scales, unemployment, compensation laws
Community	Quality of Life	Schools, shopping, housing, transportation, entertainment, recreation, cost of living
	Services	Medical, fire and police
	Taxes	Country, direct and indirect
	Environmental Regulations	Country
	Utilities	Cost and availability
	Development Support	Bond issues, low cost loans, grants
Site	Land	Cost, degree of development, soil characteristics and drainage, room for expansion, parking
	Transportation	Access to roads, railway, air freight
	Environmental/legal	Zoning Restrictions

Source: Stevenson, W. J. (1999) Production Operations Management. International Edition, Irwin /McGraw-Hill, p. 369, US.

The example of China is worth discussing. Since the mid-1990s, more than thirty large MNEs have located their wholly-owned R&D centers in Shangai, China because of its rich knowledge assets, competitive market, agglomeration of IT industrial clusters, and effective and flexible local governance. The location of these R&D centers does not result in an isolated high-tech colony, but in technology spillover (transfer) in the form of new spin-offs, the mobility of trained engineers between MNEs and local firms, and the creation of a new technology research field of MNE-university joint research labs. This is in turn enriches and restructures Shanghai's existing innovation systems (Chen, 2006).

2.3.4 Social Factors Affecting R&D Collaborations

Mutual trust and integrity, the level of commitment, cultural compatibility and management of cultural conflicts are emphasized in the literature as determining factors for the success of R&D collaboration (Mora-Valentin *et al* 2004: 17-40 and Lyles, 2007). In this study these factors are called "social factors".

The first social factor, mutual trust and integrity, was mentioned by Bader (2006: 20-21) who argued that the level of trust and integrity depends on the experience that R&D collaboration partners have had with each other in the past. Trust improves knowledge exchange, and it is a key component of organizational learning and the success of the joint venture (Nielsen, 2005: 1194-1204). It also promotes voluntary non-obligating exchanges of assets and services between actors and facilitates tighter social relationships and hence, reduces uncertainty in transactions (Mora-Valentin *et al*, 2004).

The second social factor, level of commitment, is claimed to be an important factor in the success of R&D collaborative agreements. Having previous production records, showing some success in new product development and having a good record of R&D performance in early local R&D projects are important parameters to increase the level of commitment in joint R&D projects.

Cultural compatibility and management of cultural conflicts are also mentioned by Mora-Valentin *et al* (2004: 17-40) as important factors that affect R&D collaborations. When cultures are compatible, firms collaborate easily, and there will be fewer cultural conflicts.

2.4 Local Firm's Role in R&D Collaborations

There is a growing evidence that MNEs have increased the extent of their R&D activities conducted outside their home countries and broadened the roles and ambitions of their foreign laboratories/subsidiaries/partners. However it is also clear that, only a small number of developing countries and economies in transition are participating in the process of R&D internationalization (Arvanitis and Hollenstein, 2006: 1). From the local (host) country's perspective, R&D internationalization opens the door not only for the transfer of technology created elsewhere, but also for the process of technology creation itself. This may enable some host countries to strengthen their R&D and innovation capabilities. (World Investment Report 2005: 94-95). Pearce (1994: 297-311) argued that the location of R&D is more likely to be influenced by countries' production, R&D, innovation capabilities and absorptive capacities. Absorptive capacity refers to the capacity to acquire, assimilate and apply new external knowledge. Hence, R&D internationalization may also widen the gap with those who fail to connect with the global innovation network.

2.4.1 Production Capability

"Capability" refers to the power or the ability to generate an outcome, and production capability is the firm's ability and competency in production and quality in control and testing. Dieter, E. Ganiatsos, T. and Mytelka, L. (1998:95) argued that if the local firm is competent in production and has high production capability, an MNE will decide to undertake R&D collaboration more often.

2.4.2 R&D Capability

In the management literature, the term know-how has been used to describe a company's knowledge base, which includes its R&D capability (Trott, 2005: 243). R&D capability is also stated as the ability to select, assimilate, use, maintain, adapt, design and even create technology, thus ensuring the capability to develop products and processes in response to changing economic development (Huq, 1999: 2-3). Unlike transferring product/process technologies or manufacturing technologies;

transferring R&D capability is not just about transmitting codified or equipment embedded knowledge and individual skills, but it is more about transferring and cultivating tacit and organizationally embedded routines of how to integrate knowledge and skills to generate value.

Zhao et. al (2005: 128-132) has researched the transfer of R&D capabilities in the Chinese automotive industry. He argued that R&D capabilities are the most tacit and embedded among various capabilities of the firm which is why R&D capability building is a very time consuming process (Huq, 1999: 1).

2.4.3 Innovation Capability

Innovation capability is defined by Kim (1997) as the ability to create new and useful knowledge based on previous knowledge; whereas Burgelman *et al* (2004) defined it as "the comprehensive set of characteristics of an organization that facilitate and support innovation strategies". In particular the local firm's innovation capability refers to adaptability in performing innovative ideas, products, and processes of the companies for the local market conditions. If the local firm is strategically open to generate innovations, then it is likely that it has developed its innovation capabilities.

2.4.4 Absorptive Capacity

The absorptive capacity (or learning capacity) is defined as the ability to understand, assimilate and apply external knowledge (Cohen and Levinthal, 1990: 128-152). It starts with recognizing the value of new and external information, and finishes with the application for commercial ends and it is critical for its innovative capabilities. In the middle of this process, assimilation which is also very important takes place. Nielsen (2005) described absorptive capacity as creating the space, opening up to develop the capability of "learning to learn".

Minbaeva *et al* (2003) summarized empirical studies on absorptive capacity into four dimensions namely: acquisition, assimilation, transformation and exploitation of knowledge. The first two dimensions form the potentional for absorptive capacity, while the latter two forms realized absorptive capacity.

Cohen (1990: 128-152) argued that, a firm with a greater absorptive capacity is also able to contribute more to collaboration and thus, a dynamic network can serve a double function: providing access to new, external knowledge and resources; and testing and internationalizing generated knowledge and capabilities thereby allowing for continuous learning and knowledge creation for both partners (Baranson, 1970: 436). In this respect, providing access to new, external knowledge to enable the knowledge to be internalized and then applied into its own system is a very important process for R&D collaborations. Monteiro, Arvidsson and Birkinshaw (2004) have studied local firm's absorptive capacity and found that absorptive capacity is one of the factors that affect knowledge flow between partners.

2.4.5 Technological Development Phases of the Local Firm

A local firm's technological level has an important role in R&D collaboration which can be studied in five technology phases. The first phase begins with production. After improving its production capability and absorptive capacity, the local firm becomes capable of forming a R&D department. R&D collaboration starts at this phase and the R&D capability level of the local firm develops. In the final phases, the local firm can create knowledge independently and becomes a center of excellence in the R&D of particular products. In Figure 2.8, local firm's technology phases are shown.

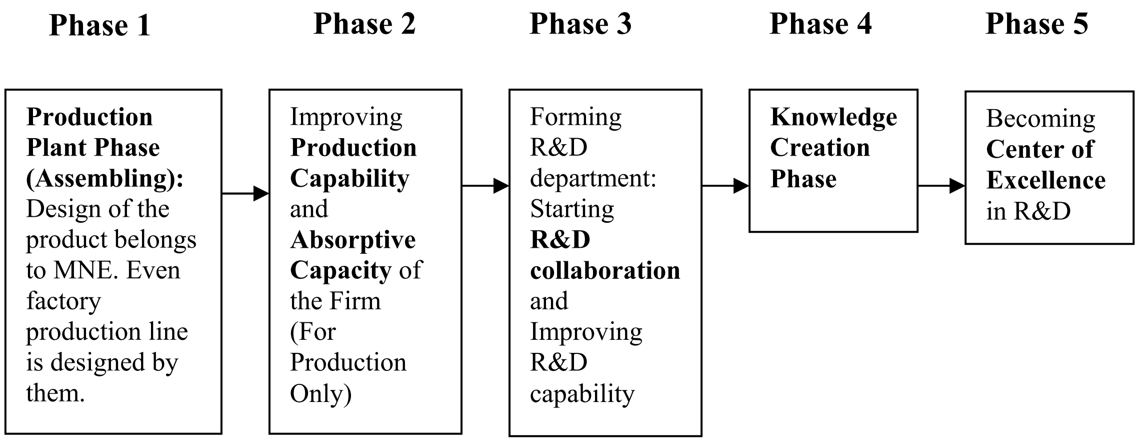

Figure 2.8 Local Firm Technology Phases

Source: Based on Pearce 1994; Ansal and Soyak, 1999; Huq, 1999; Trott, 2005; Zhao *et al*, 2005; Emden *et al*, 2006; Bader, 2006.

2.5 Knowledge Management in R&D Collaborations

Knowledge management in R&D collaboration is a very important issue within the context of research. In R&D Collaborations, there is knowledge flow (transfer) between the collaborating partners. The knowledge is transferred efficiently if the local firm has a well-developed absorptive capacity and the MNE is willing to transfer knowledge to its local partner. In Figure 2.9, major knowledge flow is shown from the MNE to its local partner and minor information flow is in the opposite direction. The share and flow of information between R&D departments is a complex issue. Literally, information flow and knowledge creation are realized between various levels of R&D departments and will be studied in the following chapters of this thesis.

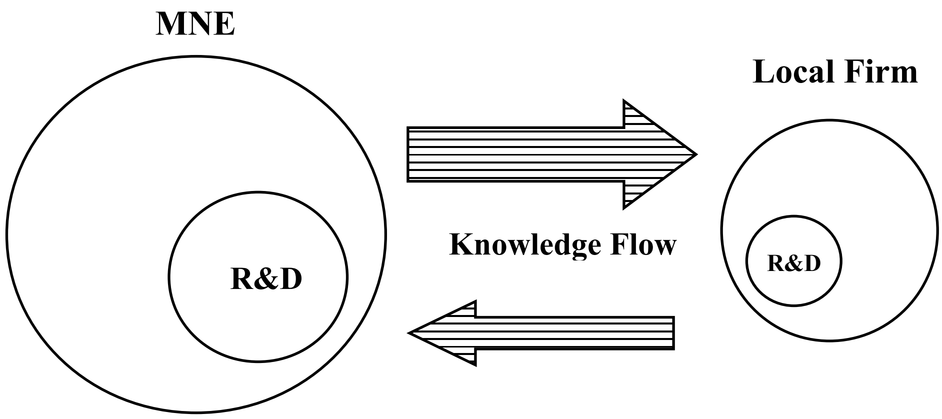

Figure 2.9 Knowledge Flow between MNE and the Local Firm

Source: Based on Lane, Salk and Lyles, 2001: 1141-1147; Gupta and Govindarajan, 2000: 473-496 and Zhao *et al*, 2005: 128-132.

2.5.1 Types of Knowledge

In the literature, there are two types of knowledge. Nonaka and Takeuchi (1995) coined the terms of "tacit" versus "explicit knowledge". Knowledge is explicit when it is formal, objective and easy to express. Patents are an example of purely explicit knowledge. "Tacit knowledge", also called "implicit knowledge" in the literature, is characterized by a high dependency on the context, experience and wisdom of the person carrying the knowledge. In Figure 2.10, forms of knowledge are illustrated.

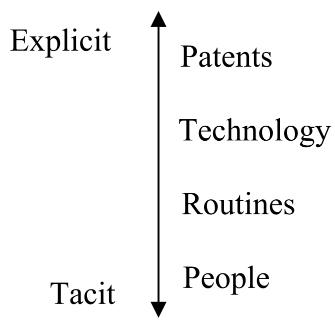

Figure 2.10 Forms of Knowledge

Source: Bogers, M. (2004) Knowledge Sharing and Protection in R&D Collaborations: Exploring the Tension Field. M.Sc. Thesis, December, Eindhoven University of Technology, The Netherlands.

On Table 2.4, knowledge management and types of knowledge is shown by examples.

Table 2.4 Knowledge Management and Types of Knowledge

Knowledge Management Processes	**Types of Knowledge**	**Examples**
Technology sharing	Explicit	• Quality control processes • Product designs • Scheduling systems
Joint venture and parent relations	Explicit	• Specific human resource practices
	Tacit	• Quality commitment
Engineer transfers	Tacit	• Continuous improvement objectives • Commitment to customer satisfaction

Source: Inkpen, A. C. and Dinur A. (1998) Knowledge Management Processes and International Joint Ventures. Organization Science, Institute for Operations Research and the Management Sciences, vol. 9, no. 4, pp. 454-467, July- August 1998.

The knowledge associated with technology sharing can be classified as explicit because it is related primarily to product designs or specific manufacturing processes. On the other hand, knowledge shared through joint ventures and parent interactions is explicit, even though there is the potential for sharing tacit knowledge. According to Inkpen (1998), product quality knowledge is viewed as tacit because it is associated with a culture and philosophy about business and is not based on specific rules or guidelines. Engineering transfers also have the potentional to transfer tacit knowledge, such as, beliefs and norms of behaviors. According to Lyles and Salk (2007), the knowledge acquired from an MNE can be explicit or tacit in R&D collaboration. There is an approach where the local firm takes tacit knowledge from the parent and then converts that knowledge into explicit knowledge.

2.5.2 Knowledge Transfer between MNEs and Local Partner Firms

Trott (2005) defined knowledge transfer as the process of promoting technical innovation through the transfer of ideas, knowledge, devices and artifacts from leading edge companies, R&D organizations and academic research, to more general and effective applications in industry and commerce. It has been proposed in the knowledge transfer literature that the absorptive capacity of the local partner firm is the most significant determinant in the transfer of knowledge in R&D collaborations (Gupta and Govindarajan, 2000; Minbeva *et al* 2003).

MNEs are no longer seen as repositories of their national imprint, but rather as instruments whereby knowledge is transferred across subsidiaries or partner firms, contributing to knowledge development (Holm and Pedersen, 2000). MNEs can develop knowledge in one location, but exploit it in other locations, implying the internal transfer of knowledge by MNEs. Hedlund (1986) and Barlett and Groshal (1989), for example focused on how knowledge is transferred in MNEs.

In the joint venture related literature, there is an adaptation mechanism being set up for the acquisition of knowledge from an MNE to its partner firm (Lane, Salk and Lyles, 2001: 1141-1147). If the local partner has enough capacity to absorb the incoming knowledge, the knowledge transfer becomes successful (Gupta and Govindarajan, 2000: 473-496). There are two perspectives relating to knowledge transfer between MNEs and local partner firms. The first one is a traditional unitary actor perspective, and the second one is called the dual-network perspective (Zhao *et al*, 2005: 128-132).

In the dual-network perspective shown in Figure 2.11, a network is defined as a set of firms and other organizations that contribute to, and draw from each other's skills and resources. Two types of networks are defined. The first one is called the 'MNE network', and it consists of the core firm, the subsidiaries and partners worldwide. The second network is called the 'local partner's network', and it involves suppliers, technical institutes, production partners, distributors and public agencies.

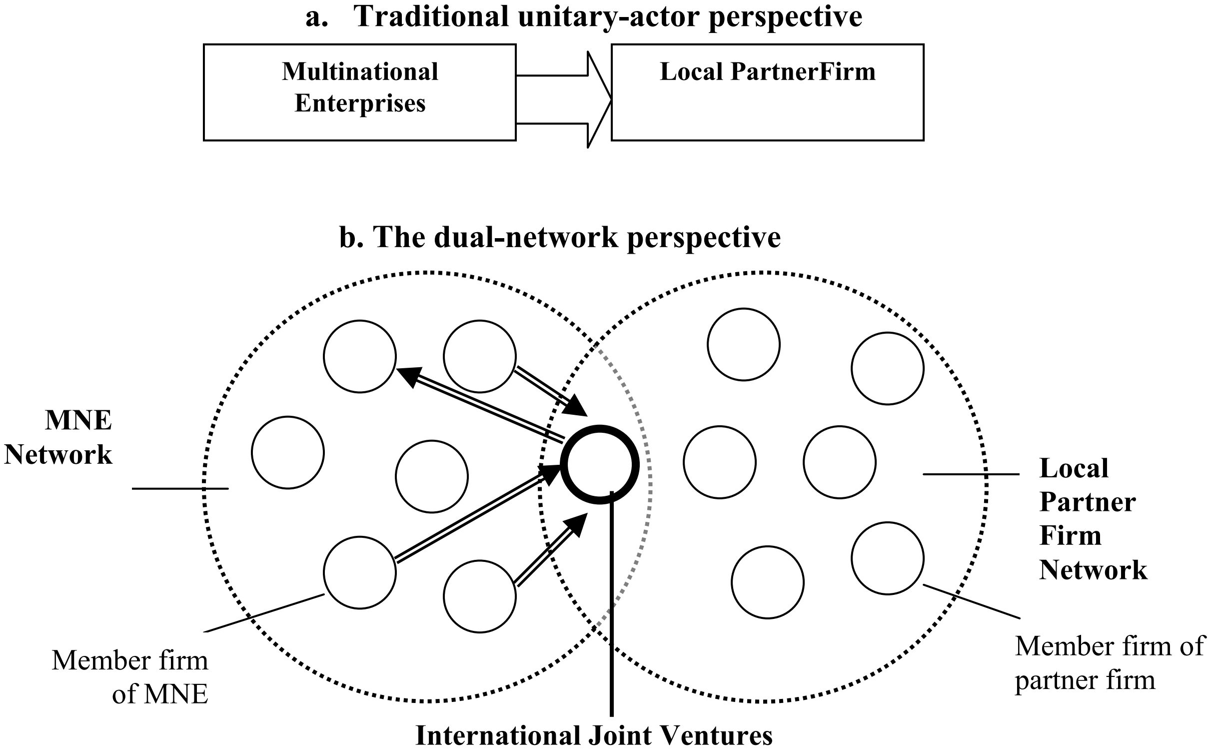

Figure 2.11 International Joint Ventures

Source: Zhao, Z. Anand, J. and Mitchell, W. (2005) A Dual Networks Perspective on Inter-organizational Transfer of R&D Capabilities: International Joint Ventures in the Chinese Automotive Industry. Journal of Management Studies, 42:1, pp. 128-132, Blackwell Publishing.

Partner firms that are geographically close to the MNEs' headquarters are more likely to send more knowledge, as well as receive knowledge inflows, than partners/subsidiaries that are geographically distant. Monteiro, Arvidsson, and Birkinshaw (2004), also argued that some partner firms can be isolated from knowledge transfer activities of the MNE. This isolation may occur due the partner firm's performance, geographical distance, communication frequency, tacitness of knowledge, partner firm's age and size and the host country's economic level.

2.6 Summary of the Factors Affecting R&D Collaborations

The following is a summary of the factors that affect MNE's R&D locations decisions factors, and the factors that relate to local partner firms.

Table 2.5 Summary of the Factors Affecting R&D Collaborations

For Local Firms
• 'Production, R&D and Innovation Capabilities' (Pearce 1994; Ansal and Soyak, 1999; Huq, 1999; Trott, 2005; Zhao *et al*, 2005; Emden *et al*, 2006; Bader, 2006)
• 'Absorptive capacity' or learning capacity of the local firm (Cohen and Levinthal 1990; Minbaeva *et al* 2003; Nielsen 2005
• 'Previous experience and success' such as prior agreements in R&D activities and previous agreements with the same partner, long-term orientation global satisfaction with the previous agreement, evolution of the relationship (Mora-Valentin *et al*, 2004; Bogers, 2004; Bader 2006, Emden *et al.*, 2006)
• 'Partners reputation, success and performance' (Monteiro *et al*, 2004, Mora-Valentin *et al*, 2004)
• 'Geographic distance': geographic distance between partners, time wasted in travel (Bogers, 2004; Monteiro *et al*, 2004; Mora-Valentin *et al*, 2004)
• 'Knowledge characteristics' such as complementarity, tacitness, codifibility, imitability, systematic, techability, complexity, newness, specificity (Bogers, 2004; Monteiro *et al*, 2004; Emden *et al,* 2006, Bader, 2006)
• 'Partner firm's age and size' (Bogers, 2004; Monteiro *et al*, 2004)
• 'Communication': frequency and content (Finne, 2003; Mora-Valentin *et al*, 2004; Bogers, 2004; Monteiro *et al*, 2004)
• 'Dependence': technical resources of the partner (Bogers, 2004; Mora-Valentin *et al*, 2004; Emden *et al*, 2006)
For MNEs
• 'Corporate philosophy' or the main policy of the firm, its R&D criteria, to be open to collaboration, strategic goals (Baranson, 1970)
• 'Transfer capability' whether the MNE is capable to transfer the knowledge (Baranson, 1970)
• 'Financial position' having enough financial resources (Baranson, 1970)
• 'Institutionalization': level of organizational design and planning of the relationship (Mora-Valentin *et al*, 2004)
• 'Host country's socio-economic infrastructure, institutional quality, communication, education, location of raw materials/supplies, market, labor, quality of life, services, taxes, environmental regulations, utilities, land, transportation, environmental and legal systems' (Stevenson, 1999; Monteiro *et al*, 2004; Bakır, 2006)

Table 2.5 Summary of the Factors Affecting R&D Collaborations (cont'd)

Both for Local Firms and MNEs
• 'Definition of objectives': requisites of objectives, knowledge and acceptance of objectives, responsibilities/tasks (Mora-Valentin *et al*, 2004)
• 'Costs of R&D' collaboration enables cost reduction (Baranson, 1971; Cassiman and Veugelers, 1998; Hagedoorn, 2001; Finne, 2003; Bader, 2006; Bakır, 2006)
• 'Uncertainty in R&D': reduction, minimizing and sharing uncertainty in R&D (Hagedoorn, 1993)
• 'Government incentives' (Hagedoorn, 1993)
• 'University/research institutes' involvement' (Bogers, 2004)
• 'Mutual trust, integrity and benevolence' (Finne 2003; Mora-Valentin *et al*, 2004; Nielsen, 2005; Bader, 2006; Lyles 2007)
• 'Commitment of the senior executives, technicians', emotional commitment, prospects of continuity, wish to invest (Baranson, 1970; Bogers, 2004; Mora-Valentin *et al*, 2004)
• 'Compatible cultures' (Finne, 2003; Bogers, 2004; Emden *et al*, 2006)

The factors affecting R&D collaboration are summarized on Table 2.5 given above. Chapter 3 Methodology of the Research studies the factors related to the main research questions of the thesis.

Chapter 3
Methodology of the Research

In this chapter the research problem will be defined and the main research questions will be presented. Then, the factors that affect R&D collaboration will be proposed. The chosen research methodology will be justified; information relating to the sample selection will be provided, and the data collection and pre-test interviews will be explained.

3.1 Problem Definition

Problem definition is identifying the factors affecting R&D collaboration between MNEs and their local partner firms discussed in the business literature. As such, the proposed study is a case study, with the aim of paving the way for hypotheses development for future research. This study helps provide answers to questions regarding what driving forces are behind R&D collaboration.

3.2 Main Research Questions

- What are the reasons for collaborating (not collaborating) in R&D activities?
- What factors affect R&D collaboration including absorptive capacities, production, R&D and innovative capabilities of the local company?
- What factors affect MNE's R&D location decisions?
- What is the nature of this R&D collaboration?

Research Questions will be formulated from two sides; some of the questions are related to the local Turkish partner and the others are related to the MNE. In this respect, there will be two separate sections of research questions, namely 1) Factors

Affecting R&D Collaboration in relation to the Local Partner Firms and 2) Factors Affecting R&D Location Decisions of the MNEs.

The Main Research Question Topics for Local Partner Firms:

1. **Production Capability of the Local Firm**

- Competency in production problems
- Quality control and testing

2. **Innovative Capability of the Local Firm**

- Adaptations to the local market
- New products idea development system

3. **R&D Capability of the Local Firm**

- Size of the R&D department with respect to human resources (number of engineers, educational level and years of experience)
- Infrastructure of the R&D department (Computer hardware and software, laboratories and testing facilities, libraries and links to international information centers, and etc.)
- Local firm's R&D department capability to produce new designs and patent applications
- Local firm's R&D investments and the new R&D law of Turkey

4. **Absorptive Capacity Level of the Local Firm**

- How adaptation mechanisms are being set up for knowledge acquisition from foreign parents in international joint ventures, such as, the capacity to learn (current capabilities, flexibility and creativity)
- The effort of the local firm to acquire external knowledge
- The effort of the local firm to apply external knowledge

The Main Research Question Topics for MNEs:

1. **Main R&D Policy of the MNE about Collaborative R&D**

- MNE's criteria for a possible collaboration
- MNE's openness to collaboration in R&D with its foreign partners
- Strategic goals of the MNE about R&D collaboration with local partner firms

2. R&D departments of the MNE

- Competition between R&D Departments in Different Countries
- The factors affecting the MNE's decision in regards to which R&D department is competent enough to undertake collaboration

3. Local Country Specifities

- Turkey as a 'Macro Environment' (socio-economic conditions, infrastructure, labor cost, government incentives, quality of life and living standards of Turkey)
- Social factors (mutual trust, level of commitment and cultural compatibility)

3.3 Proposed Factors Affecting R&D Collaboration

Factors affecting R&D collaboration were examined in detail. These factors are also shown on Table 3.1.

Table 3.1 Proposed Factors Affecting R&D Collaboration

Research Questions	Factors	Considerations
What are the factors affecting R&D collaboration in relation to local partner firms?	1. Production Capability	-Competency in production problems -Quality control and testing
	2. Innovation Capability	- Adaptations to the local market -"New products idea development system"
	3. R&D Capability	-Size (number of engineers, educational level, years of experience) -Infrastructure (computer hardware and software, laboratories and testing facilities) -Patent applications, new designs -R&D investments & new R&D law
	4. Absorptive Capacity	**-**knowledge acquisition from foreign parents -learning external knowledge -applying external knowledge
What are the factors affecting MNE's R&D location decisions?	1. Main R&D Policy	-MNE's criteria for possible R&D collaboration -MNE's openness to R&D collaboration with foreign partners -Strategic goals of the MNE
	2. R&D Departments of the MNE	-Competition between R&D Departments in Different Countries -Other R&D department's competency for collaboration

	3. Local Country Specifities	-'Macro Environment' (socio-economic conditions, infrastructure, labor cost, government incentives) -Social factors (mutual trust, level of commitment, cultural compatibility)

3.4 Research Methodology

The research methodology of this study is based on qualitative research. Why was qualitative research design chosen for this research? In order to answer this question, first of all, it is necessary to define two types of research: qualitative versus quantitative research. A quantitative research aims to understand a social problem through theories encompassing 'variables' which are measured in quantities and analyzed via statistical procedures. On the other hand, qualitative research is based on data expressed in the form of words, description, explanation etc., and analyzed in detail in descriptive ways (Sekaran, 2000: 129).

It is up to the researcher to decide which methodology is the most appropriate to use. The most important thing is the nature of the problem. Especially when the variables are already well known and already specified in the literature, the researcher does not feel any need for further exploratory research then he/she can use a quantitative technique, which is more than adequate. As an example; experiments or surveys based on questionnaires or structured interviews are the main methods for data collection in quantitative research.

On the other hand, where the research problem needs to be explored in depth and the variables in the literature were incomplete and unable to explain the full picture, qualitative research is preferred. Case studies and in-depth interviews are the main methods for data collection in qualitative research (Creswell, 1994). In this situation, the nature of the problem is to explore the factors that affect R&D collaboration. In addition, the factors were identified both through the literature review, and in the pre-test interviews. In order to explain the full picture of which factors affect MNE' R&D location decisions in relation to local partner companies, factors need to be explored in a field work through case studies.

"Case study method" was selected as the appropriate research methodology because it would allow for further exploration of the factors and there is an in-depth, contextual analysis of similar situations in organizations (Tofaş-Fiat, Ford Otosan-Ford and Hyundai Assan-Hyundai) in the same industry (automotive), where the nature of the problem, and the problem definition happen to be similar to one experienced in the current situation. In fact, although case study was mentioned as a problem solving technique, it is seldom undertaken in organizations because case studies dealing with problems similar to one experienced by a particular organization, of a particular size, and in a particular type of a setting are difficult to find (Sekaran, 2000: 129).

Rather than using samples and following a rigid protocol to examine a limited number of variables, case study methods involve an in-depth, longitudinal examination of a single instance or event: a case. According to Yin (1994), cases include a systematic way of looking at events, collecting data, analyzing information, and reporting the results. As a result the researcher may gain a sharpened understanding of why the instance happened as it did, and what might be important to examine more extensively in future research.

In this research, factors were systematically analyzed by asking each collaborating firm questions. After gathering the data, the factors' level of importance was determined. This is important for future research, because above all, the most important factors should be extensively investigated.

3.4.1 Sample

In the Turkish automotive industry there are 17 manufacturing firms (passenger cars, light commercial vehicles, trucks, pick-ups, minibuses, buses and tractors). This study concentrates only on passenger cars and the light commercial market segment. Tofaş, Ford Otosan, Hyundai Assan, Honda Turkey, Toyota and Oyak Renault are the companies producing cars and light commercial vehicles. Among those, Tofaş, Hyundai Assan, Oyak Renault and Ford Otosan are four of the local manufacturing companies that have joint ventures with MNEs. When this research started, the Oyak Renault and Renault R&D collaboration was part of the sample. Because of the limited data that could be collected, the Oyak Renault-Renault case had to be removed. In this respect, Fiat, Ford, Hyundai and their local partner firms, Tofaş, Ford Otosan and Hyundai Assan make up the sample of this research.

For the selection of cases, three criteria shown below were adopted:

- MNEs that have production plants in Turkey
- MNEs that have local partner firms (joint venture/strategic alliances)
- MNEs produces only passenger car and light commercial car segments

The following firms consist of the sample of the research.

Table 3.2 Sample of the Research Design

MNEs	**Turkish Partner Firms**
Fiat	Tofaş
Ford	Ford Otosan
Hyundai	Hyundai Assan

Table 3.3 List of Interviewees

MNEs	**Turkish Partner Firms**
Top Level Managers	CEOs/Top Level Managers
R&D Managers	R&D Managers
R&D Engineers	R&D Engineers

First of all, MNEs' (Fiat, Ford and Hyundai) top level managers were interviewed face-to-face and then R&D managers and engineers of the same MNEs were also interviewed. After receiving the data from MNEs, in-depth interviews were applied to the local firms' (Tofaş, Ford Otosan and Hyundai Assan) CEOs, R&D managers and engineers.

3.4.2 Data Collection

In this research, both primary and secondary data were collected from the companies. Statistical data from the Automotive Industry Association (AMA), which was gathered from the web site of the association, was also used. In addition, companies' annual reports and investor presentations were used as items of secondary data.

For the primary data, information was collected from the multiple respondents by in-depth face-to-face interviews. The research instrument most applicable for gathering data from face-to-face interviews with the MNEs and their local partner firms was a survey. The interview form was a semi-structured interview because the respondents were asked both planned and unplanned sequences of questions. The qualitative data obtained from firms through semi structured, open-ended questions were categorized into meaningful classifications called "the factors".

Approximately 40 face-to-face interviews were undertaken with critical informants from the companies and the industry. In the data collection process all targeted interviews were completed without any exception. The study was based on a questionnaire designed to determine the partners' behavior in R&D collaboration. The objective of the research was to collect more factual data, rather than perceptual data, on the factors and on how R&D collaboration between the parties was executed. Field based research, based on interviews with top-level, R&D managers and engineers at MNEs and at the local companies was relatively easy to conduct due to the limited number of respondent groups.

The question form used for local companies participating in this research was composed of 7 parts. On the front of the survey form, a cover letter explained the study. Part I involved questions designed to acquire basic statistical information about the company. Part II included questions about the firm's competitiveness strategy, production, technological capabilities, and related questions. Part III involved questions regarding the firm's R&D activities. In part IV, the questions related to knowledge transfer from the MNE to the local partner were included. Part V was composed of questions relating to the R&D collaboration of the MNEs and the local firm. Part VI covered questions relating to rivalry firms and the local firms. Finally Part VII was composed of questions regarding the relationships of universities and the local firm. Two separate sheets of the question form were developed and administered to the MNEs and local companies separately.

In this research, the question form used for the MNEs had 2 parts, as did the local partner's survey form: on the front of the survey form a cover letter explained the study. Part I involves questions related to the firm's R&D activities. Part II covered questions related to the firm's R&D collaboration with Turkish partner firms.

For the local company question form, there were 48 open ended questions, 4 likert scale questions and 1 yes/no question. For the MNEs, there were 14 open-ended questions and 1 likert scale question. The question form was developed in Turkish and English. Both of the question forms are presented in the appendices of this research.

Some of the descriptive information relating to the case study firms, such as the number of employees, year of establishment etc., was obtained from the AMA (Automotive Manufacturers Association) before the interviews, and respondents were asked to verify the information. During the interviews, instead of using tape recordings, notes were written in detail. After the interviews, the notes were immediately reviewed in order not lose any information.

3.4.3 Pre-test Interview

1) The questionnaire was reviewed by a panel of experts, including academicians and industry experts.
2) Face to face preliminary interviews with the director of the AMA (Automotive Industry Association) and the director of Mekatro R&D Company (Tofaş) and some critical informants were applied.

Questionnaire Revision:

Some questions were added to the final questionnaire after the pre-test interview in 2007. The structure of some questions was changed in order to elicit more information. Following an in-depth literature review over an 8 month period, some factors were added and replaced for the following format.

Chapter 4
The Automotive Industry

This chapter includes information about the world automotive industry with an emphasis on the Turkish automotive industry which includes production, export, import, sales and workforce figures.

4.1 The World Automotive Industry

The nature of automotive industry and the associated production techniques has an important bearing upon the world's industrialization period (Baranson, 1971). Automotive products consist of a broad array of vehicles consisting of hundreds of models of passenger cars, trucks, tractors, buses, and other commercial and utility vehicles. Trucks range from light-weight pickups to multi-ton trailers. Buses may range from Volkswagen-type minibuses used for city traffic to standard buses. In addition, there are hundreds of varieties of utility, construction, and farm vehicles, including road graders, forestry equipment, and tractors. All automotive products have a power train (engine, transmission, drive shaft, and axles), body and chassis, a wide variety of other parts and components (tires, batteries, exhausts, radiators, upholstery, etc.).

Because of the nature of its product, the automotive industry has always been knowledge intense in the sense of creating, sharing, using, and storing knowledge throughout its history. Tewari (2005: 1-41) stated that in terms of production, the automotive industry has been mentioned as a classic example of a producer driven value chain. Characterized by large scale, capital intensive, technology driven, production cycles, producer driven commodity chains are networks of global production in which a handful of final assemblers dominate the industry's main market.

4.1.1 History of the World Automobile Industry

The first automobile was produced in the 19th century, in Europe, especially in Germany and France. Mass production started in the early 1900s, in the USA, and in the 1940s in Europe. The production model, developed by Henry Ford in the early period of the automotive industry, became the dominant model in the economy (Clark and Fujimoto: 1991). The production of commercials vehicles began during the years of World War I (Bedir, 2002). By the late 1950s, only four or five major world players constituted the automotive industry.

There are three phases in the world automotive industry that these world major players (MNEs) experienced:

- In phase one (prior to 1950), MNEs were able to manufacture automotive products in their home countries and export them to overseas markets. During this period, limited assembly operations overseas were sometimes undertaken.
- During phase two, progressive restrictions imposed by developing countries upon automotive imports during the 1950's, forced auto manufacturers to establish first, assembly and then, manufacturing operations overseas, or alternatively lose the market.
- As a new development (phase three), certain developing countries bargained to have export capabilities built into the manufacturing operations to help pay for continuing import requirements (Baranson, 1971).

4.1.2 Product Development in World Automotive Industry

An automobile is a product composed of thousands of functionally meaningful components, each requiring many production steps. The technological sophistication of each component may be somewhat lower than that found in some high tech products. According to Clark and Fujimoto (1991), product development in the automobile industry has peculiar characteristics. A car is a complex, 'fabricated-assembled' product, comprising a large number of components, functions, and process steps. The product is complex from the buyer's perspective, giving rise to a number of important performance dimensions. Although the automobile has a long history, and customers generally have a good deal of experience with it, buying one involves a very complicated evaluation of many criteria, some of which are highly subjective, subtle, multi faceted, and holistic, and all of which may change over time, and sometimes in unpredictable ways. A project to develop a new car is complex and long lived. It may involve hundreds, even thousands, of people over many months. The processes related to planning and design, are further complicated by changing markets, long lead times, and a multiplicity of choices. Engineering complexities include the number of parts and components, demanding levels of cost and quality, the number of competing objectives, and inherent ambiguity in the customer's evaluation of the product.

These characteristics make the development of a new car a fascinating arena in which to study the management of product development. The automotive industry is so rich that it cannot help but share some basic patterns with other industries. For example, many of the critical problems in developing a car, such as, integrating engineering and manufacturing, establishing links between technical choices and customer requirements, and establishing effective leadership, show up in the development of most 'fabricated assembled' products.

There are many examples of collaborative product developments in the automotive industry, especially for MNEs who have made collaboration with other MNEs (rival companies). For example, during the 1980s, Renault jointly produced automatic transmissions with Volkswagen (VW), diesel engines with Fiat, and gasoline engines with Peugeot and Volvo; the company cross-licensed some components with British Leyland, signed a joint research agreement with five other European makers, and acquired a minority share of American Motors and then Volvo. Chrysler, during the same period, acquired engines from VW and Mitsubishi as well as completed vehicles from Mitsubishi and Maserati. Ford jointly developed the Probe and Escort with Mazda and a minivan with Nissan. General Motors (GM) has business ties (joint ventures or equity holdings) with Toyota, Isuzu, Suzuki, Volvo, Pininfarina, and Saab and owns a majority interest in Lotus Cars. Virtually all major players in the worldwide industry are involved in global networks of cooperation, exchanging drawings, tools, components, and complete vehicles at different levels and with different companies.

4.2 The Automotive Industry in Turkey

The Turkish automotive industry has become one of Europe's main automotive producers, with its $ 27 billion in exports in 2008. Today 15 out of every 1.000 cars in the world are produced in Turkey. Turkey ranks 18th in the world automotive production, 6th in the EU after Germany, France, Spain, the UK and Italy. The automotive manufacturing capacity in Turkey has reached approximately 1.3 million units (Automotive Manufacturers Association- AMA, 2007).

According to the Export Council of Turkey, including suppliers, the automotive industry is the highest exporting industry in Turkey. Following the automotive main and suppliers industry, other exporting industries in Turkey are ranked as follows: second is the textile industry, the iron and non-iron metals industry is 3rd, chemical components are 4th and the electric-electronic and machinery industry is 5th (as cited in AMA, 2007). The percentages of the leading exporting industries in Turkey are shown in Figure 4.1.

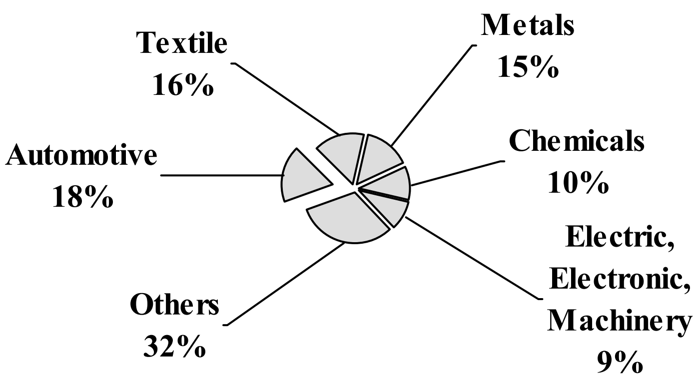

Figure 4.1 Leading Exporting Industries in Turkey

Source: Automotive Manufacturers Association of Turkey (AMA), "http://www.osd.org.tr/ 2007".

4.2.1 History of the Turkish Automotive Industry

Until the mid 1950s, Turkey did not have a vehicle production capability and all vehicles were imported. In the 1950s, some prototype vehicles were manufactured and the first assembly line was established. In 1954, the first jeep was manufactured for the Turkish army. In 1955, the first truck and in 1963 the first buses were assembled. In the early sixties, the military regime asked the Turkish Railway Repair and Maintenance factory in Eskişehir, to design and produce a car. Only three prototypes were produced and were never converted to mass production. Ironically the name of the car was "Devrim" which represented the slogan of the revolution. The development phases of the Turkish automotive industry are shown in Figure 4.2.

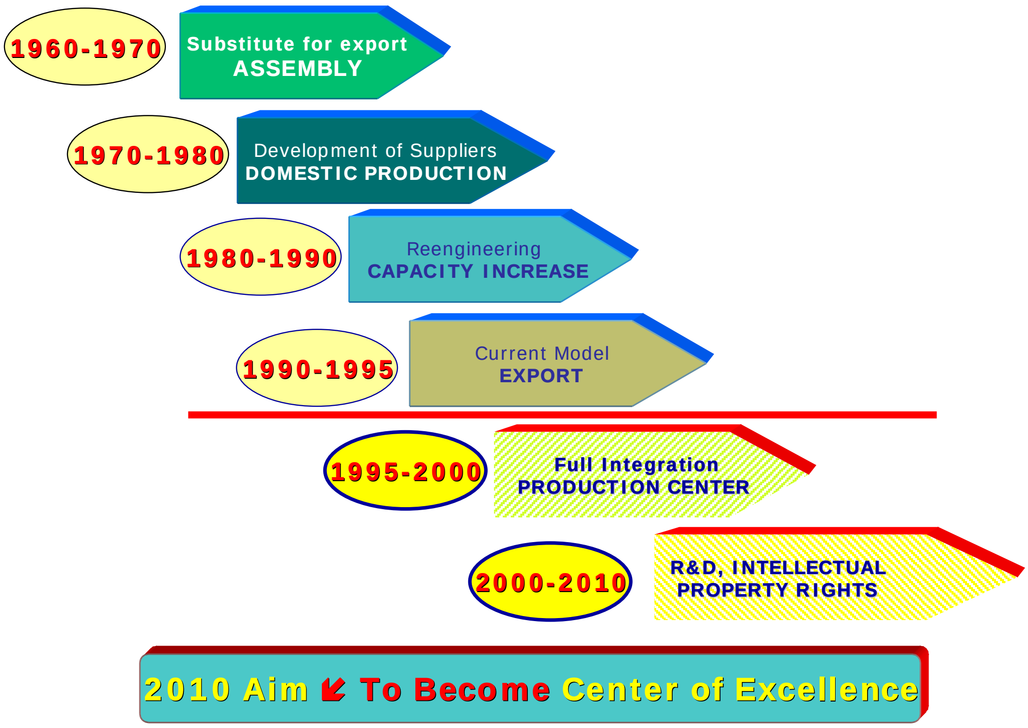

Figure 4.2 Development of the Turkish Automotive Industry

Source: Ford Otosan Company Reports, www.ford.com.tr, 2007.

As Figure 4.2 shows, the Turkish automotive industry has developed very rapidly. Since the 1960's, there has been a great improvement in the quantity and quality of production. In total there are 18 automotive manufacturing firms in Turkey which are shown below (AMA, 2007).

Table 4.1 Automotive Manufacturing Firms in Turkey

Firms	Place of the Plant	Year (production has started)	License	Foreign Capital %
1. Anadolu Isuzu Automotive Industry and Trade Company	Kocaeli	1966	Isuzu	29,74
2. Askam Truck Production and Trade Company	Kocaeli	1964	Hino	0
3. British Motor Company (BMC) Industry and Trade Company	İzmir	1966	-	0
4. Ford Otosan	Eskişehir/ Kocaeli	1983/ 2001	Ford	41
5. Hattat Agricultural Company	Tekirdağ	2002		
6. Honda Turkey	Kocaeli	1997	Honda Motor Europe	100
7. Hyundai Assan Automotive Industry and Trade Company	Kocaeli	1997	Hyundai Motor Company	70
8. Karsan Industry and Trade Company	Bursa	1966	Karsan/ Peugeot Hyundai Motor Company	0
9. MAN Turkey	Ankara	1966	Maschinen-fabrik Augsburg Nürnberg (MAN)	99,9
10. Mercedes Benz Turkey	Istanbul/ Aksaray	1968/ 1985	Mercedes	85
11. Otokar Autobus Carouser Industry Company	Sakarya	1963	Deutz/Land Rover/ Fruehauf/ Am General	0
12. Otoyol Industry Company	Sakarya	1966	Iveco	27
13. Oyak Renault Automobile Plants Company	Bursa	1971	Renault	51
14. Temsa Thermo-mechanical Industry and Trade Company	Adana	1987	Temsa/ Mitsubishi	0
15. Tofaş Turkish Automobile Factory	Bursa	1971	Fiat	37,8
16. Toyota Automotive Industry Turkey	Sakarya	1994	Toyota	100
17. Türk Traktör (Turkish Trucks and Agricultural Machines Company)	Ankara	1954	-	37,5
18. Uzel Machine Industry Company	Istanbul	1962	M. Ferguson/ Holder	0

Among these 18 companies, total of five joint ventures are in the automobile producing business. These are Tofaş and Fiat, Ford Otosan and Ford, Hyundai Assan and Hyundai, Isuzu Anadolu and Isuzu, and Oyak Renault and Renault. Until 2005, there was a joint venture between Sabancı Holding and Toyota Automotive Industry, which was terminated. Today their joint venture is no longer valid (Automotive Manufacturers Association, http://www.osd.org.tr/, 2007).

Since the 1950s, Koç Holding of Turkey, which is Turkey's oldest know-how contractor of the world's leading firms e.g. Ford and Fiat, has been dealing with the automotive business. The year 1966 was an important milestone for the Turkish automotive industry. The first locally manufactured Turkish car, "Anadol", was first assembled while an import substituting industrialization strategy was in action (Duruiz, 1990: 42). Besides the first locally manufactured car, the first Turkish tractor and truck; light bulb, refrigerator and washing machine were produced with the technologies of Ford, Fiat, Siemens, Magneti Marelli, etc. Koç Holding transformed this cooperation into joint ventures with new brands such as, Tofaş (in partnership with Fiat), Türk Siemens (in partnership with Siemens), Mako (in partnership with Magneti Marelli) and Otosan (in partnership with Ford) (Dikmen, 2006: 13). In 1971, Tofaş and Oyak-Renault began production with foreign licensors.

In the beginning of the 1980s, as the export oriented industrialization strategy was adopted, liberalisation of the economy was accelerated so that the customs barriers were weakened and protectionist policies were abandoned (Ansal, 1990). The automotive industry moved into the international arena and gradually changed its attitude of producing for the local market. Since then, the main automotive industry, and suppliers, have significantly developed with additional investment policies. In the year 1994, the industry found itself in a very different stage with Turkey's membership in the customs union. All the industrial legislations and international standards were applied to the Turkish industry and there was an increase of free flow of goods. Furthermore, the economic crisis badly affected the automotive industry. However, the difficulties that the industry faced caused the structure of the automotive industry to be strengthened.

Turkish automotive companies, with their MNE partners, have a future goal that seems to be mostly focused on R&D activities with their mother companies. It is clearly understood that being a production center is a temporary situation, and that sooner or later, cheap labor relocation of the production plants to another country is unavoidable. Today the industry is facing a trade off; Turkish partner firms know that they should focus on R&D to become sustainable, or else they will loose their competitiveness in the world automotive market.

4.2.3 Production of Turkish Automotive Industry

The development of production has increased significantly in recent years. In the year 2007, the production figures for the passenger cars, light commercial vehicles, trucks, mini and midi buses, and buses reached 1,132,932 units as shown Figure 4.3.

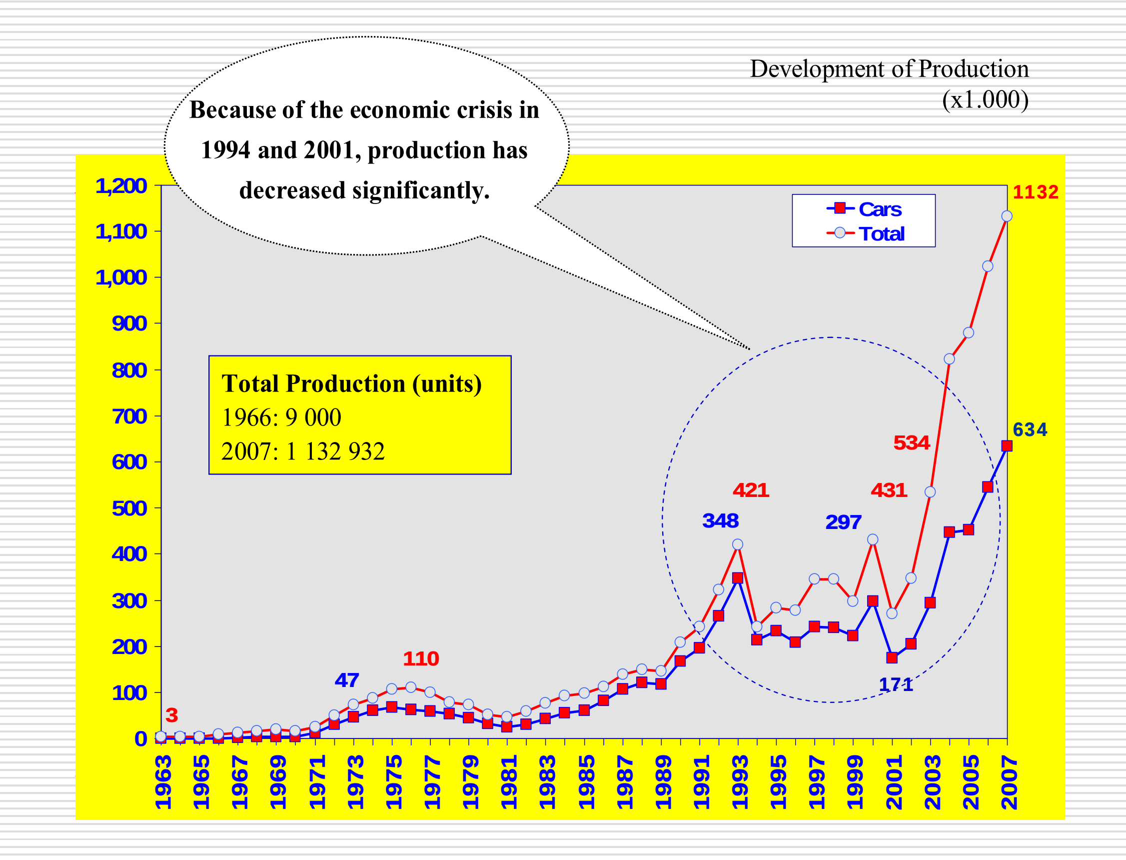

Figure 4.3 Development of Production in Turkey

Source: Automotive Manufacturers Association, http://www.osd.org.tr/, 2007.

By the end of 2007, the number of cars and light commercial vehicles manufactured in Turkey were as follows (AMA, http://www.osd.org.tr/, 2007):

	Firms	Number of Vehicles (units)
1.	Ford Otosan:	286,356
2.	Oyak Renault:	263,656
3.	Tofaş:	212,493

4. Toyota: 161,516
5. Hyundai Assan: 90,190
6. Honda Turkey: 23,663

Suppliers Industry

The suppliers industry of the Turkish automotive industry consists of approximately 2,000 firms. The production of the suppliers is approximately $ 2.5 billion and the domestic demand is $ 3.89 billion (for 2008). Supplier firms are generally located in the Marmara Region of Turkey similar to the main manufacturing industries. MNEs have opened supplier distribution centers (park) inside or near their plants. (e.g. Ford Motor Company)

4.2.4 Domestic Sales and Exports of the Turkish Automotive Industry

Domestic sales in Turkey consist of the sales of the locally manufactured vehicles (local sales) and imported vehicles (import sales) (Fındıkçıoğlu, 2008). The total units in domestic sales reached 641,315 by the end of 2007.

Sales	Units
Local Sales	282,226
Import Sales	359,089
Total Domestic Sales	641,315

According to AMA (2007), the domestic sales of passenger cars reached 277,101 units by the end of 2007. Of the total units sold, 121,181 of them were local sales and 155,820 of them were imported sales of passenger cars. Among domestic sales, Oyak Renault was in the leading position; Tofaş and Hyundai were the closest followers as is shown below.

Firms	**Units**
(Only passenger cars sales)	
Oyak Renault	54,936
Tofaş	28,505
Hyundai Assan	16,667
Honda	15,580
Toyota	5,533

On the other hand, for the light commercial vehicles segment, domestic sales reached 237,297 units by the end of 2007. 128,965 of them were local sales and 108,332 of them were imported light commercial vehicles. Among the light commercial vehicles Ford Otosan and Tofaş are the major companies in domestic sales in the local market as is shown below.

Firms	**Units**
(Only light commercial vehicles)	
Ford Otosan	58,561
Tofaş	34,791
Hyundai Assan	5,198
Karsan	3,912

For imported passenger cars, Turkish customers mostly prefer to buy Ford, Opel and Volkswagen and for imported light commercial vehicles they mostly prefer Volkswagen, Renault and Hyundai.

By the end of 2007, the total number of exports of the Turkish Automotive Industry reached to 829,879 units. The first seven firms' export numbers are shown as follows.

Firms	Export Numbers (units)
1. Ford Otosan:	221,741
2. Oyak Renault:	204,428
3. Toyota:	154,386
4. Tofaş:	146,177
5. Hyundai Assan:	69,224
6. Mercedes Benz:	8.708
7. Honda Turkey:	7.732

In Figure 4.4, production, exports and the percentage of exports values are shown. It can be seen that, the Turkish automotive industry gained from the 2001 economic crisis with increased exports of its locally manufactured cars to foreign countries. Especially Tofaş's "Doblo" light commercial vehicles were produced and exported during that time. As can be seen from the figure below, the automotive industry as very badly affected from the economic crisis in 2001 in terms of production. If exports had not been as high as they were, the industry could not have been built up again.

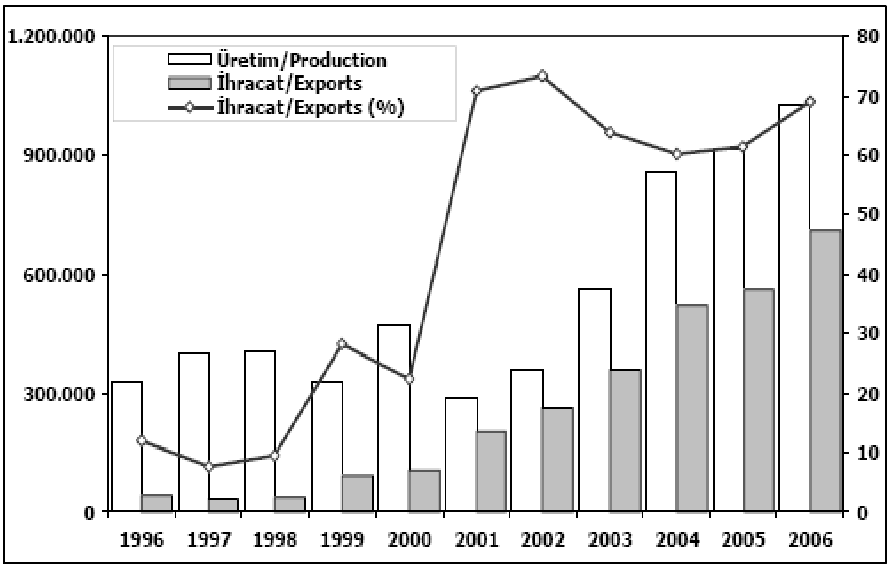

Figure 4.4 Production and Export Figures of Automotive Industry

Source: Automotive Manufacturers Association, http://www.osd.org.tr/, 2007

The comparison of the net import and export figures shows that export value slightly exceeds that of import. This reflects that the Turkish automotive Industry is now successfully selling more vehicles abroad than Turkey's total vehicle imports. However, it should be pointed out that in each locally manufactured vehicle, there are parts and components imported from abroad. In general, when a vehicle is designed by the mother company, and the factory in Turkey is used only for manufacturing purposes, its added value level remains very low. In order to increase the added value, the design competence of the local firm should be developed. Recently the Turkish government has increased the R&D supports (government incentives) and local R&D departments in manufacturing plants have been formed for this purpose.

4.2.5 Workforce of the Turkish Automotive Industry

According to the AMA, approximately 47,000 employees were working in the main automotive industry of Turkey by the end of 2007. Among those, the highest numbers of employees work for Ford Otosan.

Firms	Number of Employees
1. Ford Otosan:	9,515
2. Tofaş:	7,778
3. Oyak Renault:	6,209
4. Mercedes Benz Turkey:	4,422
5. B.M.C.:	3,281
6. Toyota:	3,423

According to the data gathered by preliminary interviews with the AMA, the short term goals of the industry are to increase all the industry's production to 2 million vehicles per year, and to become 10th in terms of world production and at the same time become 3rd in EU production. Turkish automotive manufacturers would like to become one of the top five companies in the EU in terms of R&D.

Chapter 5
Macro Environment of Turkey

This chapter includes Turkey's socio-economic conditions, labor cost, foreign relations, quality of life and living standards, government incentives, the new R&D Law, infrastructure, communication, energy and transportation.

5.1 Socio-Economic Conditions of Turkey

Turkey, with a population of 73,3 millions, has a GDP of $ 363,30 billion and a GDP per head (purchasing power parity) of $ 8,392.4. Economically Turkey is in the index of developing countries category (World Bank, World Development Indicators 2008).

Turkey is a large, middle-income country with relatively few natural resources. Its economy is currently in transition from a high degree of reliance on agriculture and heavy industrial economy to a more diversified economy with an increasingly large and globalized services sector. Coming out of the tradition of a state-directed economy that was relatively closed to the outside world, the industrialization strategy changed to export oriented industrialization in the 1980s, which led to the signing of a Customs Union with the European Union in 1995. In the 1990s, Turkey's economy suffered from a series of coalition governments with weak economic policies, leading to high-inflation boom-and-bust cycles that culminated in a severe banking and economic crisis in 2001 and a deep economic downturn (GNP fell 9.5 % in 2001) and an increase in unemployment (Çelik and Naqvi, 2007).

Turkey has a very volatile market economy, which is rapidly affected by the political and social situation of the country, as well as the world markets. Turkey's dynamic economy is a complex mix of modern industry and commerce along with the traditional agriculture sector that still accounts for more than 35 % of employment. It has a strong and rapidly growing private sector, yet the state still plays a major role in basic industry, banking, transport, and communication. The largest industrial sector is textiles and clothing, which accounts for one third of industrial employment; it faces stiff competition in international markets because of the end of the global quota system. However, within Turkey's export mix other sectors, notably the automotive and electronics industries are rising in importance. Real GNP growth has exceeded 6 % for many years, but this strong expansion has been interrupted by sharp declines in output in 1994, 1999, and 2001. The economic crises of 1994 and 2001 especially affected Turkey's economy very badly. Production nearly stopped, and imports rates decreased. Consumer's purchasing power parity also decreased.

Turkey's economy has recovered from the 2001 crisis. With the support of the International Monetary Fund (IMF) and the World Bank, the government made good monetary and fiscal policies, as well as, structural economic reforms. This program is still being successfully continued. The independence of the Central Bank has been firmly established, a floating exchange rate system has been put in place, and the government's overall budget deficit has been substantially reduced. In addition, there have been substantial reforms in the financial, energy, and telecommunications sectors that have included the privatization of several large state-owned institutions. Inflation and interest rates have fallen significantly, the currency has stabilized, government debt has declined to more supportable levels, and business and consumer confidence has returned. Turkey's economy grew an average of 6.0 % per year from 2002 through 2007 one of the highest sustained rates of growth in the world except for China. However, because of the world economic crisis it is expected to drop to about 4 % in the end of 2008, which is comparatively lower.

In 2007, Turkey succeeded in attracting $ 16,6 billion in foreign direct investment (FDI) and is expected to attract a similar level in the end of 2008. A series of large privatizations, the stability fostered by the start of Turkey's EU accession negotiations, strong and stable growth, and structural changes in the banking, retail, and telecommunications sectors have all contributed to the rise in foreign investment.

Turkey has taken steps to improve its investment climate through effective administration of foreign investment screening, and strengthened intellectual property legislation.

The economic situation has improved due to the implementation of economic reforms; GDP growth, for 2004, reached 9 %, followed by roughly 5 % annual growth from 2005-07. Inflation fell to 7.7 % in 2005 but climbed back to 8.5 % in 2007 and is currently above 10 %. Despite the strong economic gains from 2002-07, which were largely due to renewed investor interest in emerging markets, IMF backing, and tighter fiscal policy, the economy is still burdened by a high current account deficit and high external debt. Further economic and judicial reforms and prospective EU membership are expected to boost foreign direct investment (Central Intelligence Agency, The World Factbook, 2008).

5.1.1 Labor Cost

Labor cost is defined as the wages paid to employees on a daily, monthly or job basis plus payroll and related taxes and benefits. According to the World Bank's Labor Market Study (2006), the labor cost per employee in Turkey is considerably lower than Europe's average. However, Turkey's labor cost is eight times higher than China's. Eurostat's labour costs survey (2004) shows that labour cost per hour is $ 8.99 in Turkey, $ 9.03 in Slovenia, $ 1.13 in Bulgaria, $ 0.53 in Romania, $ 0.88 in Russia, $ 0.84 in China and $ 0.59 in India.

5.1.2 Foreign Relations

The European Union (EU) Accession and alliances and membership of Turkey is explored in the foreign relations section.

EU Accession

In 1996, Turkey joined the EU's the customs union. In 1999, Turkey became a candidate for EU membership and in 2005; Turkey began negotiations on accession to the European Union. As a candidate country, Turkey aims to adopt the EU's basic system of national law and regulation by 2014. The accession period is progressing gradually through the passing of adjustment bills in different areas. This is a costly and difficult procedure; however, adjustment will generate a significant contribution to the modernization of the economy.

Alliances and Memberships

Turkey entered the North Atlantic Treaty Organization (NATO) in 1952 and serves as the organization's vital eastern anchor, controlling the straits leading from the Black Sea to the Mediterranean and sharing a border with Syria, Iraq, and Iran. Besides its relationships with NATO and the European Union (EU), Turkey is a member of the Organization for Economic Co-operation and Development (OECD), the Council of Europe, and the Organization for Security and Co-operation in Europe (OSCE). Turkey also is a member of the United Nations (UN) and the World Trade Organization (WTO). It has signed free trade agreements with the European Free Trade Association (EFTA), Israel, and many other countries. In 1992 Turkey and 10 other regional nations formed the Black Sea Economic Cooperation (BSEC) Council to expand regional trade and economic cooperation. Turkey chaired BSEC in 2007 and hosted the 15th BSEC Summit in June 2007, in Istanbul (US department of State; Çelik and Naqvi, 2007).

Although by definition the Republic of Turkey is a stable, peaceful, democratic and secular country; there is social misunderstanding between permanent urban populations and those recently moved there. Sometimes misinterpretation of religious rules and secularism cause problems. Additionally the south-east of Turkey has economic and ethical problems. Turkey is located in a region full of conflicts. In the current post-September 11 world, in which there has been a trend towards polarization of East and West, Turkey is better poised to bridge these differences, than any other country in the world. In the years ahead, Turkey will likely continue to be a strong ally of the US and the EU as a member of NATO, while also seeking other alliances. Continued progress toward EU accession is the best course for Turkey, even taking into account that accession may never occur. A more positive tone from Europe with respect to Turkey’s candidacy would send a very constructive message to Turkey as it continues to implement reforms. It would also send a message to the Muslim world that religion is no barrier to integration in Europe.

5.1.3 Quality of Life and Living Standards

For foreign researchers, the living standards of the local country are comprised of the quality of following items: the housing, hotels and pensions, schools, universities, health care and hospitals, shopping centers, sports facilities, art galleries, opera and theatres, cafes and restaurants. First of all, housing facilities are well developed in Turkey, especially in the Marmara Region in which automotive industry is highly clustered. Expatriates and their families can find satisfactory housing for their needs and wants. For short visits, luxurious and boutique style hotels are available. Since Turkey is a tourist country, the quality of the hotels, restaurants and cafes are of good standards. For children, there are number of modern schools with good instruction and sports facilities, and educating in various languages such as English, French, German and Italian. For shopping needs, there are big shopping malls in almost all the cities in the Marmara region, where automotive industry is located. Istanbul is at most two hours traveling distance from them.

5.1.4 Government Incentives and R&D Law of Turkey

Turkish R&D expenditure was about $ 3.5 billion in 2006, which accounted for 0.76 % of the gross domestic product. Developed countries have 3 % R&D expenditure rate and, as such, the gap between them and Turkey is very wide. There are about 54,000 full-time R&D personnel working in Turkey. The Turkish patent office received 6,188 patent applications in 2007, 70 % (4.350) of which came from foreign applicants. An increase of 68 % in domestic applications (1,838) was recorded while foreign applications had only a 7 % increase in the last year. Although government incentives have been in action since the 1990s, the results show that additional support is necessary. Hence in 2008, a new legislation on R&D support was introduced.

One of the major factors that affect the R&D collaboration of an MNE and a local partner is the government incentives of the local country. Although all of the macro factors have a positive impact on R&D collaboration, this factor has the highest influential effect. In Turkey, the government funds almost half of the R&D expenditures of projects through TÜBİTAK (Scientific and Technical Research Council of Turkey). The Turkish government supports the research, innovation, technology development, new product development and patents. These programs contribute to the reduction of the costs in R&D. This is one of the reasons why R&D costs per capita in Turkey is lower than in other countries. Obviously, the other reason is the comparatively low wages of R&D personnel in Turkey.

MNEs' managers have expressed their views that the Turkish government's incentives for R&D are attractive. It has been observed that the government incentives and low R&D costs in Turkey have a direct effect on the decisions of MNEs to undertake R&D collaboration with their local partner firm. Even Hyundai, who was not interested in undertaking any R&D in Turkey, showed interest right after the establishment of the new R&D Law of Turkey.

The new R&D Law came into effect as of April 1, 2008 and introduced incentives and supports for investors in R&D activities, through tax incentives, land allocations and other financial instruments. The new law allows companies to deduct their R&D investments from their tax base. The law, in general, aims to encourage R&D in the private sector, to increase exports of high-technology products, while decreasing technology imports, to attract multinational companies to move their R&D facilities to Turkey and to cover the current account deficit of the country in the medium term by increasing the added value of each product.

In terms of the Turkish R&D Law, international automotive firms have gained additional advantages to do R&D in Turkey. In addition to the general incentives described above, R&D departments of automotive companies located inside the factory are accepted as if they are located in techno parks. Tofaş, Ford Otosan and Oyak Renault had already established their R&D departments in Turkey and it is likely they will benefit from this law. Some of the properties and incentives of the new Law of R&D are shown below.

1. Incentives will be granted regardless of the sector or industry until 2024.
2. Companies will have to employ at least 50 staff in their R&D departments.
3. Foreign companies with no production facility in Turkey can also benefit from the incentives by establishing an R&D facility there.
4. Full deductions of R&D expenditures from taxes. This rate is increased to 90 % for personnel who have a Ph.D.
5. 80 % discount on income taxes of R&D personnel.
6. 50 % of the R&D personnel social security premiums will be funded by the Ministry of Finance (MoF) for five years.
7. All expenditures concerning pre-competition cooperation projects and half of additional expenditures made in enterprises with over 500 R&D personnel will be deducted from tax assessment (in the following years via amortization).
8. R&D and modernity expenditures made by companies with a separate eligible R&D Center, within the scope of a R&D Project, can be deducted at a rate of 100 % from the corporate income tax base.
9. The documents prepared for the R&D activities are exempt from stamp duty.
10. The funds obtained from state institutions, trusts and international funds are exempt from corporate income tax on the condition that such funds are not extracted from the Company within five years.
11. The applications principles will be determined by the bylaws to be prepared jointly by the Ministry of Finance (MoF) and the Ministry of Industry and Commerce.
12. Any unutilized R&D deductions, may be carried forward through indexing to the revaluation rate.
13. The R&D and modernity expenditures - which lead to the creation of an intangible right - must be capitalized and may be depreciated according to the tax procedural law regulations. Therefore, in effect, the R&D expenditures are deducted from the corporate income tax base and depreciated separately

from the deduction mechanism described above (Dereligil, 2008; PricewaterhouseCoopers, 2008).

As the Industry and Commerce Minister of Turkey stated, the R&D Incentive Law is a revolutionary law that will bring many opportunities. It will empower the R&D departments of the companies operating in Turkey, increase their innovativeness and hence their competitive power, as well as encourage MNEs to establish their R&D departments in Turkey.

This incentive law involves some advantageous factors such as the tax deduction of R&D expenditures, as well as, provides support for R&D personal and techno-venture capital (Coşkun-Karadağ et. al, 2008).

To enhance these incentives, it is anticipated that a series of reforms in taxation, bureaucratic transactions and intellectual property (IP) rights will follow. The primary targets are the automotive, textile, pharmaceutical and telecommunication industries. The new law has been criticized; however, as not covering small and medium-size enterprises (SMEs), independent R&D companies and the training costs of R&D personnel. Regardless, this law is believed to provide a very suitable climate for companies investing in R&D facilities in Turkey, which has relatively low labor cost compared to EU countries (Dereligil, 2008).

5.2 Infrastructural Development of Turkey

It is known that an efficient R&D collaboration depends heavily upon the infrastructure of the local country (Erken, Kleijin and Lantzendörffer, 2004). Tangible and intangible R&D values should be transferred quickly and safely. To further the understanding of what contributes to an efficient R&D collaboration, the following topics will be explored: communication, energy, environment, and transportation.

5.2.1 Communication

Communication involves internet availability with adequate speed and capacity, audio visual communication and data links. There are 18978 million (2005) main telephones lines in use and 52663 million (2006) mobile cellular telephones. The general telephone system is undergoing rapid modernization and expansion, especially with cellular telephones. Domestic additional digital exchanges are permitting a rapid increase in subscribers. The construction of a network of technologically advanced intercity trunk lines, using both fibre-optic cable and digital microwave radio relay, facilitates communication between urban centers; remote areas can be reached by a domestic satellite system; the number of subscribers to mobile cellular telephone service is rapidly growing internationally. According to the EU Innovation Scoreboard of 2007, the usage of the internet was a main factor in classifying the innovativeness of countries. There are 217887 internet hosts (2007) and 12284 million (2006) internet users. Today there are three GSM (Global System for Mobile Communications) operators in Turkey namely: Turkcell, Vodafone, and Avea, and three telecommunication satellites Turksat-1b, 1c and 2a. In addition, there are 20.4 million installed access lines of which 18.3 million are in service (National Economies Encyclopedia Asia and Pacific).

5.2.2 Energy

In general, the topic of energy is investigated under two main headings. The first one is “Prime Energies” such as coal, petroleum, natural gas, nuclear, wind, solar etc., and the second one is “Electrical Energy”, which is derived from a prime energy. Energy sources and supplies of a country should be sufficient, sustainable and less costly. It is also important that, electricity production and use should be continuous and efficient. Risks in energy supplies adversely affect an MNEs decision to invest in a country.

Prime Energies

In the "EU Energy Policy and Turkey" report, the European Commission notes that "Currently, Turkey imports about 70 % of its total energy needs" and that "at the moment, the largest part of its energy (both gas and oil) comes from Russia, followed by Iran" (European Commission, 1).

- **Oil:** Oil provides about 43% of Turkey's total energy requirements. Turkey does not have significant reserves and around 90% of the oil is imported. Domestic production is mostly from small fields in the Southeast. New exploration is taking place in the Eastern Black Sea region. In 2004, Parliament approved a petroleum market reform bill that liberalized consumer prices and would lead to the privatization of the state refining company Tüpraş, which was privatized in 2005. Another petroleum company Petrol Ofisi (PO) was also privatized earlier. Recent increases in petroleum prices have increased the cost pressure on automotive industry and have also had a shrinking effect on sales.

- **Natural Gas:** Another major prime energy of Turkey is natural gas which is used for heating and electricity production. Over 40 % of electricity production is done by natural gas. In 2006, Turkey contracted to receive 67 % of its natural gas imports from Russia. Russia previously supplied gas to Turkey overland and now also transports it through the Blue Stream pipeline, which reaches from Russia to Ankara. Turkey also has a direct gas pipeline link with Iran. Turkey also purchases some liquefied natural gas from Algeria and Nigeria (International Energy Agency, 2007).

- **Coal:** Turkey has substantial low quality coal reserves which is mainly used for electricity production and heating. With increasing concerns over clean energy and climate change, it is unlikely that coal will be a solution to the energy problem of Turkey in the foreseeable future unless there is a radical development in clean coal technology.

- **Energy Corridor:** The security of energy supply is vital and in that sense Turkey has tried to improve its energy supplies. Turkey aims to be an important link in the East-West Southern Energy Corridor bringing Caspian, Central Asian, and Middle Eastern energy to Europe and the world markets. The Baku-Tbilisi-Ceyhan petroleum pipeline and South Caucasus natural gas pipeline (from Shah Sea) started bringing petroleum and natural gas from Azerbaijan to Turkey. Turkey's interconnected pipeline to Greece is an important step in transferring Caspian natural gas to Europe (Italy).

Electrical Energy

There is concern that Turkey could experience shortfalls in its electricity supply over the coming several years. The World Bank has issued a loan to Turkey for a project which aims to mitigate that risk and support the sector's privatization (The World Bank 2008). The US Department of State (2007) noted that the growth in electricity generation has remained below electricity demand until recently, which has made Turkey a net importer of electricity since 1997. The growth of energy demand slowed as a result of the 2001 economic crisis, but has picked up again. Turkish authorities expect a significant electricity shortfall unless new facilities become operational. The European Commission's Turkey 2007 Progress Report cites another problem: "Electricity theft and technical losses remained high, at around 17 %. The South Eastern Anatolia Project (GAP, as per its Turkish acronym) is a major development and water resources project in Turkey's southeast (Southeastern Anatolia Project Regional Development Administration). There is also a nuclear power programme under way.

5.2.3 Environment

It has been stated that "Turkey faces a backlog of environmental problems, requiring enormous outlays for infrastructure. The most pressing needs are for water treatment plants, wastewater treatment facilities, solid waste management, and conservation of biodiversity" (US Department of State 2007). The discovery of a number of illegal chemical waste sites in 2006 has highlighted the weakness in environmental law and the magnitude of governmental oversight. After long years of silence, Turkey's becoming a signatory of the Kyoto Protocol was back on the agenda in 2007. Despite the positive approach, Turkey would still like to keep its reservation to receive developing country treatment with regards to the emission levels set by the protocol (Çelik and Naqvi, 2007).

With the establishment of the Environment Ministry in 1991, Turkey began to make significant progress in addressing its most pressing environmental problems. The most dramatic improvements were significant reductions of air pollution in big cities including Istanbul and Ankara. However, progress has been slow on the remaining, serious, environmental challenges facing the nation.

5.2.4 Transportation

Transportation facilities include the quality of the airways, railways, sea and road transportation, their ports, locations and the routes. The quality and location of transportation facilities to major automotive industry plants and R&D centers are effective parameters on R&D collaboration between MNEs and their local partners. If the transportation facilities are well developed in a local country, the mobility of researches could easily be established without consuming extra time and money (National Economies Encyclopedia Asia and Pacific, 2008).

- **Air Transport:** In Turkey there are 117 airports, the 2 busiest being, Atatürk and Sabiha Gökçen airports in Istanbul. Since the automotive industry is mostly located in the Marmara Region, managers and research engineers can easily use these airports. The new international passenger terminal in Istanbul, which opened in January 2000, is one of the largest in Europe. Over 300 foreign airlines serve Turkey; there are direct flights from all over the world. Turkish Airlines (THY), with its fleet of 73 passenger planes, operates both domestic and international destinations. There are 15 additional public and private domestic airlines operating on a smaller scale. Finally it can be concluded that, air transportation in Turkey provides excellent traveling facilities for international automotive companies.

- **Maritime Transport:** The country's 8430 kilometers coastline is covered with large and small ports, 21 of which are international. Most of the manufactured cars are shipped to different locations in the world through the ports located along the coasts of the Marmara Sea. These ports are very close to manufacturing plants. This line is also used to transport prototype vehicles abroad for testing. There are various fast ferryboat services between locations in the Marmara region, which are extensively used by automotive managers and researchers. Since the automotive industry and its R&D departments are located near the Marmara Sea, sea transportation offers advantages in costs, speed and comfort.

- **Rail Transport:** The total length of railways in Turkey is 10933 kilometers, of which 2133 are currently electrified. Turkey's 2007 Progress Report of the EU notes that there has been progress in air, maritime, and road transportation, but not in rail transportation. It is widely agreed that the rail sector, which is controlled by Turkish State Railways (TCDD), needs reform. Major new rail projects, which include high speed passenger trains, importantly, one that connects Istanbul to Ankara, and the Marmara project that will provide a rail connection for mass transit between Europe and Asia beneath the Bosphorus in Istanbul. As far as the automotive industry is concerned, there is only one railway connection between Adapazarı-İzmit-Istanbul where four car factories (Toyota, Hyundai Assan, Ford Otosan and Honda) are located. However; two major plants belonging to Tofaş (Fiat) and Oyak Renault are located in Bursa and there is no railway there.

- **Road Transport:** The national road network length has reached 62000 kilometers of which 1726 km are motorways and 55000 km are asphalt roads. 95% of passenger transport and 90 % of the transport of goods are realized via highway transport. Roads in the Marmara Region are quite sufficient and they are widely used by the automotive industry members.

Part 2
Case Studies

Part 2 presents the three case studies that were utilized to explore the factors that affect R&D collaboration. Chapter 6 examines the Tofaş-Fiat R&D collaboration, Chapter 7 presents the Ford Otosan-Ford R&D collaboration and Chapter 8 explores the Hyundai Assan-Hyundai's R&D collaboration.

Chapter 6
Tofaş-Fiat Collaboration

6.1 Tofaş

Tofaş was founded as a joint venture of Koç Holding and Fiat Auto in 1968. Tofaş is owned by Fiat (37.9 %), Koç Holding (37.9 %), and the Istanbul and Luxemburg Stock Exchange (28 %). Manufacturing, assembly and parts distribution facilities are located in Bursa.

Tofaş also conducts the sales and marketing activities of Fiat, Alfa Romeo, Lancia, Maserati and Ferrari. Other than Italy, Turkey is the only country where all five Fiat brands are represented. This is one of the indications of a good relationship between Fiat and Tofaş (trust, integrity, commitment etc.). Apart from the industrial and commercial activities carried out under the main entity, the company also operates through fully owned subsidiaries in various other areas as shown on Table 6.1. For R&D, especially, there are two subsidiary firms where Tofaş delegates some of its R&D activities. Their functionality will be presented in section 6.1.3.2 Size and Structure of the R&D Department.

Table 6.1 Subsidiaries of Tofaş

Subsidiary Companies	Operating Area
Fer Mas Oto Ticaret A.Ş.	Ferrari & Maserati Sales and After Sales
Platform Araştırma Geliştirme Tasarım ve Tic. A.Ş.	R&D and Design
Mekatro Araştırma Geliştirme A.Ş.	R&D
Koç Fiat Kredi Tüketici Finansmanı A.Ş.	Consumer Financing

Source: Tofaş Investor Relations, "www.koc.com.tr/NR/rdonlyres/98696CC7-FA7E-4D2C-9720 1C338E5E4A57/9581/TOASO_Jan2008.pdf, 2008.

Tofaş manufactures models of Doblo, Linea, Albea Sole, Palio Sole and Minicargo at its Bursa plant. In 2007, Tofaş produced a total of 212.493 units (102.357 passenger cars and 110.136 light commercial vehicles). Tofaş's annual production capacity of 250,000 vehicles reached a capacity of 360,000 vehicles with the Linea and Mini Cargo investments of € 550 million. The company's exports increased by 13% of its total production to € 534 million in the first half of 2008, compared to the same period of the previous year. The company's exports increased by 16 % (146,177 units in 2007, compared to 123,061 units the previous year). Among the leading export firms, first is Ford Otosan, followed by Oyak Renault and Toyota; Tofaş is in fourth place.

Fiat launched its Linea model, which ranks second in the automotive market alongside its second position in light commercial vehicles, in May 2007. With this model, Tofaş acquired over 12 % of the market. After presenting Doblo in the light commercial vehicle market, Fiat Commercial Vehicles reached an even higher position as one of the top two brands on the market. With a 0.6 % increase by selling 15,566 units, Doblo took a 16.6 % share and led its class in the market for the first half of 2008. Minicargo was manufactured at Tofaş in partnership with Fiat Auto and Peugeot Citroën (PSA). The Minicargo project (MCV), a joint effort of Tofaş, Fiat Auto and PSA, is a milestone, since Tofaş manufactures this vehicle for three automotive brands, a first in Turkey's automotive industry. Tofaş also owns the intellectual property rights. Minicargo is a proactive response to the expected development of the light commercial vehicle segment in the European market and is believed to fuel Tofaş' exports.

In addition, there is cooperation between Tofaş, Fiat Auto and Severstal Group of Russia. The agreement, signed with Fiat Auto and Severstal Group in 2006, called for the assembly of Doblo in Russia with all parts to be sourced from Tofaş. The manufacture of Albea, another model, started in Russia in 2006; Tofaş successfully continues to export parts to Russia for its assembly. This cooperation in the Russian market provides a successful model for Tofaş's entry into new markets and the development of a balanced profit model.

Today, Tofaş exports more than 70 % of its production, with the aim of developing export projects. Apart from the other production centers in Brazil, China and India, Tofaş aims to become one of Fiat's three largest global production centers by 2010. The company aims to achieve higher growth in 2008 with exports of € 1.1 billion. Once new investments come on-stream, Tofaş will have an annual production capacity of 400,000 units by the end of 2008. With the arrival of the Mini cargo project, Tofaş has forecast annual exports of € 2 billion over a two year period from 2008 to 2010 (Koç Holding Investor Relations, "http://www.koc.com.tr/", 2008).

Tofaş has a total of 7,778 employees; of which 1,073 are white-collar employees and 6,705 blue-collar employees. The distribution of the employees is shown on Table 6.2.

Table 6.2 Number and Distribution of the Employees (Tofaş)

Distribution of Employees	Number of Employees
White Collar Employees	**1,073**
• Office Employees	470
• Managers	64
• Engineers	407
• Administrative Level Engineers	132
Blue Collar Employees	**6,705**
Total	**7,778**

Source: General and Statistical Information of Bulletin of AMA, 2007-1, "http://www.osd.org.tr/cata2007.pdf", p.38.

6.1.1 Production Capability

Being a successful production partner of Fiat for more than 40 years, Tofaş's production capacity has increased throughout the years (Tofaş Company Reports, 2008). In order to comply with the customer demands, Tofaş engineers have generated minor product modifications, along with production activities. For example: using flexible assembly lines in production increased the efficiency of Tofaş. These techniques are used in the production of two different segments of vehicles namely Minicargo and Linea vehicles. After Tofaş became competent in product modifications, they started to do R&D collaboration.

6.1.1.1 Competency in Production

This factor relates to Tofaş's competence to solve problems in the local production process. Once a problem has been detected in one of the vehicles, production engineers analyze the problem in order to find solutions. This development process enables them to improve their competence in special topics. During production, Fiat generally observes Tofaş while they are solving any production problems. Tofaş finds solutions to make the production process simpler since they are able to solve the problems immediately after production in Bursa plant.

If Tofaş as not involved in product modifications, Fiat would take care of them. This would slow down production. Some engineering examples that Tofaş is capable of using include production tailored blank metal sheet usage, high resistance metal sheet usage, conveyor systems, and assembling systems with robots and bicomponent structural chassis cements.

6.1.1.2 Quality Control and Testing

The quality control and testing requirements of the local factory are another factor affecting R&D collaboration. As mentioned before, the Bursa plant of Tofaş is very modern and developed with quality control and testing requirements that are of a high standard and led by skilled staff. Fiat R&D engineer stated that the Bursa plant of Tofaş is more modern than any Italian plant. If control and testing was performed in another plant, then maybe Fiat's managers would think that Tofaş was not ready to do R&D; that's why this factor became an important factor for Tofaş-Fiat R&D collaboration.

6.1.2 Innovation Capability

Tofaş R&D is capable of vehicle design (body, chassis, trim designs, power train integration and packaging), prototype manufacturing, performance testing (road, noise, vibration, and harshness (NVH) and bench tests), material engineering, tool design and manufacturing and vehicle homologation.

Tofaş is capable of carrying out R&D to generate adaptations for the Turkish market, as well as having the capability to work on future technologies in vehicle designs, such as, intelligent vehicles, environment-friendly vehicles and light-durable vehicles.

6.1.2.1 Adaptations to Local Market

Adaptations to the local market include Turkish customer's demands or problems related to the conditions in Turkey, which may lead to the creation of minor product or design adaptations. Tofaş has been successful in finding solutions to various problems of production, as well as making design adaptations. After the R&D department was established, it focused on design, adaptations and restyling. When a department strengthens its position for minor product and design adaptations, they should increase the level of R&D collaboration in subsequent years. A minor product adaptation at the beginning of a project may increase collaboration, and then a new R&D project may be handled later on. In this respect, this factor is one of the most influential ones of all. Because Tofaş was good at making product adaptations at the beginning, the absorptive capacity level increased so the company is able to undertake R&D projects on a continuing basis.

6.1.2.2 New Products Idea Development System

There is a special program in Tofaş to promote innovation and to develop new product ideas. The R&D department serves as a jury for this program. Every worker at Tofaş is invited to produce new ideas to produce models that are more efficient, more robust, safer, and less costly with less production time. These ideas are reported from group leaders to the R&D department. Following an evaluation phase, ideas that are found to be applicable, are rewarded. In addition, R&D department researchers are also expected to produce new ideas with this respect. There is a group in the R&D department particularly responsible for "Innovation Management" activities.

6.1.3 R&D capability

This section examines the background, size, infrastructure of the R&D department, educational and professional experience levels of the employees, and the R&D capability of Tofaş to produce innovative, creative solutions, which reflect a degree of innovativeness.

6.1.3.1 R&D Department

The R&D department of Tofaş was established in 1994. Prior to this, Fiat and Tofaş were only partners in production. Fiat's main goal was to make production in Turkey, but there was no thought of involving Tofaş in Fiat's R&D activities. That's why, in the early days, Fiat showed no interest in establishing an R&D department in Turkey. On the other hand, Tofaş was very ambitious to start R&D in Turkey. Tofaş definitely believed that, establishing R&D would not only enable them to improve their product quality, but it would also increase the added value in new models. Although Tofaş managers believed that they would be able to succeed in contributing to the R&D activities of both; the MNE side believed that forming R&D with a local partner would not make any substantial contribution. Thus, Tofaş took this decision alone, without asking its partner Fiat, and in 1994, they established an emissions laboratory as a starting point for local R&D department. Later on, Fiat recognized the benefit and let Tofaş establish its own research team. The important milestones of the R&D Department are shown on Table 6.3.

Table 6.3 Important Milestones and R&D Capabilities (Tofaş)

1994	2000	2002	2003	2004	2005	2007
Production Support, Problem Solving	Qualification and Reliability Tests	Process Verification	Light face- lift	Prototype Vehicle Production	Product development collaboration with Fiat	New product development

Source: Tofaş Company Reports, 2007.

When the R&D department was first established, the department aimed to support production and solve daily problems in the production process. In the year 2000, the department became capable of making qualification and reliability tests on cars. They began to make model changes according to the needs of Turkish customers. Process verification was achieved in 2002. Light Face Lift was realised in 2003 and finally the first prototype vehicles were produced in 2004. After 10 years of R&D experience, the department had increased their absorptive capacity and experience so that they were able to produce prototypes.

As the literature review has shown, prototype production is a very important step of the new product development process. Tofaş and Fiat's official product development collaboration started in 2005. 2 years later this collaboration was successfully extended to the PSA Group with the MCV project. Recently Tofaş has started a new product development (NPD) project: the P263 New Doblo Project, which is currently under development. The integration and good relationship between the R&D departments of Tofaş and Fiat continues to improve. Some Fiat researchers have already located to the Bursa plant and some Tofaş researches are in the Turin plant (Italy) working together on the New Doblo Project.

Stages of R&D

Basically, the development of a new product involves identifying and creating a new design concept and building and testing prototypes. The R&D stages of Tofaş are shown in detail in Figure 6.1.

1. Concept development
   ⇩
2. Technological/technical and economic feasibility study
   ⇩
3. From the development concept to design process via laboratory research
   ⇩
4. Design
   ⇩
5. Design development and verification research
   ⇩
6. Prototype production
   ⇩
7. Establishment of the pilot test environment
   ⇩
8. Trial production and application of the tests
   ⇩
9. Solution of the problems about the design of the product

Figure 6.1 Tofaş's R&D Stages

Source: Obtained through the in-depth interview with Tofaş R&D managers, 2008.

The first stage of R&D is identifying and developing the product concept. For example in the automotive industry, managers and engineers firstly decide which car concept they would like to launch in the market. The product concept can be a light commercial vehicle designed for small business owners or a large family car for traveling (Nahum, 2008). Then a feasibility study of concept is handled in terms of whether the vehicle can be produced technologically, technically and economically. After they have emphasized that the concept is feasible, the department begins the concept's design process. Design is a very important step in this stage of R&D. One way of interpreting what engineers do during this process is to think about how they decide whether or not a design is attractive. To do this, they follow a variety of technical specifications and established tests.

6.1.3.2 Size and Structure of the R&D Department

A total of 420 people are employed in the main R&D department of Tofaş in the Bursa plant. For the Minicargo project, approximately 100 engineers are employed temporarily from the R&D office in Italy. These Italian engineers have 10-15 years of work experience. Each year, 50 Italian engineers are employed in the R&D department of Tofaş.

Apart from the main R&D center of Tofaş located in the Bursa plant, there are 3 more R&D offices. One is located in the city of Bursa, at the Uludağ University Görükle Campus Technology Development Center. This office belongs to "Platform" R&D and Design Company (subsidiary of Tofaş). The second R&D office is located in Gebze, at the Scientific and Research Council of Turkey (TÜBİTAK) Marmara Research Center (MAM). This office belongs to "Mekatro" R&D Company. The third office is in the city of Ankara, at the Middle East Technical University Techno park. In all, 150 R&D engineers work in these three R&D offices of Tofaş.

In the main R&D office, there are 13 divisions, namely; Body Design, Interior Design, Electrical & Electronical Systems Design, Power Train Application, Chassis & Vehicle Dynamics, Vehicle Integration, R&D Project and Coordination, MCV Project, Linea Project, 263 Project Management, Method & Planning, Prototype Production and Strategic Sourcing & Projects.

The R&D team of Tofaş is led by an R&D Director. There are five managers in the R&D department working under the R&D director, who are responsible for the following groups; Project, Body Design, R&D Project & Coordination, Vehicle Integration and Interior Design. These five managers report directly to the R&D

director of the company. There are also project managers who are responsible for particular R&D projects. Namely MCV, Linea and 263 projects groups. The Electric and Electronics Design Administrator, Power Train Application Administrator, Chassis & Vehicle Dynamics Administrator and Method and Planning Administrators are grouped according to their areas of expertise. Whereas, the Strategic Sourcing & Project Administrator and Prototype Production Administrators, are two different administrators in the R&D department. The structure of the R&D department is shown in Figure 6.2.

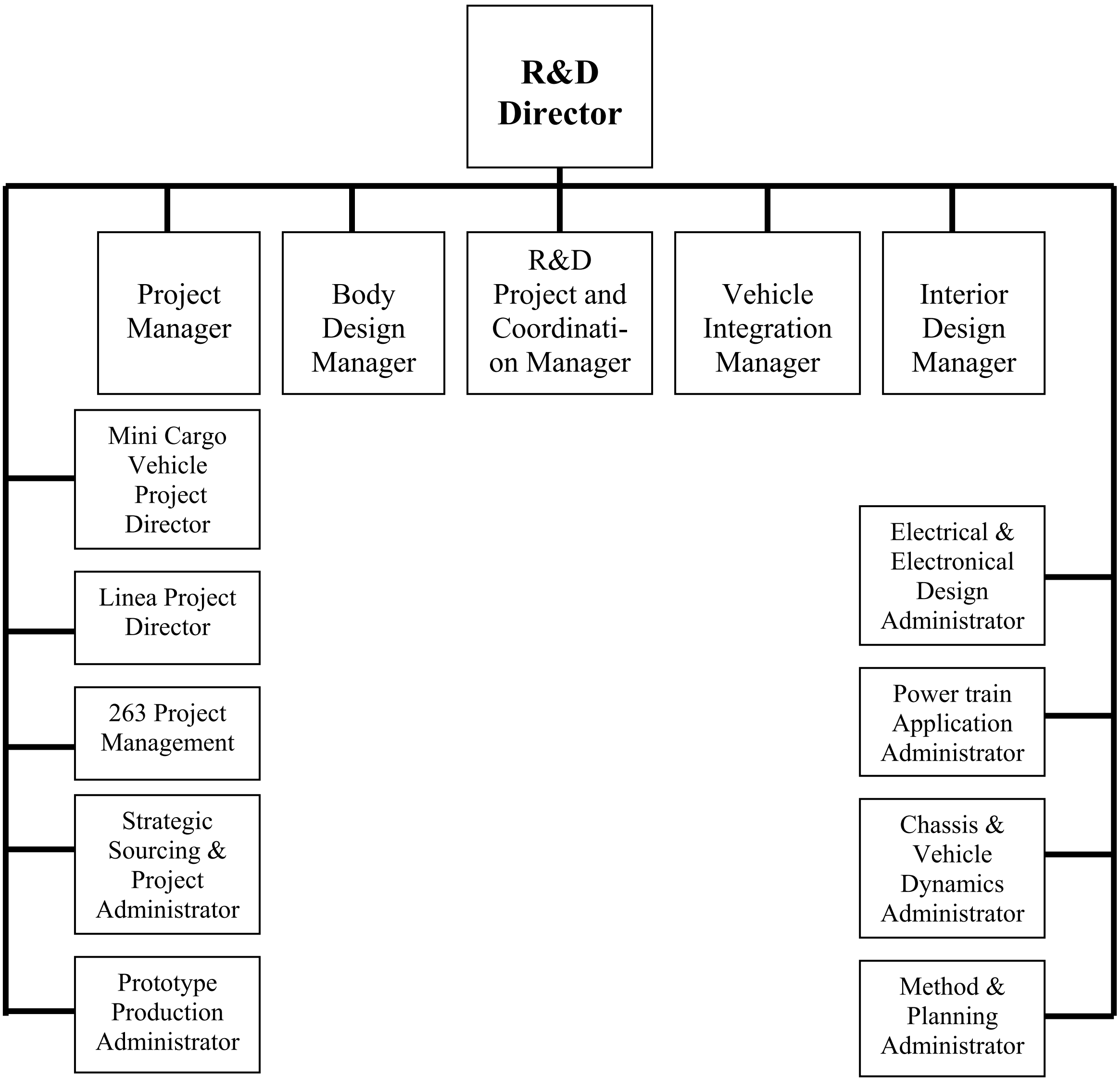

Figure 6.2 Tofaş's R&D Structure

Source: The data gathered through the in-depth interviews with the R&D manager, 2008.

As Figure 6.2 shows, every project is operated by separate groups of engineers and team members. Each project has one project director. Besides the projects, important R&D stages are controlled by separate administrators. With respect to the point integration between Fiat and Tofaş R&D departments, it should be noted that there are similarities between the structures of the R&D departments. These similarities are a reflection of the level of collaboration as well as the facilitation of the joint R&D projects.

6.1.3.3 Infrastructure of the R&D Department

The infrastructure (physical) of the R&D department consists of offices, laboratories, various testing systems, software computational facilities, equipment and links to international information centers. In order to make high quality R&D work, a well equipped office with computerized systems integrated within the members of the team are essential. In this respect, Tofaş seems to be a highly organised technological company.

The location and facilities of the R&D department should be suitable to the company. In general R&D engineers initially study the design topics theoretically, and then the design and component manufacturing phases follow. Finally the manufactured components are tested, mounted on a frame, and a vehicle prototype is formed. A number of extensive tests is conducted on these prototypes, and then the mass production phase is reached. To efficiently achieve this phase, an R&D department should have office blocks with high computational facilities, and there should be a material component prototype test and measurement laboratories. As far as Tofaş is concerned, the physical infrastructure and the organisation of the R&D department are very good. There are sufficient office areas and well developed test and measurement facilities and laboratories.

There is a three-storey building allocated to the R&D department accommodating 400 plus researchers in Bursa. In this building, the divisions of the R&D departments are settled on these three floors. Open offices with cubicles have been established on every floor and research divisions are located by considering their functions.

R&D cannot be handled without tests and measurements, so testing facilities are a major requirement. Tofaş's R&D department laboratories, testing materials, and equipment consist of bench testing, material lab, vehicle performance, fatigue test rigs, electric and electronic tests and a small scaled runway. Bench testing is used to test the vehicle's components. In addition, the material lab is used to test material and heat. Fatigue test rigs are used to apply emission, fatigue and road tests. There is a small scale runway that belongs to Tofaş for testing cars. In addition to that, Tofaş uses the area of the old Eskişehir airport for some road tests. There are some special testing facilities that Tofaş does not have (e.g. test track, full crash test and aero dynamic wind tunnel).

6.1.3.4 Educational and Professional Experience Level of the Employees

Among the 420 employees in Tofaş R&D, there are 260 white collar and 160 blue collar employees. There are 60 employees who are university graduates of which 5 have Ph.D.s and 10 have a Master's. There are 40 computer aided designers (CAD), 50 technicians and 10 specialists in the department (this data was gathered from the in-depth face to face interviews with the R&D manager).

Table 6.4 Education Level of R&D Employees (Tofaş)

Personnel	Numbers
Engineers	260
• PhD	5
• MSc	10
• BSc	45
CAD	40
Technician	50
Specialist	10
Blue Collar	160
Total	420

Source: The data gathered from the in-depth interviews with the R&D manager.

Professional experience levels vary between the experienced and newly hired employees. Generally employees have 5-6 years of work experience.

6.1.3.5 R&D Investments and New R&D Law

The effects of the new R&D Law on Tofaş's R&D investments are highly important and effective in R&D collaboration. The year's (2008) R&D budget, including R&D investments, is $ 140 million. Table 6.5 presents Tofaş's R&D investments.

Table 6.5 Tofaş's R&D Investments

Years	2001	2002	2003	2004	2005	2006	2007	2008
R&D investments (Million Euro)	16,8	10,8	10,5	15,9	119,5	168,5	180,2	244

Source: Obtained through the interviews with Tofaş R&D director, 2009.

As the table above indicates, there has been a significant increase in R&D investments through the years. Under the new R&D Law of Turkey, up to 30 % of the R&D projects of Tofaş can be funded by the Turkish government. Since 1996, the government has funded 29 R&D projects through the Scientific and Technology Research Council of Turkey (TÜBİTAK) Technology and Innovation Support Programmes (TEYDEB) projects.

6.1.4 Absorptive Capacity Level

The absorptive capacity level of the local firm combines Tofaş's effort to reach and acquire and then apply external knowledge. External knowledge may come from the mother company Fiat, research institutes, scientific journals, universities, etc.

6.1.4.1 Acquiring External Knowledge

In Tofaş, R&D knowledge is transferred directly from Italian engineers to Turkish engineers. The local firm's efforts to acquire external knowledge are at a maximum level because their collaborative level is high. Every Turkish coordinator works closely with an Italian coordinator, so the Turkish coordinator among Tofaş's employees, is the first to learn external knowledge. They contact each other more than once a day via e-mail, teleconferencing or by telephone. In addition, in Tofaş there is a software system called "knowledge management system". This system was designed to increase knowledge sharing between Tofaş and Fiat. Both coordinators use the same system via the internet while they are working on a project. At the same time, knowledge that has been gathered from the previous R&D projects, which has been saved in this system, can be used for future R&D projects.

There is a continuous technical staff rotation system between Tofaş and Fiat. Once a R&D project has been started, some employees from Fiat are temporarily sent to Tofaş in order to work on the projects. Their may stay for at least 5 months and up to 3 years or for the duration of the R&D project. In the other direction, some of the Tofaş researchers work in Fiat Italy in order to develop some phases of the project together.

Furthermore, Turkish engineers are continuously being trained by Italian engineers (via technical and managerial education programs). Last year, 70 Tofaş engineers were sent to Italy for technical education. One of Tofaş's R&D policies is to send employees to Italy several times to have technical education so they can acquire external knowledge and then apply this knowledge upon their return to Turkey. The average education of a Tofaş employee is 100 hours in one year. Table 6.6 shows the number of incoming and outgoing engineers every 5 years.

Table 6.6 Number of Incoming and Outgoing Engineers

Years	**Number of engineers in Tofaş R&D**	**Number of Italian engineers in Tofaş R&D**	**Number of Turkish engineers in Fiat R&D**
1994	7	-	-
1999	84	-	-
2004	140	100 (for Minicargo project)	50
2008	420	37 (for P263 project)	70

Source: Obtained through the interviews with Tofaş R&D director, 2009.

6.1.4.2 Applying External Knowledge

Local firms learn, absorb and apply external knowledge at the highest level. Inside Tofaş there is a mechanism by which the company becomes a learning organization which refers to organizations where employees continually expand their capacity to create the results they truly desire; where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where employees are continually learning how to learn together (Senge, 1990: 210). Tofaş R&D Centre's capabilities are evaluated annually and shared with Fiat R&D centre.

During the interview with the Tofaş R&D director, questions were posed about the number of engineers leaving the job and the employee turn over ratio, these questions were asked because this issue is important as the number of engineers who leave the job may transfer their R&D tacit knowledge to other organizations. Employee turnover ratio has decreased since 1994 when the R&D department was established, as Table 6.7 shows.

Table 6.7 Number of Engineers Leaving the Job (Tofaş)

Years	**Number of engineers leaving the job**	**Employee Turnover Ratio (%)**
1994	3	13,64 %
1999	4	6,35 %
2004	6	6,76 %
2008	8	4,47 %

Source: Obtained through the interview with Tofaş R&D director, 2009.

Apart from the external knowledge gained from Fiat, Tofaş is in collaboration with some research institutes and universities. In all, Tofaş is engaged with 69 university and research institute projects. The research areas of the projects and the numbers of the projects are shown on Table 6.8.

Table 6.8 University and Research Institute Projects

Research Areas	Total	Ongoing	New projects	EU 7th Framework (applied but not approved yet)
Safety	17	9	8	3
Emission and Environment	8	4	4	1
Intelligent Vehicles	5	3	2	2
Equipment and Lightness	9	1	8	-
Product Development	4	1	3	-
Acoustics and Comfort	13	5	8	-
Operational Efficiency	13	8	5	1
Total	69	31	38	7

Source: Tofaş Company Reports, 2008.

Some of the topics are highly technical and some of them are future oriented projects. In addition, Tofaş has applied to the European Union (EU) 7th Framework Programme for financial support for 7 projects. In Figure 6.3, the numbers of projects started and completed through the years will be shown.

It can be shown that the initial condition for reaching a high level of absorptive capacity is to employ experienced and skilled engineers at the beginning. This is directly linked with the quality of education (universities, technical high schools) in the local country. In this respect, Tofaş initiated a joint program between the University of Turin and Uludağ University for a master's program in automotives.

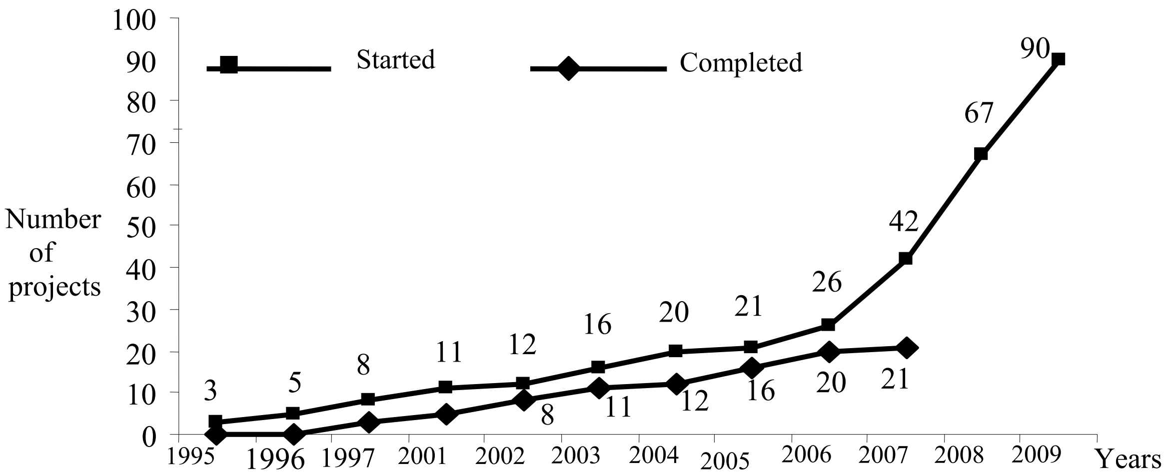

Figure 6.3 University-Tofaş R&D Projects

Source: Tofaş Company Reports, 2008.

As can be seen from Figure 6.3, there has been a continuous increase in the number of projects throughout the years. Tofaş has close R&D collaboration with the universities by making joint R&D projects. In addition, Tofaş R&D engineers attend the university's technical based education programs. Istanbul Technical University, Uludağ University and Middle East Technical University are some of the universities with which Tofaş collaborates closely. Tofaş has technical consultants from academia and uses facilities of the technical universities as well. Tofaş is very open to collaborative Master's and Ph.D. theses and Tofaş is involved in some dissertations; especially in areas of engineering.

Past and Current R&D Projects

The R&D department's first aim was to solve minor problems in production. When Tofaş's R&D department was first established, they were only capable of developing already existing technology. Their first product development project was "Liquid Petroleum Gas (LPG) Adaptation" to the Murat 131 type of Tofaş car. This development project was started in 1994 and completed in 1998. As the mission of the R&D department was to react perfectly to the problems of production in order to increase quality and cost reductions, they succeeded with the first project.

In 2000 a new R&D project was started called the "Doblo Project". Within the same year, "Albea" passenger cars were restyled in the R&D center. In this project, product ideas, design, and design approvals were all accomplished by the R&D department of Tofaş. Cost reductions were made through face-lift applications. The total project time was 7 months and the total investment was € 4 million. There were modifications in the version of Albea Sole for example: black auto bumpers, colour changes at back stops, new parcel trays with third stop, new air emission systems and MVC fuel pumps.

In 2001, the "Doblo Special Series" were also developed in the R&D center. These included Doblo Family, Lungo, Lungo Combi and Lungo Combi Bipower. In 2002, Doblo vehicles' transmissions and their motors were adapted and one year later, Doblo Family vehicles development began. There was specialization in the segment of light passenger vehicles, and finally, in 2004, Doblo Lungo was developed in Turkey.

For the “Doblo Lungo Combi”, the product idea, design and design-verification phases were completed by Tofaş R&D. This project consisted of applying second row seats, designing new back side ways glass and back side parcel shelf and carrier, applying new back side seat belts, seat connection elements and the design of a central floor panel. This project was started in 2006, with a total duration of 10 months and a total investment of € 5 million. In this project, Tofaş achieved sufficient resource allocation and combined project conformation processes. In addition, Tofaş succeeded in decreasing the process of template production by synergy with the Fiat Doblo Project staff.

In addition, the “Doblo Cargo Lungo BiPower” project included the adaptation of the motor and fuel systems. The vehicle is capable of running both gasoline and CNG (Compressed Natural Gas) fuels. The product idea, design, and design approval were all accomplished by the R&D department of Tofaş. The production goal was 600 vehicles in that year with project duration of 7 months. The project was completed in October 2007. The total investment was € 1,3 million.

On the other hand, Tofaş along with Fiat, has started to develop “Linea”, a new car in the passenger car division. It was built on a new Fiat-General Motors platform. 70 % of the cars are produced for the local market and 30 % are being exported. Linea’s production started in April 2007. Tofaş’s role in the project was vehicle concept development, design verification and changes, prototype vehicle production, vehicle performance tests and management of pre-production phase. Currently a study is underway to reduce costs by replace foreign components with those from local suppliers.

After the Doblo, Albea and Linea projects, the R&D department took responsibility for the R&D of the Mini Cargo Vehicle (MCV) Project in 2005, as mentioned earlier. The MCV Project was a new light commercial vehicle project with 3 versions: Cargo, Combi and Passenger car. These vehicles are produced for Peugeot, Citroen and Fiat.

This project's R&D responsibilities and intellectual property rights were owned by Tofaş and were finalized in 2008. It is marketed under three brands as: Fiat Fiorino, Peugeot Bipper and Citroen Nemo. In addition, 2.000 people were employed by Tofaş, and the suppliers employed approximately 10.000 additional employees.

The annual allocated capacity was 165.000 units per year, more than 90 % of which would be exported. 10.630 units were produced, 8.435 units were exported, 598 units were sold as Fiat Fiorino in the local market. The characteristics of this new segment was usage in the city, carriage capacity, height, easy to park, low fuel consumption and low cost. The innovative part of this MCV project was that Tofaş collaborated with universities (19 university collaborations) while undertaking this project. In addition, through this project, Tofaş has 14 patent applications, which have a direct impact on the Turkish economy.

Lastly, a light commercial vehicle R&D project called "P263" is still in development by Tofaş and Fiat. Production and manufacturing agreements were signed with Fiat Group Automobiles in 2007**.** Production is scheduled to start in July 2009. Tofaş applies patent applications from the above mentioned projects every year. In the year 2007 Tofaş patented 15 products. An interesting part of this project is that, for the first time, all intellectual property rights and loyalties related to the developed vehicle, "New Doblo", will belong only to Tofaş.

Czarnitzki, Ebersberger and Fier (2004) argued that R&D collaboration has a positive effect on the application of patents for German and Finnish MNEs. Table 6.9, shows the number of R&D projects and patents (national and international) to present how the two partner firms share the benefits of R&D collaboration.

Table 6.9 Sharing the Benefits of R&D Collaboration (Patents)

	Number of R&D projects	**Number of patents**
Tofaş-Fiat R&D collaboration	29	14*

*National and International Patent Applications

Source: Obtained through the interviews with Tofaş R&D director, 2009.

The R&D manager of Tofaş were asked 5-point Likert scale questions that related to the level of importance of the factors that affected Tofaş in undertaking R&D collaboration with Fiat. Table 6.10 shows the results of Tofaş's responses. (Level of Importance: Very High (5 points); High (4 points); Moderate (3 points); Low (2 points); and Very Low (1 point))

Table 6.10 Importance Level of Factors Affecting R&D Collaboration with Fiat According to Tofaş

Factors according to Tofaş	**Level of importance**
'Production Capability'	Very High
'Innovation Capability'	Very High
'R&D Capability'	Very High
'Absorptive Capacity'	High

Source: Obtained through the interviews with Tofaş R&D director, 2009.

6.2 Fiat (Italy)

The company was founded in 1899 at Palazzo Bricherasio, Turin, Italy. The first factory was opened in 1900 in Corso Dante with 150 employees. In 1903, Fiat produced its first truck. In 1908, the first Fiat was exported to the U.S. That same year, the first Fiat aircraft engine was produced. Also around the same time, Fiat taxis became popular in Europe. By 1910, Fiat was the largest automotive company in Italy. That same year, a plant licensed to produce Fiats in New York, USA, made its first car. This was before the introduction of Ford's assembly line in 1913. Upon the entry of the US into World War I in 1917, the factory was shut down. After the war, Fiat introduced its first tractor. By the early 1920s, Fiat had a market share in Italy of 80 %. In 1922, Fiat began to build the famous Lingotto car factory, the largest in Europe up to that time, which opened in 1923. It was the first Fiat factory to use assembly lines.

Fiat was a key player in developing motor industries for a number of countries from the 1950s, particularly in Eastern Europe, Spain, Egypt, Ethiopia and Turkey. Lada products in Russia and Seat products in Spain were Fiat based. Today Lada is controlled by Renault, and Seat by Volkswagen. A small number of Fiats were also constructed in Bulgaria.

In 1955 Fiat agreed to a deal with the Yugoslavian carmaker Zastava to assemble Fiats for Eastern Europe. The first cars to be produced by Zastava were its versions of the Fiat 1300 and the Fiat 1400. By 1970, Zastava was producing parts for the newer Fiat 124 and Fiat 125 models, although these cars were actually assembled in Poland. Zastavas were not popular outside of Eastern Europe before the 1980s, even though they were exported to the USA under the Yugo brand as early as 1973. It was based on the 1971 Fiat 127, which was due to be replaced by the Fiat Uno in 1983. It was among the cheapest cars on sale in both countries, and it was well received in its class in Britain, but not so much in the more competitive US market.

In 1987, Zastava came up with a new car design. The Zastava Florida known in other markets as the Yugo Sana which featured a range of refined Peugeot engines, and was mechanically similar to Fiat Tipo. It was sold in Britain from 1988 to 1992, but was withdrawn from sale for a number of reasons - particularly the domestic upheavals in Yugoslavia and the fall in popularity of the whole Yugo range in Britain. Sales continued in its homeland, with an updated model at the end of the 1990s. Zastava did not launch another new car for another 16 years. The 2003 Zastava 10 model was another Fiat design, the second generation of Punto. It boasts similar features to the Punto and other cars in its class such as the Volkswagen Polo. It is competitively priced compared to other similar-sized cars, including the Punto on which it is based.

Fiat automobiles have been produced in Poland since 1920. In 1992, Fiat Auto purchased 90 % of the FSM (Fiat Auto Poland, since 1993) stock. Another Fiat investment in Poland is a joint Fiat-GM venture of power train, producing multijet car engines both for Fiat and for GM models. In 1966, Fiat helped Russia to build a new car factory. A planned city called Tolyatti was developed around the factory, which started producing a "people's car" similar to the Volkswagen Beetle of Germany and the Citroën of France. The new Soviet car, called the Lada, however, was a more spacious offering, in the four door saloons and the five-door estate variants. The 124's design was mechanically upgraded to survive the treacherous

Russian driving conditions and the extremely cold winters. Imports to Western Europe, Canada, and some third world countries began, and by the early 1980s, the cars began to sell fairly well thanks largely to their low asking price. This car was upgraded to become the Lada Riva in 1980. A year after its launch, a four-wheel drive, the Lada Niva, was specially designed for the Soviet army.

In 2008, Fiat and Severstal's formalised a number of joint ventures to make and sell Fiat cars and engines in Russia. They will make up to 90,000 diesel engines and up to 50,000 Fiat Linea sedans a year. Production started in 2008. Tofaş also played a role in developing the manufacturing plant as mentioned the earlier in the Tofaş section.

In Spain, Seat was set up with Fiat assistance, producing Fiat models under its own brand name until 1981, when Fiat withdrew its support. However, production of the Fiat based models continued, with the final Fiat based Seat (the Marbella) not finished until 1996. By this stage, after several years of ownership by the Spanish government, Seat became part of the German manufacturer Volkswagen.

In South Africa, the Fiat Uno was assembled under license by Nissan, which marketed it through its dealerships as the Uno, without Fiat branding. The Fiat 131 was known as the Holland Car Docc. In addition, in Egypt some Fiat models were produced by the El Nasr automotive manufacturing company based on the Tofaş's Şahin. In addition, Fiat India Automobiles was established in 1997, as a joint venture between Fiat and Tata Motors and is based in Ranjangaon in the Pune District of Maharashtra. Fiat built the 500, Bravo, Palio Stile and Palio Stile Multijet in India.

Today, Fiat's headquarters are located in Turin, Italy. Fiat has six plants in Italy. The Punto and Grande Punto models are produced in the Mirafiori plant (Piedmont) and the Melfi plant (Basilicata), the Croma and Fiat Stilo models and the future Lancia are produced in the Cassino plant (Latium), the Saloon and station wagon Alfa Romeo models (Alfa 147, Alfa 159) are produced in the Pomigliano plant (Campania), the Ducato model is produced in the Sevel plant (Campania) and the Lancia Ipsilon model is produced in the Termini Imerese plant (Sicily). Fiat based cars are produced all around the world and the largest production centers outside

Italy are in Brazil and Turkey. There are also factories which belong to Fiat in Argentina and Poland. Fiat has a long history of licensing their products to other countries regardless of the local political or cultural persuasion. Apart from Turkey, joint venture operations are found in France, Egypt, South Africa, India and China.

6.2.1 Main R&D Policy of the MNE

Fiat has a centralized R&D center in Italy and there are production plants and R&D centers in Brazil, Turkey, China, and India. As described earlier, Fiat's acceptance of Tofaş's R&D department as one of their R&D partners was an evolutionary process that took some time. Fiat chose Turkey as a place to establish an R&D department because the Turkish government supports R&D by giving high government incentives. Another factor why an MNE collaborates with its Turkish partner in terms of R&D is Turkey's highly skilled labour force. Low transaction costs are also indicated as a strategic factor why MNEs undertake R&D collaboration with Tofaş. In Figure 6.4, the R&D structure of Fiat is shown.

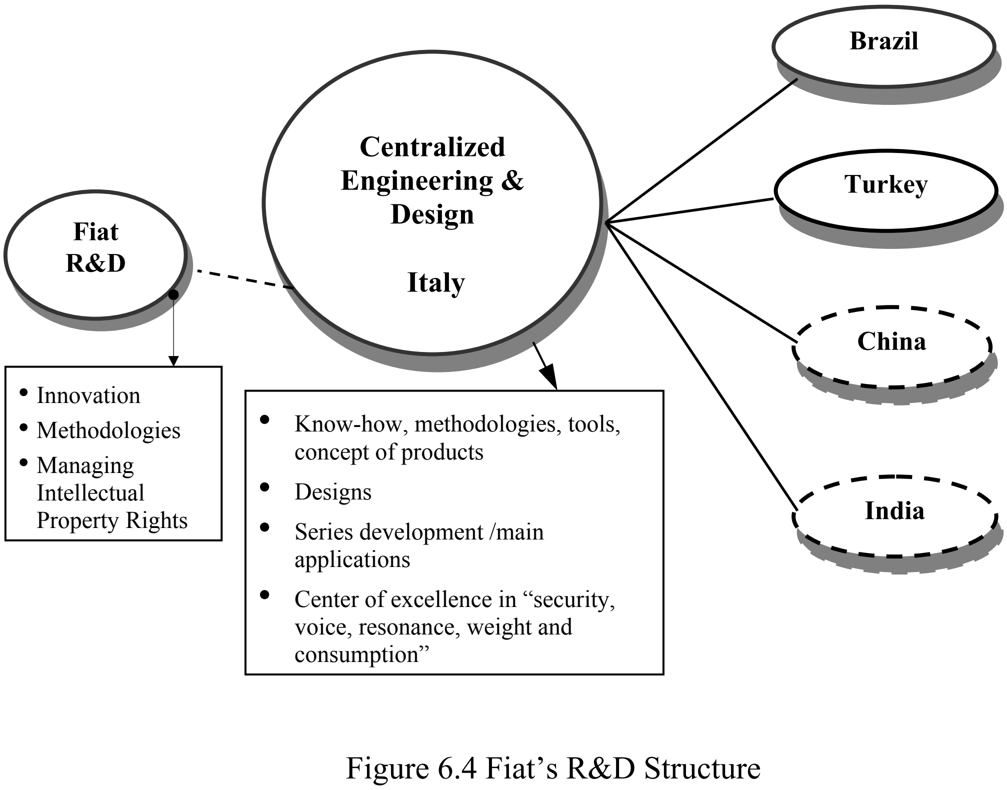

Figure 6.4 Fiat's R&D Structure

Source: This information and figures were gathered from Tofaş, 2008.

6.2.1.1 MNE's Criteria for Possible R&D Collaboration

In this case, one of the most important criteria for Fiat's possible collaboration in R&D is the local firm's R&D experience in the given tasks. If Tofaş was not experienced, it would take a lot of time for Fiat to teach the local side and then o make use of the outcomes. The local team should be experienced enough to be involved in collaborative R&D.

The second criterion for Fiat is the trustworthiness of the local company. As is known, R&D activities should be kept within the company as company information and should not be shared with outside forces. If an outsider learns the details of the R&D projects of Fiat, Fiat will lose its market share because competitors may easily copy the projects and be in production before Fiat. This is one example of why R&D collaboration can be so risky. As long as Fiat trusts their partner, in terms of keeping R&D information secret, they will go on with the R&D projects.

Lastly, the third criterion of the MNE is the costs of the R&D activity to the local company. If the costs are higher than their centralized R&D, Fiat would not be interested in making R&D with the local firm.

6.2.1.2 MNE's Openness to R&D Collaboration with Foreign Partners

One of the most important factors is the MNE's openness to collaboration in R&D with its foreign partners. There is no doubt that, if Fiat expressed no interest, there would not be any collaboration. Fiat might have chosen to have a strictly closed R&D structure centralized in Italy. In contrast, Fiat is open to collaboration in R&D with Tofaş. As a result of this, the collaboration level is very high. There are many Italian R&D researchers and engineers working in Tofaş Turkey and many Turkish researchers working in Fiat's R&D center in Italy as mentioned in the Tofaş section of the case study.

6.2.1.3 Strategic Goals of the MNE

As an MNE, Fiat has strategic goals related to R&D collaboration with its local partner firms. The fundamental goal is to get R&D service from a local firm with high quality and low cost. Forming the R&D collaboration with a local partner is a milestone in the strategic management process of a company. If the MNE did not think of letting another party handle some of its R&D activities, then there would not be any collaboration. Strategically, companies prepare 5-10 years plans. In these strategic plans, companies' mission, vision, and strategic goals are written down for the future. Fiat's strategic goals were for spreading its R&D activities among all its shareholders, such as, partner firms, suppliers and universities. Another strategic goal of the company is, no doubt, to make collaborative R&D work and to develop high quality products.

6.2.2 R&D Departments of the MNE

The relationship between the local country's R&D departments and the MNE is a delicate research policy. In the Fiat case, there are four R&D departments (Brazil, China, India and Turkey) belonging to Fiat worldwide. Fiat divides R&D activities into different R&D departments. Each and every R&D department concentrates on different topics; for example, Tofaş concentrates on light commercial vehicles. So far, it is not expected for Tofaş to make R&D on new technologies, like intelligent vehicles, vehicle communication, fuel cell vehicles, electric and hybrid vehicles. On the other hand, in Brazil the Fiat company, Magneti Marelli, conducts research on electronics applications in automotives. In Italy, the main high tech R&D research is done. New technologies are researched, and the coordination and evaluation between branch R&D departments is done. For the Fiat case, this coordination seems successful and there is no clear competition observed between R&D departments (http://www.magnetimarelli.com/index.htm).

6.2.2.1 Competition between R&D Departments in Different Countries

This variable includes the existence of competition between R&D departments of the same MNE located in Brazil, Turkey, India and China. As is known, the centralized R&D department is located in Italy and most of the R&D is handled in Italy. On the other hand, R&D is also realized in the four different countries stated above. The R&D department in each country, works on different subjects. If they worked on the same subject, there would be much higher competition between the R&D departments of the same MNE. The competition exists because every R&D department wants to make the highest technological products. Our argument for this factor is, if there is competition, and then the R&D departments need to work harder in order to attract the attention of the MNE. The most competitive R&D department would take the responsibility of doing R&D more than the others. On the contrary, if the competition is not high, then there will be the allocation of jobs to R&D departments in different countries.

In our case, Fiat operates its R&D activities separately. There is no collaboration between other R&D departments of the same MNE. In fact, Turkey (Tofaş) is one of the most experienced, in terms of R&D experience, because the R&D departments in India and China were established very recently. Brazil's R&D department is one of the oldest and most experienced ones. All the R&D departments are working in different research areas, so there is no competition between the departments. However, they may compete on Fiat's future projects. Fiat managers stated that they did not think this factor was important for R&D collaboration.

6.2.2.2 Other R&D Department's Competency for Collaboration

The factors that affect Fiat's decision as to which R&D department is ready for collaboration, are basically concerned with the department's absorptive capacity, its experienced and skilled human base and the technological capability of the R&D departments in Brazilian, Turkish, Indian and Chinese.

First of all, as mentioned above, the Brazilian R&D has the highest absorptive capacity, largest experienced and skilled human base and the highest technological capability among all the mentioned R&D centers, including Turkey. They are the most experienced R&D center, so their absorptive capacity is high. At the same time the number of experienced and skilled engineers is also higher than any of the others. In terms of technological capability, Fiat mentioned that their technological capability is also very high. They are a perfect partner for Fiat. On the other hand, both China and India are not 100 % ready for collaboration. They are new partners of Fiat. In terms of Turkey, as it can also be found in the Tofaş case, Turkey was ready for collaboration in 1994; which is why R&D collaboration started and continued successfully from that date.

A series of 5-point Likert scale questions were asked of the R&D manager of Fiat. The questions dealt with the level of importance of certain factors regarding Fiat's decision to do R&D collaboration with Tofaş. Table 6.11 shows Fiat's responses. (Level of Importance: Very High (5 points); High (4 points); Moderate (3 points); Low (2 points); and Very Low (1 point))

Table 6.11 Fiat's Evaluation of Factors related to the 'Main R&D Policy of the MNE' and 'Other R&D Departments'

Factors according to Fiat	**Level of Importance**
Main R&D Policy of the MNE	
MNE's Criteria for Possible R&D Collaboration	Very High
Openness to R&D collaboration with Foreign Partners	Very High
Strategic Goals of the MNE	Very High
'Other R&D departments'	
Existence of competition between R&D departments	Moderate
Other R&D Department's Readiness for Collaboration	Moderate

Source: Obtained via e-mail from R&D Manager of Fiat, 2009.

6.2.3 Local Country Specifities

6.2.3.1 Macro Environment

R&D labour costs and the government incentives of Turkey are explored as macro environment of Turkey that influences R&D collaboration.

R&D Labour Costs

Tofaş's monthly R&D personnel cost is 1.3 million TL (Turkish Lira). A person's hourly cost is roughly € 25 per hour (TL 48 per hour). This cost includes Social Insurance Institute (SSK) premiums, monthly taxes and etc. This amount is pretty low when compared to MNE's monthly R&D personnel cost. In Italy, the cost of R&D of a single R&D staff is above € 45 per hour which is a high amount when it is compared with Turkish employee costs. This is one reason why Fiat chooses to shift some collaborative R&D work to Turkey since the R&D cost per person is much lower.

Government Incentives

According to the literature, government incentives to the local company are one of the most important factors affecting R&D collaboration. According to the strategic plan of Tofaş R&D, approximately TL 30-40 million will be gained from the government for one year of government incentives. The total budget of the R&D department is $ 140 million (220 million TL) including all the R&D projects in 2008. Half of this budget is targeted for support from the government, through TÜBİTAK incentives and investment discounts. Considering the Frescati and Oslo rules (OECD, 2002) about incentives adopted by Tübitak, which excludes indirect R&D expenses, this ratio cannot be higher than 30 %.

6.2.3.2 Social Factors

To enable a better understanding of why Fiat chose Tofaş as an R&D location, the Fiat R&D manager was asked both open-ended questions and likert scale question about three social factors (mutual trust and integrity, level of commitment and cultural conflicts).

Mutual Trust and Integrity

Fiat R&D managers stated that when they first came to the Tofaş Bursa plant, they found the plant to be more than their expectations. They were quite happy with the technical background of the young Tofaş researchers as well as their willingness to learn new techniques. Mutual trust in keeping secret information produced by Fiat is another important issue. The Turkish project leaders are able to access some secret information, which is another reflection of the degree of mutual trust established between the MNE (Fiat) and its local partner (Tofaş). Fiat managers think that there is mutual trust and integrity between Italians and Turks. They also stated that if there were no mutual trust, there would be no relationship. When interviewing the leading Italian and Turkish R&D managers, they both insisted that there was no differentiation between Italians and Turks in assigning the researchers to projects. The only parameter they said is “the liability” of a person for a particular task, nothing else.

Level of Commitment

Fiat R&D manager stated that there should be a close working situation in joint research projects. Turkish and Italian staff should obey the rules and prepare for announced meetings. They should respect the specific deadlines. If one of the parties delays in an announced meeting/deadline etc., the other side will lose its commitment. According to Tofaş company reports, all R&D projects were completed 3-5 months before the deadline. Today Tofaş’s R&D director had Japanese auto firm experience so he uses some Japanese management techniques in production and

R&D activities, such as, “just in time” production and total quality management (TQM).

Cultural Compatibility and Management of Cultural Conflicts

In terms of cultural conflicts, there is no clear culture conflict. However, Fiat engineers working for Tofaş recognized some similarities, as well as some cultural differences. The general education level of Turkey is quite low compared to Italy. This causes some cultural conflicts, but these conflicts do not take place in the factory. Italians face these in their daily lives. Most of the Italian engineers think that the two cultures are quite compatible and Turkish people are easy to work with.

Turkey and Italy are two Mediterranean cultures that have many similarities. The habits of the people are quite similar. People prefer to work with people when they share a similar culture. Especially if they have to make daily phone calls, e-mail, participate in video-conferences and go to each other’s plants, sometimes as often as twice a week or for longer terms, these factors become more important.

The R&D manager of Fiat was asked some 5-point Likert scaled questions concerning the level of the importance of the ‘Macro Environment’ factors and Social factors for Fiat in their decision to undertake R&D collaboration with Tofaş. Table 6.12 shows the results of Fiat’s responses. (Level of Importance: Very High (5 points); High (4 points); Moderate (3 points); Low (2 points); and Very Low (1 point))

Table 6.12 Fiat’s Evaluation of Factors related to the ‘Macro Environment’ of Turkey and ‘Social Factors’

Factors according to Fiat	**Level of Importance**
Macro Factors	
‘Socio-economic Conditions’	High
‘Infrastructure’	Very High
‘Labor Cost’	High
‘Government Incentives’	Very High

Table 6.12 Fiat's Evaluation of Factors related to the 'Macro Environment' of Turkey and 'Social Factors' (cont'd)

Social Factors	
'Mutual Trust and Integrity'	Very High
'Level of Commitment'	High
'Cultural Compatibility and Management of Conflicts'	Very High

Source: Obtained via e-mail from R&D manager of Fiat, 2009

6.3 Nature of R&D Collaboration

Vehicle design and manufacturing is a difficult and complex job which involves various concerns and concepts of dynamics, mechanics, control and communications. In order to reach a complete design phase, a certain amount of experience is necessary and a high level of competency should be gained. This requires at least a few decades. Tofaş-Fiat R&D collaboration was based on the long joint venture relationship. These two firms have been partners for 40 years. As it has been mentioned before, in the early days there was no R&D department in Tofaş and the factory was only a production plant. Later on, as Tofaş's technological information level gradually built up, and Fiat realized Tofaş's absorptive capacity, Fiat allowed its partner to make some minor product adaptations and small changes in product development projects.

Collaboration in R&D started and developed over the years. Tofaş acquired most of the knowledge from Fiat, and Turkish engineers learned from Italian engineers how to produce a car. The Fiat manager emphasized that their R&D collaboration is based upon mutual trust. Until recently, R&D collaboration was limited because Fiat did not let its partner design and manufacture a car from the top to bottom. Tofaş keeps on developing its capabilities to perform R&D and will one day develop a car of its own.

Chapter 7
Ford Otosan-Ford Collaboration

This chapter will involve the factors affecting R&D collaboration of Ford Otosan and Ford. Additionally, it will provide a brief history and company information, such as, exports, imports, production and sales figures.

7.1 Ford Otosan

Ford Otosan was founded as a joint venture of Koç Holding and Ford Motor Company in 1959. Ford Otosan is jointly owned by Ford (41 %), Koç Holding (41 %), and Istanbul and Luxemburg Stock Exchange (18 %). Manufacturing and assembly facilities are located in Kocaeli at İnönü Powertrain and Cargo Assemblies. Parts distribution facilities are located in Kartal, Istanbul.

At first, Vehbi Koç was assigned a Ford dealership in 1928, in Ankara. After 30 years, Ford Otosan became a Ford assembler in Turkey in 1959. Production of Transit minibuses was launched in 1967. Ten years later, in 1975, transit vans and pick-ups were added to the range. Two years later, in 1977, a licensing agreement was signed with Ford Motor Company to manufacture passenger cars and commercial vehicles. Then in 1982, the İnönü Factory was opened and the company started producing engines. Later, Ford Escort passenger cars of Ford Otosan were produced and launched in 1994. Koç Holding and Ford Motor Company equalized their shares by signing a partnership agreement in 1997, and changed the company's official name to Ford Otosan. In 2001, transit cars, a component of light commercial vehicles were produced and launched in the Kocaeli plant, and in 2002, Transit Connect production was launched. One year later, in 2003, a new heavy truck was introduced. Transits were first exported in 2004, the New Transit models were launched in 2006, and finally, the Gebze Engineering Research Center was opened in 2007.

Today Ford Otosan has made its mark in all the sectors of Turkey's automotive industry, offering a wide range of products, from Ford Fiesta to Cargo. At its award winning manufacturing facilities, Ford Otosan produces Transit and Transit Connect at its Kocaeli factory. This facility has been selected as "Europe's Best Plant" five years in a row; Puma Transit engines, Ecotorq truck engines and Cargo trucks are built at its Eskişehir İnönü factory. As has been mentioned above, there are three Ford Otosan plants in Turkey, namely Kocaeli, İnönü and Kartal. In Ford Otosan's Kocaeli Plant (Kocaeli) all "Transit" and "Transit Connect" model cars are produced. In addition, this plant has a sea front location and integrated pier/terminal devoted to exports and imports. It has been the "Best Ford Brand Assembly Plant" in Europe since 2002.

In addition, at the İnönü Plant (Eskişehir) heavy trucks, engines and powertrains are produced. The annual capacity is 55,000 for powertrains and 15,000 for trucks and it as been chosen the "Best Ford Powertrain Plant Worldwide". As previously mentioned, the Parts Distribution Center is located in Kartal near Istanbul. The parts operations, service engineering, warranty and field operations are done there. More information will be provided about the plants and centers in the infrastructure part of this thesis. Ford Otosan promoted Ford to "The Best Selling Brand" in the automotive market through retail sales in Turkey for five consecutive years, 2002-2006. Ford Otosan has undertaken a prominent role in boosting Turkey's economy, not only in export revenues, but also in employment opportunities in its own company as well as in the automotive supplier industry. Ford Otosan reinforces its leadership role by introducing new products while enhancing its achievements with awards. Ford Transit, manufactured at the Kocaeli factory, was named the "Commercial Vehicle of the Year" in Europe for 2007, while Ford S-Max, which was introduced into the market with a new kinetic design, won "Car of the Year."

After launching the new Ford Ranger in March 2007, Ford Otosan next introduced the new Ford Mondeo in June 2007, setting new standards for its class. As expected, the New Mondeo was welcomed with much attention and appreciation. The new Ford Transit 200 PS engine manufactured by Ford Otosan engineering is accepted as one of the most powerful engines in its class. Having achieved a great engineering feat with Ecotorq, the first diesel engine designed from start to finish in Turkey, for Cargo Trucks, Ford Otosan further distinguished its accomplishments in commercial vehicle production with the new engine. Notably, Ford Transit celebrated its 41^{st} birthday the previous year with more than 5 million Ford Transits manufactured to date. After winning the "Commercial Vehicle of the Year" in 2007, in Europe, Ford Transit now has the most powerful engine in its class, proving the importance Ford Otosan attributes to R&D. This advance in engine development brings to light the superior level attained by Turkish engineering.

Ford Otosan celebrated the official opening of the Ford Otosan Gebze Technology Center in a ceremony attended by Koç Holding Chairman Mustafa V. Koç, Ford Europe CEO John Fleming, and executives from Koç Holding, Ford Europe and Ford Otosan. This center is located in a techno park area and free zone, the Marmara Research Center near Istanbul. This opening ceremony reflects the importance of R&D between the Mother company and its local partner. The Ford Otosan Gebze Technology Center will provide comprehensive support to R&D. The Gebze Technology Center is the most recent byproduct of a positive, long-term partnership that created Ford Otosan, a production hub for Ford Europe in commercial vehicles. With a staff of 200 engineers, the new $ 1.2 million center will support Ford Otosan products and Ford Europe's future model development programs while complementing Ford Europe's main product development and engineering center in Dunton, England.

The Gebze Technology Center was created as part of Koç Group's mission to lead the Turkish industry in spotlighting the importance of R&D and unsparingly providing the necessary resources. Further, the Koç Group regards R&D as a powerful element encompassing a local industry 'which not only assembles but also develops and produces, has a voice in the international arena', and is in active competition. Today, Ford Otosan manufactures models of Transit, Transit Connect, Cargo, and a full line of cars at its Kocaeli factory. By the end of 2007, Ford Otosan had produced 261.025 units of light commercial vehicles in total. Ford Otosan's annual production capacity is 315,000 vehicles in total, including light commercial vehicles and trucks. The light commercial vehicles production capacity was 235,000 by the end of 2007 (General and Statistical Information Bulletin of AMA, 2007-1).

Company exports increased to 221,964 units ($ 3,373,728,560) by the end of the 2007. Ford Otosan is in the highest position of all exporting companies. Other leading firms in the list were Oyak Renault, Toyota and Fiat. Their export figures were mentioned in the Tofaş-Fiat part of this case study. In addition, a total of 219,062 units were sold in the light commercial vehicle markets abroad during the year 2007. In the annual report 2007, Ford Otosan's competitive advantages are indicated by its large scale export program, strong, committed joint venture partner supports, its strong distribution network, low cost and flexible manufacturing, its competence in commercial vehicle product development, its engineering capabilities, its experienced and skilled work force, and the best corporate governance activities.

There was a total of 9,515 employees working for Ford Otosan by the end of 2007. 1,377 of them are white-collar employees and 8,100 of them blue-collar employees. 68 % of the blue-collar employees graduated from technical high schools, 15 % from vocational colleges, 9 % from primary and secondary schools, 7 % from high school and 1 % are university graduates. In addition to that, 62 % of the white-collar employees graduated with a Bachelor of Science or Arts degree, 19 % have a Masters and 1 % of them have a PhD. The distribution of the employees is shown on Table 7.1.

Table 7.1 Number and Distribution of the Employees

Distribution of Employees	**Number of Employees**
White Collar Employees	**1,377**
• Office Employees	357
• Managers	75
• Engineers	708
• Administrative Level Engineers	237
Blue Collar Employees	**8,100**
Total	**9,515**

Source: General and Statistical Information of Bulletin of AMA, 2007-1, p.36.

Remarkable changes relevant to R&D collaboration have occurred in the relationship between the mother company Ford, and its local partner Ford Otosan. It is known that the R&D center in TÜBİTAK Marmara Research Center (MRC) Technology Free Zone was originally planned for a maximum of 200 research projects. However it was recently decided that this number should be increased to over 1000. This is a significant change and should be explained in detail as a case study, which will be informative in understanding the threats and opportunities of the R&D center of the local partner.

7.1.1 Production Capability

It was mentioned in the interview with Ford Otosan managers, that being a successful production partner for 50 years, during which time the production capacity continuously increased with satisfying quality control and testing requirements, was an important factor in starting an R&D collaboration between the two partner companies. Ford acknowledges the importance of having full trust in its local partner's skilled staff, as well as the modern and technologically well equipped Otosan plants, in terms of quality control and testing.

In order to comply with customer demands, Otosan engineers have generated minor product modifications along with production activities. Learning from these product change processes, and the success achieved in these activities, has generated an impetus to start R&D collaboration between Ford Otosan and Ford.

7.1.1.1 Competency in Production

Production problems and deficiencies should be solved in the production area. Ford Otosan's production problems and deficiencies are solved in Turkey. Once the manufacturing firm gets involved in solving these problems and deficiencies, its' absorptive capacity level increases. The more the firm becomes competent in R&D, the more it is capable of producing more innovative products. When a problem is found in a car, production managers and their team analyze the problem and find a solution that enables them to improve different areas of automotive design.

At the Kocaeli plant, Ford Otosan finds solutions to production problems and deficiencies. The competency was shaped while Ford Otosan's managers were trying to find solutions right after the production process or during the production process. Ford Otosan is free to solve the problems by itself or to ask the mother company to solve them or make further R&D, depending on the depth and size of the problems and deficiencies.

7.1.1.2 Quality Control and Testing

Satisfying quality control and testing requirements was mentioned as an important factor affecting R&D collaboration between the two partner companies. In this case, the Kocaeli plant of Ford Otosan has a lot of advantages because all the quality control and testing requirements are fully satisfied. The plant of Ford Otosan is a modern plant, and Ford trusts its local partner's skilled staff and highly modernized and technological plant in terms of quality control and testing.

7.1.2 Innovation Capability

This section examines Ford Otosan's R&D department's capability to produce innovative and creative solutions, and the degree of innovativeness of the R&D department such areas as patent applications, new design, and creative solutions. Similar with Tofaş, Ford Otosan's R&D department is capable of vehicle design (body, chassis, trim designs, powertrain integration and packaging), prototype manufacturing, performance testing (road, noise, vibration, and harshness (NVH) and bench tests), material engineering, tool design and manufacturing and vehicle homologation. Ford Otosan has advanced technology in R&D in house; they have the engineering capability and the interest to work together collaboratively. Ford Otosan's research is mostly concentrated on the design of light commercial vehicles and model changes for local market applications and cost reduction of the existing models.

Ford Otosan is able to manufacture two different types of vehicles. The first segment is heavy-duty vehicles and the second one is light-duty cars. For heavy-duty vehicles, in terms of R&D, all engine and vehicle designs are made by Ford Otosan. Ford lets Ford Otosan work by itself and is free in all its applications. They only obtain permission from the mother company to use the “Ford” royalty. This is only a judicial application between Ford Otosan and Ford. The mother company seldom gets involved in Ford Otosan’s R&D studies on this issue. For the second type, (light duty), Ford Otosan is capable of making the R&D for Transit and Transit Connect’s vehicles and the engineering work. The Transit’s engine is also developed by Ford Otosan at the İnönü plant. On the other hand, Transit Connect’s engine is imported.

7.1.2.1 Adaptations to Local Market

The variable called “adaptations to the local market", consists of local customers and suppliers’ needs, and expectations and demands in Turkey. Although Ford Otosan now exports most of its products, Turkish customers’ needs and desires are still very important. Quite often these demands become an important and effective parameter in order to make small product changes. It must be remembered that in the early days, the requirements for small product changes had the impetus to start R&D collaboration between Ford Otosan and Ford. In this respect, the expectations of local customers and suppliers are an important factor for the Ford Otosan-Ford R&D collaboration. It should be emphasized that the expectations of the local market is one of the most important factors for R&D collaboration.

7.1.2.2 New Products Idea Development System

Similar to the Tofaş-Fiat case, there is a special program in Ford Otosan to promote innovativeness. The R&D department serves as a jury in this program. Every worker of Ford Otosan is invited to produce a new idea to make models more efficient, more robust, safer, and less costly, with less production time. These ideas are reported from group leaders to the R&D department. Following an evaluation phase, ideas that are found to be applicable are rewarded. In addition, R&D department researchers are also expected to produce new ideas in this respect. One of the goals of the R&D department is to solve minor problems in production.

7.1.3 R&D capability

This part of the thesis aims to present the R&D capabilities of the local firm Ford Otosan. It starts with the background and continues with the size, infrastructure of the R&D department, educational and professional experience levels of the employees, and the R&D capability to produce innovative, creative solutions, which reflect the degree of innovativeness.

7.1.3.1 R&D Department

Ford Otosan's product development department was established in 1986. When the product development department was first established, the department was capable of supporting production and solving daily problems in the production process; however, they were only capable of developing technology that already existed. They were working according to the needs of the local customer. For example, one of the projects was to modify the gasoline engine to a diesel engine. Collaborative R&D started when the R&D department of Ford Otosan was officially established in 1997. As is known, Ford and Ford Otosan have had a long production partnership history. As in the previous case study for Tofaş-Fiat R&D collaboration, Ford's main goal was to have production in Turkey, not to undertake collaborative R&D activity with Ford Otosan. That's why, in the early days, Ford showed little interest in establishing an R&D department in Turkey. Important milestones of the R&D Department are shown on Table 7.2.

Table 7.2 Important Milestones and R&D Capabilities

1986	1997	2007
Production Support, Problem Solving	R&D Department Established	New product development

Source: Ford Otosan Company Reports, 2007.

The department's first aim was to make model changes based on the needs of Turkish customers. Through the years, the department's R&D experience increased and they began to make new products. In the early days, while the R&D team of Ford Otosan was working on the development project of Transit Connect, they started with brain storming sessions, and benchmarking with similar vehicles. They have worked very hard on the concept of the car. Ford's R&D department has now improved their skills, their absorptive capacity and their experience level. For any R&D project, Ford Otosan allocates 46 months (approximately 4 years) for the design and R&D of the project.

7.1.3.2 Size and Structure of the R&D Department

A total of 558 people are employed in the main R&D department of Ford Otosan in the Kocaeli assembly. For the R&D projects, some engineers are employed temporarily from the USA R&D office. These American engineers have 8-12 years of work experience. Today five American engineers work in the Ford Otosan R&D department. Apart from the main R&D center of Ford Otosan, located in Kocaeli plant, there are two different R&D offices belonging to Ford Otosan in Turkey. One of them is located at the Istanbul Technical University Maslak Campus Automotive Technologies R&D Center (OTAM). The second R&D office is located in Gebze, at the Scientific and Research Council of Turkey (TÜBİTAK) Marmara Research Center (MAM). The total investment was approximately € 29 million, including all the R&D activities of Ford Otosan for the first half of 2008.

There are 13 divisions in the main R&D department of Ford Otosan. These are: the Product Development and Homologation Department, the Powertrain and Engine Department, the Body Engineering Department, the Chassis Engineering Department, the Electrical Engineering Department, the Vehicle Engineering Department, the Cargo Truck Engineering Department, the Design Studio Department, Special Vehicle Engineering Department, the Pre-Production Management (PPM) Department, the Total Value Management (TVM) Department, the Product Development Coordination Department and the Plant Vehicle Team Department. The R&D team of Ford Otosan is led by an R&D Coordination

Manager. There are thirteen managers in the R&D department working under the R&D Coordination Manager, who are responsible for the groups mentioned above. The structure of the R&D department is shown on Figure 7.1.

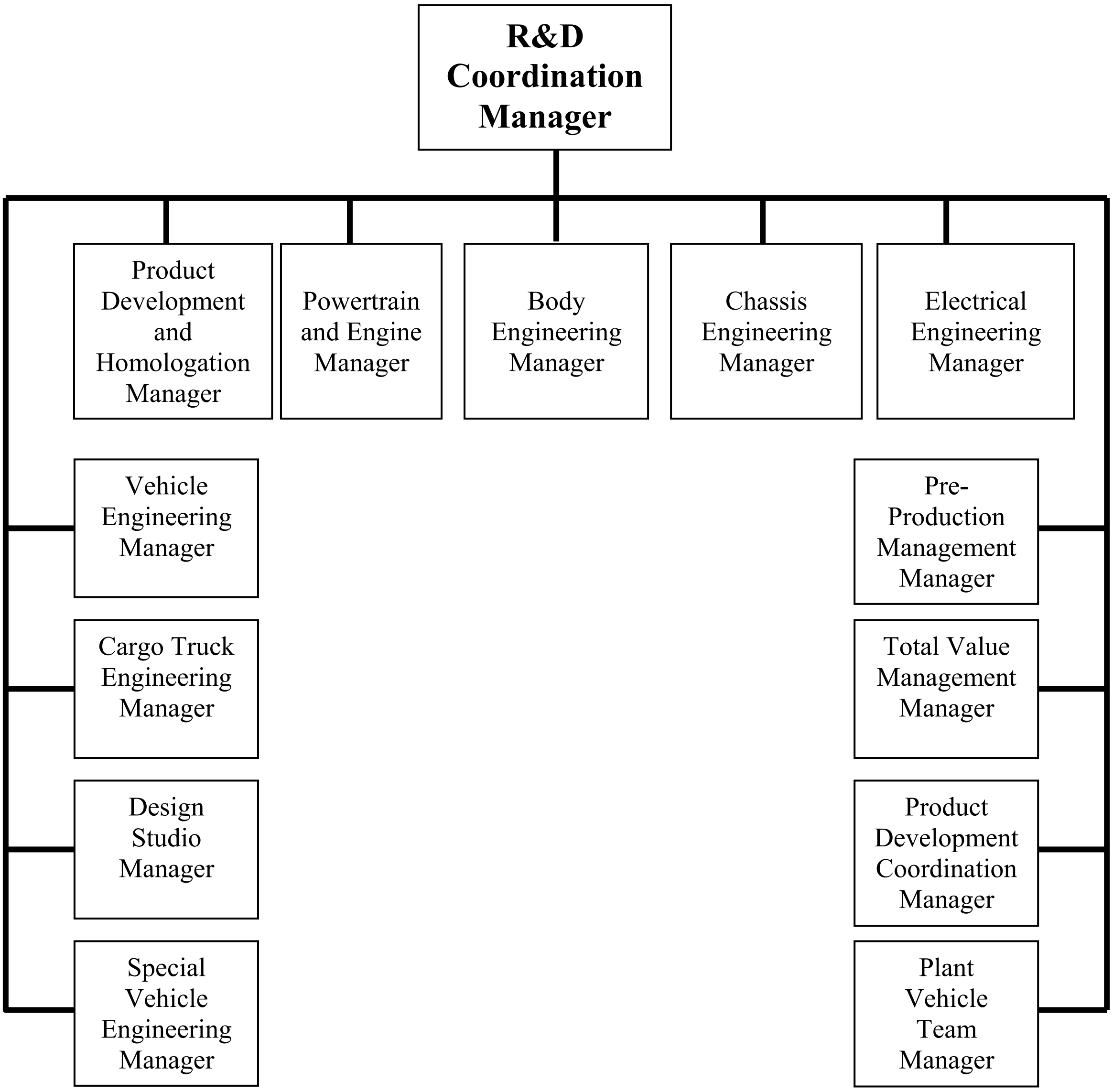

Figure 7.1 Ford Otosan's R&D Structure

Source: Ford Otosan Company Report, 2007.

7.1.3.3 Infrastructure of the R&D Department

Offices, laboratories, various testing systems, software computational facilities, equipment and links to international information centers form the infrastructure of the R&D department. In this respect, similar to Tofaş, Ford Otosan seems to be a very well organised technological company.

In order to have strong R&D activity in any company, the location and working environment of the R&D staff should be appropriate for their research. Before proceeding to the measures of the R&D department facilities, it is necessary to briefly discuss the product development phases. New product development commences with extensive theoretical and design studies. After studying the design topics theoretically, R&D engineers design and manufacture the prototype and components. Then manufactured parts and components are tested, mounted on a frame, and a vehicle prototype is formed. A number of extensive tests are conducted on these prototypes, sources of failure are eliminated and the prototypes are improved. Finally, the mass production phase is reached. This process was also mentioned in the Tofaş-Fiat case.

There is a need for an R&D department to have office blocks with a high level of computer facilities and material component prototype testing and measurement laboratories. Ford Otosan's R&D department's physical infrastructure is well developed. The office areas are sufficient and equipped with hardware and software computer facilities. There are enough test and measurement facilities and laboratories.

There is a building allocated only to R&D department accommodating more than 500 researchers. In this building, the divisions of the R&D departments are settled on one floor. Open offices with cubicles have been established and research and divisions are located by considering their functions. As is known, testing facilities are an important dimension of R&D departments. The Ford Otosan R&D department has good laboratories, testing materials and equipment. The equipment in the R&D department of Ford Otosan includes: a material labs, engineering hardware, and vehicle performance measuring equipment, fatigue test rigs and durability rig test laboratories. The material lab is used to support material characterization and failure root cause analysis. The engineering hardware includes computer-aided design (CAD) and computer aided engineering (CAE) workstations. In addition, vehicle performance measuring equipment is used to measure speed, acceleration, brake performance, fuel consumption and noise & vibration. Fatigue Test Rigs have programmable 6 hydraulic cylinders and resonance frequency fatigue test rig. The durability rig test laboratory is used to support key life tests on the automobiles.

7.1.3.4 Educational and Professional Experience Level of the Employees

Of the 558 employees in Ford Otosan R&D and product development, 507 are white-collar and 51 are blue-collar employees. There are 411 employees who are university graduates of which 25 have Ph.D.s and 139 have a Master's degree. There are 45 computer aided designers and 41 technicians in the department. The education levels of the employees are shown on Table 7.3.

Table 7.3 Education Level of Employees (Ford Otosan)

Personnel	Numbers
Engineers	507
• PhD	25
• MSc	139
• BSc	257
CAD	45
Technician	41
Blue Collar	51
Total	558

Source: Ford Otosan Company Report, 2007.

Professional knowledge depends upon the experience of the researchers. Generally employees have 4-5 years of work experience.

7.1.3.5 R&D Investments and New R&D Law

Ford Otosan's R&D investments and new R&D Law is highly important and effective in R&D collaboration. In the R&D budget for 2008, was $ 70-100 million, this figure included R&D investments. Table 7.4 presents Ford Otosan's R&D investments.

Table 7.4 Ford Otosan's R&D Investments

Years	2001	2002	2003	2004	2005	2006	2007	2008
R&D investments (Million Euro)	47, 1	21,5	25	31,8	45, 4	38, 7	41, 8	58, 4

Source: Obtained through the face to face interview with Ford R&D director, 2009.

As can be seen from above, the R&D investments of Ford Otosan have increased, but not significantly. According to Turkey's new R&D Law, 30 % of the R&D projects of Ford Otosan can be financed by the Turkish government. Since 1997, 32 R&D projects were financed by the government through the Scientific and Technology Research Council of Turkey (TÜBİTAK) Technology and the Innovation Support Programmes (TEYDEB) projects.

7.1.4 Absorptive Capacity Level

As has been defined before, absorptive capacity is defined as the local firm's ability to understand, assimilate and apply external knowledge (Cohen and Levinthal, 1990: 128-152). External knowledge may come from the mother company Ford, research institutes, scientific journals, universities, etc.

7.1.4.1 Acquiring External Knowledge

The flow of information between Ford and Ford Otosan is moderate since the R&D competency of Ford Otosan is of a high level and the need for information flow is not extensive. There is no comprehensive R&D collaboration between Turkish and American engineers. In fact, they contact each other via e-mail, teleconferencing or telephone. In addition, there is a software system called "knowledge management system" at Ford Otosan. This system was designed to increase knowledge sharing between Ford Otosan and Ford. However, R&D knowledge is transferred from the American engineers to the Turkish engineers directly, but in limited terms.

There is a continuous technical staff rotation system between Ford Otosan and Ford. However it seems that Ford Otosan has handled most of the R&D projects alone. Today there are 5 American engineers working for Ford Otosan. When an R&D project is started, some employees from Ford are temporarily sent to Ford Otosan in order to work on these projects. Their stay may take from 2 years up to the duration of the R&D project. In the other direction, some of the Ford Otosan researchers work in the USA. The number of engineers in joint R&D collaboration is low compared to the Tofaş-Fiat case study.

One of the R&D tools utilized by Ford Otosan is to send employees to the USA to receive technical education and to get information about the mother company's knowledge and, then return to Turkey to apply this knowledge. In this respect, Turkish engineers are educated by American engineers both in technical and in managerial terms.

Table 7.5, shows number of incoming and outgoing engineers for every 5 years.

Table 7.5 Number of Incoming and Outgoing Engineers

Years	Number of engineers in Ford Otosan R&D	Number of American engineers in Otosan R&D	Number of Turkish engineers in Ford R&D
1986	7	-	-
1991	50	-	-
1996	200	5	1
2001	350	-	-
2008	558	5	1

Source: Numbers obtained during the interview with Ford Otosan R&D director, 2009.

7.1.4.2 Applying External Knowledge

As with the Tofaş-Fiat case study, external knowledge is learned, absorbed and applied by the local firm Ford Otosan at the highest level. Apart from the external knowledge gained from Ford, Ford Otosan is in collaboration with some research institutes and universities. Ford Otosan needs to make a special effort to apply this external knowledge and to gain extra knowledge, Ford Otosan has close R&D collaboration with universities through joint projects. It has technical consultants from academia and uses the facilities of the technical universities as well. Ford Otosan is very open to collaborative Master's and PhD theses, and there are some dissertations that Ford Otosan is involved with; especially in areas of Automotive Mechatronics and Hybrid Electric Vehicles. There is an R&D collaboration agreement between Istanbul Technical University (İTÜ), TÜBİTAK, AMA and Automotive Technologies R&D Center (OTAM).

In the "Drive Safe" R&D project, leading automotive companies, universities and research institutes are involved in collaborative R&D. In total, there are 7 partners namely: Ford Otosan, Renault, Tofaş, İTÜ, OTAM, Sabancı University and Koç University. In another R&D project, the "Fuel cell-consortium" project, all the partners are from Koç Holding and from different industries. These are Ford Otosan, Arçelik (a leading Turkish company in the white appliances industry), Tofaş, TTGV (Turkish Technology Development Foundation), Aygaz (liquid gasoline distribution company), Demirdöküm (recently sold to Valliant Co, heating systems company), BOS (a Turkish hydrogen distribution company). This agreement was the first initiation of strategic research collaboration at the pre-competitive level. In addition, ODTÜ (Middle East Technical University) and Ford Otosan collaborated in the vehicle crash and "High G" test center R&D project, with support from government incentives.

Hybrid transit prototype development: The first phase of the project is a prototyping stage before commercialization, in which the know-how gained from this stage will be the starting point of phase 2. The second prototype will be designed and built by assembly techniques suitable for mass production. Partners who are involved in the R&D Collaboration are Ford Otosan, TÜBİTAK, OTAM and Istanbul Technical University. For the Hybrid Cargo R&D project, Ford Otosan and TÜBİTAK are partners in joint product development. In one part of this project, Ford, TÜBİTAK and İnci Akü were partners in the development of hybrid electric vehicle batteries. In terms of electric motor development, Ford, TÜBİTAK and Arçelik were R&D

collaboration partners. Ford and TÜBİTAK were partners for the hybrid Electronic Control Unit (ECU) R&D center.

Ford Otosan also took part in the European Union 6th Framework Programme. They were involved in integrated projects (IP) related to the Green Heavy Duty Engine project called "Euro 6 Diesel Engine Concept for 2012" which was coordinated by Volvo. The other partners were AVL, Ricardo, FEV, DC, IVECO, Delphi, Johnson Matthey, Ricardo, University of Valencia, Bosch, Chalmers University, and Daimler Chrysler AG. Ford Otosan's task was performance comparison tests with different alternative fuels. By being a partner in this project, Ford Otosan has become the first and only automotive company to participate in an IP project under the European Commission's 6th Framework Programme. In total, Ford Otosan has engaged in approximately 30 university and research institute projects. There is high collaboration with Istanbul Technical, Boğaziçi, Middle East Technical, Kocaeli, Sabancı and Koç Universities. Ford Otosan works with 74 graduate students and 43 professors. Some of the aforementioned universities have related graduate education programmes.

As mentioned before, the quality of the universities in the local country is directly linked with the initial conditions for reaching a high level absorptive capacity. It provides the opportunity to employ high quality researchers for the local company.

Past and Current R&D Projects

The licensing rights of any vehicle reflect the degree of value provided by the partners. In other words, R&D contributions are shown in design and engineering rights. "Transit" is a good example, it was chosen as International Van of the Year 2007. Transit was manufactured in the Kocaeli Plant, and it was the domestic market leader in 2007 with 32 % market share. For the Transit/Tourneo Connect, all licensing, design and engineering rights are shared between the MNE Ford and Ford Otosan.

The other brand name of Ford Otosan in the segment of light commercial vehicles is "Transit Connect", which is also manufactured in the Kocaeli Plant. The domestic market share of the company was 26.2 % in 2007. The vehicle was chosen as International Van of the Year in 2003. All licensing, design and engineering rights are shared in half between Ford Otosan and Ford. The product "Cargo" is in the sector of trucks and had a domestic market share in 2007 of 16.3 %. It is manufactured in the İnönü Plant of Ford Otosan. All licensing, design and engineering rights belong to Ford Otosan. S-Max was chosen as car of the year in 2007. It was chosen third in the domestic market in 2007. It has a 9.2 % of the market share. The engine and powertrain are both designed in the Kocaeli and Gebze Engineering Center and manufactured in the İnönü plant. All products (Ecotorq, Puma I5 Engine, Rear Axle, MT75 and Suspension) are designed in the Kocaeli plant and manufactured in the İnönü plant.

One of Ford Otosan's R&D areas is in Hybrid Electric Vehicles (HEV). Ford Otosan conducted two research projects related to HEVs, collaborating with the Marmara Research Center's (MRC) Energy Institute and Istanbul Technical University's (İTÜ) OTAM and Mechanical Engineering Faculty. As a result of these projects, Ford Otosan improved its technological know-how and developed full-scale HEV prototypes. Tests on the prototypes yielded encouraging results.

It is known that Ford's R&D centers, located in various parts of the world, are reluctant to accept the quality of the work done by Ford Otosan. Recently however, as a result of successive efforts, Ford's managerial board and Ford's R&D center in the USA have acknowledged the value of these projects, and have decided to support HEV research projects in Turkey. This is one reason behind the decision to improve the capacity of Ford Otosan's research center in the Technology Free Zone. A direct conclusion that may be drawn from this example is that, the equal base R&D collaboration between partners, or shifting some of the R&D work responsibility and leadership to local companies, will never be possible unless the local partner proves its competency to implement cutting edge technology and show its skills in the development of updated products.

Table 7.6 Sharing the benefits of R&D collaboration (Patents)

Ford Otosan-Ford R&D collaboration	**Number of R&D projects**	**Number of patents**
	32	4*

* National and International Patent Applications

Source: Numbers obtained during the interview with Ford Otosan R&D director, 2009.

The R&D director of Ford Otosan was asked 5-point Likert scale questions concerning the level of importance of the factors for Ford Otosan to make R&D collaboration with Ford. Table 7.7 shows the results of Ford Otosan's responses. (Level of Importance: Very High (5 points); High (4 points); Moderate (3 points); Low (2 points); and Very Low (1 point))

Table 7.7 Importance Level of Factors Affecting R&D Collaboration with Ford according to Ford Otosan

Factors according to Ford Otosan	**Level of importance**
'Production Capability'	Very High
'Innovation Capability'	Very High
'R&D Capability'	High
'Absorptive Capacity'	High

Source: Obtained during the interview with Ford Otosan R&D director, 2009.

7.2 Ford (USA)

Ford Motor Company is a global automotive industry leader that manufactures and distributes automobiles on six continents. Based in Dearborn, Michigan, with approximately 246,000 employees and 95 plants worldwide, its core and affiliated automotive brands include Ford, Lincoln, Mercury, Volvo and Mazda. In addition, it has an automotive financing business called Ford Motor Credit Company. The company operates as a globally integrated worldwide team with four key priorities: aggressively restructuring to operate profitably at the current demand and changing mix, accelerating development of new products that customers want and value, financing its plan and improving its balance sheet, and working together effectively as a global team (Ford Motor Company 2007 Annual Report). Lundback (2004) mentioned that when Ford Motor Company acquired Volvo Cars in 1999, they worked very hard on the integration of the R&D.

In the UK, there are 13,000 employees employed at seven locations and it has been the British car market leader for over 30 consecutive years. The Southampton-built Ford Transit, engineered at Ford's UK product development HQ in Essex, has led the commercial vehicle sector for 43 successive years. Ford's Dunton product development center, near Basildon, also works on future powertrains (engines/transmissions), which are produced at the company's Dagenham and Bridgend plants. The Ford Focus has been the UK's top selling car every year since it was launched in 1998. Joining Focus in the country's top three favourite cars is the Ford Fiesta.

Ford’s vision is simply to be the world's leading consumer company for automotive products and services. They mention that people are at the heart of their vision and they strive to improve the quality of peoples' lives through progress. They see themselves as a global, versatile family with a proud heritage. They have said that they have a passion that drives them to create excellent products and services that their customers welcome, both now and in the future. As a company, they are responsible for the welfare of their customers, their employees and their society.

7.2.1 Main R&D Policy of the MNE

Ford has a centralized R&D center in the USA and there are production plants and R&D centers in the UK, Germany (2), Canada and Turkey. As it was described earlier, Ford’s acceptance of Ford Otosan’s R&D department as one of their R&D partners was an evolutionary process which took some time. There were some reasons behind Ford’s decision to allow its partner, Ford Otosan, undertake R&D for their cars. The first reason was that the Turkish government supports R&D by giving valuable government incentives. As important as the first reason and similar to the other case study for Fiat, the MNE collaborates with its Turkish partner in terms of R&D because of Turkey’s highly skilled labour. Low transaction costs are also indicated as a strategic factor for the MNE Ford to undertake R&D collaboration with its local partner Ford Otosan.

The centralized engineering design in the USA is used to study: know-how; methodologies; tools; concept of products; designs; series development/main applications; and the center of excellence in “security, voice, resonance, weight and consumption”. Ford R&D is innovation centered; they manage the intellectual property rights and methodologies. In terms of hydrogen technology, Ford is working directly with the US Department of Energy to design vehicles that will be powered by 50% hydrogen fuel.

Ford's Dunton (UK) product development center, near Basildon, also works on future powertrains such as engines and transmissions, which are produced at the company's Dagenham and Bridgend plants in the UK. In addition, there are two more separate R&D centers in Germany, in the cities of Aachen and Merkenich. These R&D centers research R&D of hybrid electrical vehicles and R&D of fuel cell supplied vehicles. They work on highly technological and innovative topics. In Canada, Ford is collaborating directly with the government to make hydrogen fuel cells there. Ford’s R&D structure is described in Figure 7.2.

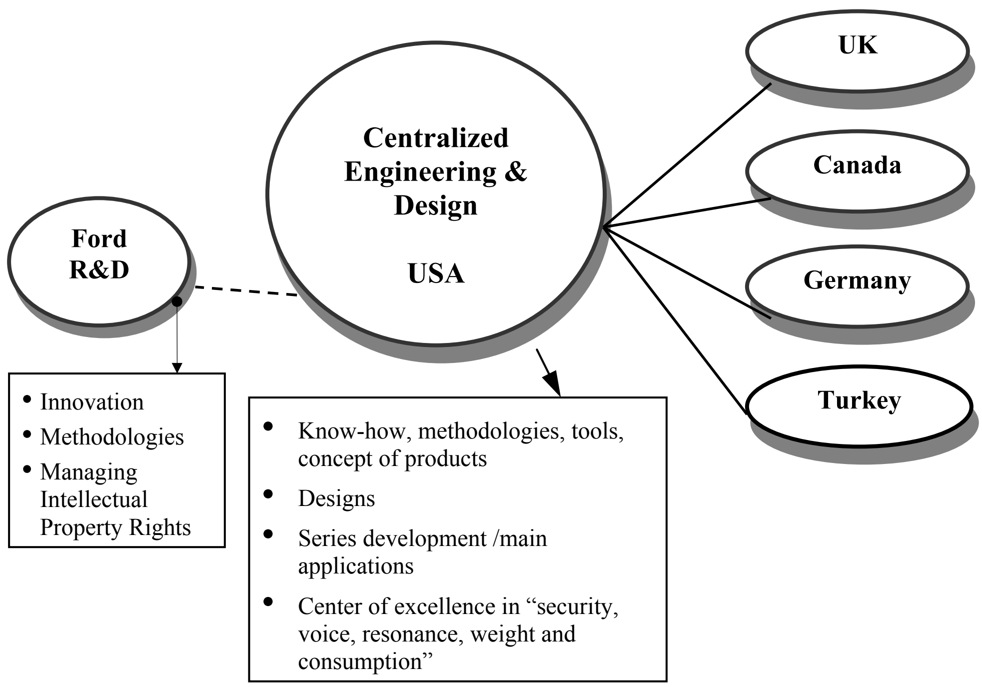

Figure 7.2 Ford’s R&D Structure

Source: This information and figures were gathered from Ford Otosan, 2008.

As declared in the annual report of Ford Otosan, for the longer term R&D policy, the company will explore the potential of plug-in hybrids, fuel cells, hydrogen internal combustion engines and other advanced technologies in laboratories and test fleets around the world. “These actions are not only the right and responsible thing to do; they will also give their customers the kind of products they want and value”. Ford’s intent in working with Ford Otosan is to allow them to gain knowledge. There is mutual benefit between the mother company, Ford, and the local company, Ford Otosan. They all benefit from sharing knowledge. Ford managers stated that Ford Otosan is a knowledgeable partner.

7.2.1.1 MNE’s Criteria for Possible R&D Collaboration

One of the most critical criteria of the MNE (Ford) for possible R&D collaboration is the local firm’s R&D absorptive capacity. If Ford Otosan’s absorptive capacity level were low, the local company may not have been ready to do R&D activities in Turkey. The higher the local partner’s level of absorptive capacity, the more collaboration occurs between the MNE and the local partner. Obviously it will take less time for the mother company to improve the technological level of the local partner if its absorptive capacity is high. In addition, Ford mentioned that Ford Otosan’s level of R&D experience was an important factor for them to be involved in R&D collaboration. If there were a lack of experience, this would waste the time and energy of both parties. Previous R&D works (projects) of Ford Otosan were one of the criteria since the previous research projects are a reflection of the success for future R&D jobs.

7.2.1.2 MNE’s Openness to R&D Collaboration with Foreign Partners

R&D collaboration is directly linked with the behaviour of the mother firm because, in terms of collaboration, the MNE is the decision maker, and the local partner firm is the one that obeys the rules of the MNE. If Ford was not interested, no collaboration would take part. In fact in this case, Ford had a strict R&D policy but at the same time Ford liked to outsource its R&D when it was necessary. They were open to collaboration in R&D with Ford Otosan. However, their level of collaboration was low. The R&D departments are not integrated like they are with Tofaş-Fiat. The number of American engineers is not as many as the Italian engineers in Turkey. Ford lets its partner handle R&D on its own. There are some reasons behind this decision. The first reason is because Ford Otosan has the highest experience level to undertake its own R&D. Secondly; Ford divides the divisions of its partners and as a strategy, Ford prefers to control its R&D without becoming involved in too much collaboration and integration between the departments.

7.2.1.3 Strategic Goals of the MNE

Ford has strategic goals related to R&D collaboration with its local partner firms. Nowadays MNEs prefer to internationalize their R&D to low cost countries. As mentioned before, managing R&D collaboration with the local partner is a milestone in the strategic management process. In Ford's strategic goals, internationalization of R&D activities within the partner firms and suppliers are mentioned. In practice, Ford applied a different R&D policy; sourcing the R&D activities to different regions of the world to the centers of excellence. For example: Ford Otosan is accepted as a center of excellence in light commercial vehicles.

For the future strategic goals, the mother company, Ford, aims to continue in research. Ford managers stated that after passing today's financial crisis, government policy will force them to make emission regulations. They should be prepared with green technology for 2020. That is why Ford will continue to go on researching and they will continuously undertake R&D collaborations.

7.2.2 R&D Departments of the MNE

The relationship between the local country's R&D departments and the MNE is a delicate research policy. In the Ford case, there are four R&D departments worldwide (UK, Germany 2 and Turkey) belonging to Ford. Ford divides R&D activities into different R&D departments. As it was seen in the Tofaş-Fiat case study, each and every R&D department concentrates on different topics. In this case, Ford Otosan concentrates on light commercial and heavy-duty vehicles. Ford Otosan does not take a lead role in doing R&D on high-tech technologies, as mentioned before. However, the department has the highest absorptive capacity to be able to work on high-tech issues. Without obtaining permission from the MNE, they developed a hybrid car with TÜBİTAK.

Two R&D centers in Germany and the UK's R&D center are doing research related to intelligent vehicles, vehicle communication, fuel cell vehicles, electric and hybrid vehicles technologies, and they would probably prefer it if Ford Otosan did not work on the same high technologies. In Ford's case, there is not a close coordination between the main R&D and the other R&D centers. According to the in-depth interview results, there is competition between the R&D departments.

7.2.2.1 Competition between R&D Departments in Different Countries

This variable includes the existence of competition between R&D departments of the same MNE located in Germany, UK, and Turkey. As is known, R&D is coordinated from the centralized R&D department of Ford in the USA. As mentioned before, the R&D department in each country should be working on different subjects. If they work on the same subject, there would be competition. The most competitive R&D department would take responsibility for doing R&D more than the others.

The relationship between the MNE's other R&D research centers and the local partner should also be discussed. Obviously, the other R&D centers, that are spread around the world, would also seek to have higher shares from the total R&D cake of the mother company. If the MNE grants responsibility to any R&D center to begin research in one area of leading technology, this would be a loss for the others and they would not easily accept this decision. Generally R&D personnel and managers are self confident about their quality, and they do not want other departments to do work concerning their topics. Thus they don't like to outsource research projects; instead they prefer to conduct research by themselves. In this case, Ford operates its R&D activities separately. There is no collaboration between other R&D

departments of the same MNE; however, there is real competition between the departments. R&D departments for the same MNE would like to work on the same research areas. For example: the German and Turkish R&D departments are in competition to pick-up R&D projects from Ford. In addition, they compete on future projects from Ford as well. When Ford Otosan was asked question, they have stated that this factor is very important. However in the interview, Ford manager did not mention the importance of this factor and they said this factor is not very important in their R&D collaborations.

7.2.2.2 Other R&D Department's Competency for Collaboration

Factors affecting Ford's decision as to which R&D department is ready for collaboration basically deals with the absorptive capacity, the experienced and skilled human base and the technological capability of the German, English and Turkish R&D department's. The British and German R&D departments both have a very high absorptive capacity, experienced and skilled human base and technological capability compared to Turkey. They have more experience, and the number of experienced and skilled engineers is higher than in Turkey. In terms of technological capability, their technological capability is also very high. They are 100 % ready for collaboration with Ford.

The R&D manager of Ford were asked 5-point Likert scale questions that asked about the level of the importance of the factors for Ford to undertake R&D collaboration with Ford Otosan. Table 7.8 shows Ford's responses. (Level of Importance: Very High (5 points); High (4 points); Moderate (3 points); Low (2 points); and Very Low (1 point))

Table 7.8 Ford's Evaluation of Factors related to the 'Main R&D Policy of the MNE' and 'Other R&D Departments'

Factors according to Ford	**Level of Importance**
Main R&D Policy of the MNE	
MNE's Criteria for Possible R&D Collaboration	Very High
Openness to R&D collaboration with Foreign Partners	High
Strategic Goals of the MNE	Very High
'Other R&D departments'	
Existence of competition between R&D departments	Moderate
Other R&D Department's Readiness for Collaboration	Moderate

Source: Obtained via e-mail from R&D Manager of Ford, 2009.

7.2.3 Local Country Specifities

The local country specifities section of the thesis, will study the factor's that affect Ford's R&D location decisions in terms of the macro environment and social factors.

7.2.3.1 Macro Environment

The labour costs and government incentives in Turkey are explored as part of Turkey's macro environment that influences collaboration.

R&D Labour Costs

Ford Otosan's hourly personnel cost is roughly € 28 per hour (50 TL/hour). This cost includes Social Insurance Institute (SSK) premiums, monthly taxes, etc. Costs in Turkey are very attractive for Ford's R&D managers. This amount is quite low when it is compared to the MNE's R&D personnel cost.

In the USA, the cost of a single R&D staff is above € 48 per hour, which is quite high when compared with Turkish employee costs of € 30 per hour at Ford Otosan.

Ford may choose to shift some collaborative R&D work to Turkey since R&D cost per person is much lower.

Government Incentives

The total budget of the R&D department is $ 70-100 million, which includes all the R&D projects for the last year. 30 % of the R&D expenditures are returned by the government as R&D incentives. The new R&D law in Turkey has also encouraged the mother company to leave some of the R&D responsibilities, such as work on Hybrid Electric Vehicles and Fuel Cell supplied Electric Vehicles, to Ford Otosan. Especially because of the exchange differences and the government incentives, Ford is really interested in working with Turkey. Ford managers have relevant information about Tübitak and the incentives, and they found those incentives very attractive.

7.2.3.2 Social Factors

The Ford R&D manager was asked both open-ended questions and likert scale question about social factors that included mutual trust and integrity, the level of commitment and cultural conflicts.

Mutual Trust and Integrity

One of the factors under the title of "Social factors" is Mutual Trust and Integrity. Here mutual trust is the absolute trust between the MNE and the local partner firm which, in this case, is Ford and Ford Otosan. In the data collection process for this case, respondents were asked questions about mutual trust and integrity issues. As with the managers in the Tofaş-Fiat case, Ford managers indicated that if Ford managers did not trust Ford Otosan, there would not be any R&D collaboration. Their relationship has a very long and strong history which is why they have mutual trust and integrity. Ford is very comfortable working with Ford Otosan, and they have stated that senior management is very appreciative. The level of education of the employees and the managers is outstanding, and there are no language barriers because every employee working for Ford Otosan knows English. The issue of the "work ethic" is very important. They believe that the Turkish work ethic is outstanding. According to an American R&D engineer, Transit Connect is a combination of both the engineering excellence and the manufacturing experience of Ford Otosan.

Level of Commitment

Ford R&D managers mentioned that the level of commitment in joint research projects is also very high. They express that, the level of commitment between the MNE's researchers and those of Ford Otosan is satisfactory while they work on collaborative projects. On the other hand, if there is no collaborative research effort, then knowledge flow is limited. Commitment is rather a social issue and there are some behavior differences between American and Turkish engineers such as commitment in project's deadlines. However, it should be observed that, in general, the commitments of both parties are high and it would be impossible to complete research and development work if there was a lack of commitment between them.

Cultural Compatibility and Management of Cultural Conflicts

Turkey and the USA are located on different continents in the world. Turkish and American cultures are different from each other as well. In the literature, American culture belongs to the group of western cultures and is known as more individualistic and task oriented in which jobs are managed individually. On the other hand, Turkey is located both in Europe, Asia and the Mediterranean regions and it is accepted that Turkey has a more collectivistic culture. This type of culture is more team centered and employee oriented. We can say that Turkish and American cultures are two absolutely divergent cultures. However, cultural differences did not affect the good, strong relationships of these two countries. They are allied powers from the past until today and they share the same history.

In terms of cultural conflicts, there were no clear cultural conflicts mentioned in the in-depth interviews of this case study. However, some Ford engineers, who came temporarily from the USA to work on an R&D project at Ford Otosan mentioned cultural differences. Because Turkish culture is collectivistic, jobs are managed by teams. Everybody in the team has some responsibilities. Apart from their own responsibilities, they are assigned to work in other teams as well. Every employee has more than one job that she/he takes care of. This is totally different in the USA. Generally, American engineers like to concentrate on one task. They used to start and finish the task on time according to their schedules. They are task and job oriented. Too much human involvement and employee centered policies may cause conflict in some situations. Generally they stated that Turkish engineers were easy to work with and there was no culture conflict between Turkish and American employees.

Table 7.9 Ford's Evaluation of Factors related to the 'Macro Environment' of Turkey and Social Factors

Factors according to Ford	Level of Importance
Macro Factors	
'Socio-economic Conditions'	High
'Infrastructure'	High
'Labor Cost'	Very High
'Government Incentives'	Very High
Social Factors	
'Mutual Trust and Integrity'	High
'Level of Commitment'	High
'Cultural Compatibility and Management of Conflicts'	Moderate

Source: Face to face interviews with Ford R&D Manager, 2009.

7.3 Nature of R&D Collaboration

Ford Otosan and Ford have undertaken joint ventures for 50 years, and their R&D collaboration was based on this long term partnership. According to Ford's strategic plan, they outsourced a certain part of their R&D activities to Ford Otosan. All R&D activities are confined to developing a vehicle, which is manufactured in the plants of Ford Otosan only. Ford Otosan R&D does not deal with any of the R&D activities for units that are manufactured outside Turkey.

The Ford Otosan R&D department was established 20 years ago. In the beginning, there was only a product development department, not an R&D center. Ford Otosan's R&D engineers acquired the necessary information to manufacture and design a vehicle from Ford's engineers, and gradually Ford Otosan developed its R&D capabilities. After Ford Otosan had reached an acceptable technological and absorptive capacity level, Ford allowed its partner to become involve in R&D, and their collaboration developed within the years. Especially for some R&D projects, Ford allows its partner to design and manufacture the car from top to bottom. Hence Ford Otosan takes unilateral R&D decisions by itself.

Today Ford Otosan is capable of undertaking its own R&D without becoming involved in R&D collaboration. Their R&D departments are less integrated when compared to the company in the previous case study. This decision was the company policy of Ford. They might have chosen to be integrated with Ford Otosan, and to work on each stage of R&D together. However, in contrast, they decided to give authority to Ford Otosan. The nature of their R&D collaboration is "high collaboration with delegation for the R&D work given to the local company".

Chapter 8
Hyundai Assan-Hyundai Collaboration

In contrast to the previous two case studies, this chapter will not involve the study of factors that affect the R&D collaboration between Hyundai and Hyundai Assan because Hyundai Assan has not yet performed any substantial R&D activities in Turkey. As has been explained in the previous chapters of this thesis, the need for R&D collaboration is a process which is not conducted unless there is a real necessity for this. This process takes time during which the MNE and its local partner get used to their managerial and technical approaches. In addition, the local partner's absorptive capacity needs to progress to a level which is adequate for R&D collaboration. In this respect, this chapter will involve only the reasons behind why the mother company did not let its partner get involved in any substantial R&D studies in Turkey, and why the local firm has not established an R&D center like Tofaş and Ford Otosan.

8.1 Hyundai Assan

Hyundai Assan was founded as a joint venture of Kibar Holding and Hyundai Motor Company in 1984. Hyundai Assan is owned by Hyundai (70 %) and Kibar Holding (30 %). The manufacturing, assembly and parts distribution facilities are located at Izmit Assembly of Turkey. Hyundai Assan is an example of an automotive joint venture of a Turkish and a foreign company that is mostly managed by the Koreans. Hyundai Assan produced 292 minibuses, 6,207 trucks and 83,691 automobiles in 2007, for a total production of 90,190 units by the end of 2007. The company exported 69,336 units with revenues of $ 764,485,169 by the end of 2007. Its sales in Turkey were 1,662,390.111 TL for same period. There are in total 2,143 employees working for Hyundai Assan: 1,796 are blue collar employees and 347 are white collar employees including 261 office employees, 16 managers, 59 engineers and 11 administrative level engineers. The distribution of the employees is shown on Table 8.1 below.

Table 8.1 Number and Distribution of the Employees

Distribution of Employees	Number of Employees
White Collar Employees	**347**
• Office Employees	261
• Managers	16
• Engineers	59
• Administrative Level Engineers	11
Blue Collar Employees	**1,796**
Total	**2,143**

Source: General and Statistical Information of Bulletin of AMA, 2007-1, "http://www.osd.org.tr/cata2007.pdf", p.37.

In 2005, Hyundai Motor negotiated with the Czech and the Turkish Governments on investment incentives before building its 1.5 billion dollar new car plant in Europe. After the negations, Hyundai chose the Czech Republic for it's investment because of the higher government incentives and more liberal laws & regulations. Bakır argued that the Czech government performed well in both its bargaining with the Hyundai, and in its incentives-based and institutions-based policy competition with the Turkish government. The Czech government's major strengths in policies and institutions were also key weaknesses of the Turkish government: Fiscal and financial incentives, as well as, the formal institutional environment relating to inward FDI, are designed to attract greenfield investments which contribute to national competitiveness through innovation and R&D by foreign affiliates of MNEs. In addition, the Turkish government could not have the policy flexibility to deal with the issue of incentives-based policy competition that would also promote strategic partnerships between the government and Hyundai in investments in such public goods as infrastructure and human capital (Bakır, 2006).

8.1.1 Existence of R&D in the Local Company

Today, there are some technical activities relating to R&D in Hyundai Assan; but so far a R&D department has not been established within Hyundai Assan. The collaboration between Hyundai Assan and Hyundai is based upon production only. Production deficiencies are solved both in the manufacturing plant, and the after sales department. Vehicle modifications are not done in Turkey. As the mother company, Hyundai's main goal is to conduct mass production in Turkey, so Hyundai Assan has developed their 'production capabilities'. However, they have not yet allowed Hyundai Assan to be involved in Hyundai's R&D activities. In terms of 'innovation and R&D capabilities', Hyundai Assan has not matured enough. On the other hand, Hyundai Assan is attempting to establish an R&D department in Turkey. In the same manner as Fiat and Ford Otosan, Hyundai Assan thinks that establishing R&D will enable them not only to improve their product quality, but it would also increase the value adds in new models. Turkey's recently introduced new R&D Law which provides additional incentives, has led to increased pressure on the mother company to persuade Hyundai to establish an R&D center in Turkey.

Currently, Hyundai Assan is in negotiation status with the mother company, Hyundai, in terms of establishing an R&D department in Turkey. They have prepared some of the infrastructure for such a department. R&D offices and laboratories have been physically prepared to get ready for R&D collaboration. Most probably, Hyundai Assan would be able to be successful in establishing its R&D department in Turkey. Hyundai Assan will employ new engineers. In addition, some of the engineers will be transferred from production to the R&D department. One of the informants from Hyundai Assan stated that, R&D in the automotive industry of Turkey has emerged to satisfy the needs of the Turkish market and to find solutions to the technical problems in the production period. These technical problems generally occur when modifications are necessary. Hyundai-Assan is now approaching to that phase.

It should be concluded at this stage that the collaboration between Hyundai and its local partner Hyundai-Assan has reached the end of the "production only" phase.

Now the need for component improvements, face lifts and other technical requirements is forcing the mother company to start R&D collaboration on a small scale. However, government incentives remain the major impetus for establishing such an R&D center on joint R&D activities. The production manager of Hyundai Assan was asked the following question relating to this factor: "If Hyundai had R&D Collaboration with its partner Assan, then how you would rate the level of importance of Assan's factors (production, innovation and R&D capabilities, and absorptive capacity)" Table 8.2 shows the results of Hyundai Assan's responses. (Level of Importance: Very High (5 points); High (4 points); Moderate (3 points); Low (2 points); and Very Low (1 point))

Table 8.2 Importance Level of Factors Affecting R&D Collaboration with Hyundai According to Hyundai Assan

Factors according to Hyundai Assan	**Level of importance**
'Production Capability'	Very High
'Innovation Capability'	Very High
'R&D Capability'	Very High
'Absorptive Capacity'	High

Source: Obtained through the interviews with Hyundai Assan production manager, 2009.

8.1.2 Reasons of not Collaborating in R&D

According to the strategic plan of Hyundai, the local partner firm was responsible for production only. Hyundai retained all responsibility for even minor product modifications, including model changes or product improvement activities. Until 2008, Hyundai Assan did not authorized the establishment of an R&D center in Turkey. As a result, it is difficult to improve the absorptive capacity and capabilities of the local firm, which is a base for further innovative research and product development works. This approach in the strategic plan has prevented the establishment of collaborative R&D work between Hyundai and Hyundai Assan.

8.2 Hyundai

When Hyundai was first established in 1947, by Chung Ju Yung, it was an engineering and construction company. In 1965, Hyundai Construction begins its first overseas venture, a highway project in Thailand. Hyundai Motors was established in 1967. The group began construction on an integrated car factory and launched a new Korean vehicle in 1975. During the Asian financial crisis in 1988, Hyundai acquired Kia Motors and LG Semi-Conductor. In 1998, Korea's economic crisis forced the group to begin restructuring efforts, which included the selling off subsidiaries and focusing on the automotive industry.

8.2.1 Main R&D Policy of the MNE

The production plants of Hyundai Assan are located in South Korea, the USA, Canada, Germany, Japan, India, China and Turkey. The Hyundai Motor USA plant was built in California, in 1985. The Hyundai Auto Canada plant was built in Ontario Canada, in 1995. The Hyundai Motor Germany was established in Germany, in 1990. The Wuhan Grand Motor Company plant was established in Japan, in 1993. Hyundai’s India plant was located in Chennai, in 1996 and the plant in China is located in Beijing. In addition to that, Hyundai and Kia opened an R&D center (in Malbuk) in the south of Seoul, South Korea. Hyundai has also increased productivity by completing the construction of its second plants in China and India. Hyundai has grown into the Hyundai Automotive Group, which includes the Kia Motors Corporation and over two dozen automobile related subsidiaries and affiliates. Employing nearly 50,000 people worldwide, Hyundai Motor posted $ 21.94 billion in sales in 2002. Hyundai motor vehicles are sold in 166 countries through 4,504 dealerships and showrooms. As it can be seen in Figure 8.1, Hyundai has a centralized R&D center in Korea. Hyundai’s other R&D centers are in Germany (Frankfurt), the USA and Japan.

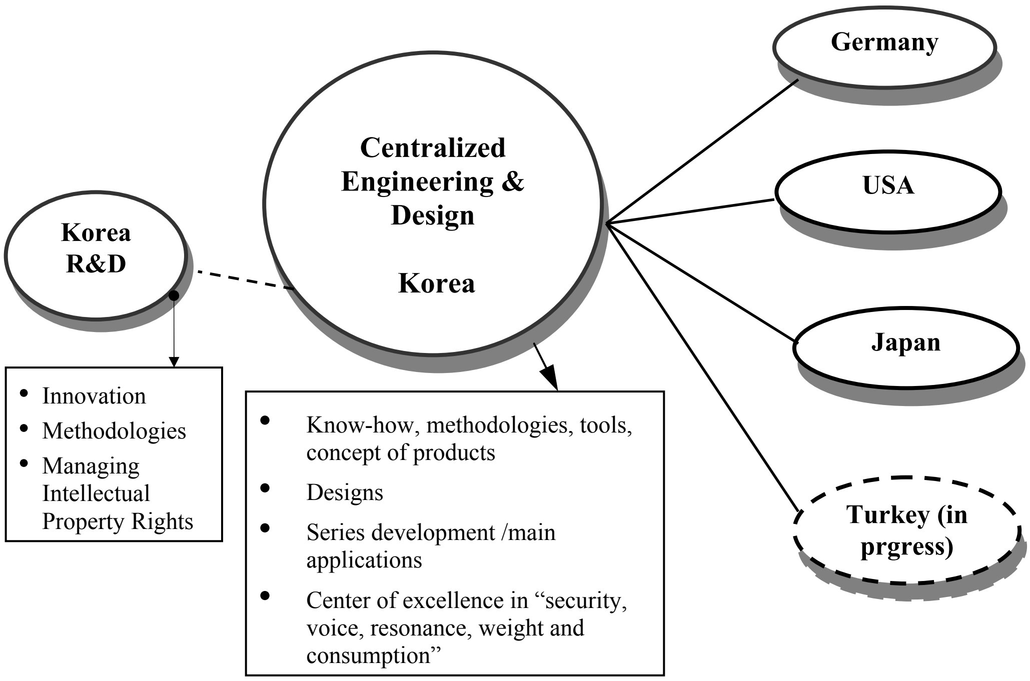

Figure 8.1 Hyundai's R&D Structure

Source: Obtained through face to face interview with Hyundai's R&D manager, 2008.

As mentioned before, there is no direct R&D collaboration between Hyundai and Hyundai Assan. Hyundai Assan does not have an R&D department in Turkey. According to information gained through face-to-face interviews, Turkish Hyundai managers stated that they had applied to TÜBİTAK (Research and Technological Development Institute of Turkey) to open an R&D department in Turkey. The manager of Hyundai Assan was in Korea to initiate the first steps in establishing an R&D department in Turkey.

8.2.1.1 MNE's Criteria for Possible R&D Collaboration

In Hyundai case, the MNE's criteria for possible R&D collaboration are different than the other case studies previously mentioned. Their main criterion is the local firm's level of experience in R&D. Hyundai managers stated that if the local firm is highly competent in R&D, the firms will be able to participate in more R&D collaborations.

Hyundai has never allowed Hyundai Assan to perform R&D and all the R&D activities are produced in other states. It is known that the bulk of the added values are produced in R&D phase, and mother companies are not willing to share it. This factor is very important for Hyundai Assan as a company policy if they will perform R&D collaborations in the future.

8.2.1.2 MNE's Openness to R&D Collaboration with Foreign Partners

Similar to the other mother companies, Hyundai is open to R&D collaboration with its foreign partner firms when the cost of R&D is low and there are benefits from the partner's experiences and knowledge. Hyundai has established R&D collaboration with its partners in three countries, Japan, India and China. If there had been R&D collaboration with Hyundai Assan, this factor would positively affect the mother company and possibly its local partners.

8.2.1.3 Strategic Goals of the MNE

Hyundai is interested in making R&D collaboration with their foreign partners. This stance was verified in the face-to-face interviews that were conducted for this study. Furthermore, it is stated in Hyundai's long-term strategic plans that, they will establish R&D collaborations with their partners, suppliers, universities/research institutes and even competitors via pre-competitive research.

8.2.2 R&D Departments of the MNE

As mentioned before, Hyundai has three R&D departments, apart from those in South Korea, ,based in Germany, the USA and Japan. Hyundai divides all its R&D activities to separate R&D departments. Every R&D department concentrates on different topics. In Hyundai's Namyang R&D Center the team is responsible for medium and large passenger cars and light trucks. While in the Mabook R&D

Center, the team is responsible for power train activities. Hyundai's R&D Center in Ulsan is responsible developing mini and small passenger cars, light trucks, and small commercial vehicles, and the commercial vehicle R&D Center is responsible for mid-size and large trucks and buses. In this case, Hyundai Assan is not involved in R&D and concentrated only on the production of passenger cars, not light commercial vehicles or trucks. However, Hyundai Assan is a candidate for undertaking R&D for passenger cars only.

Prior to the integration of Hyundai with Kia, the R&D Division had 4100 engineers, designers, and staff in 87 functions and in 15 groups. The integrated Hyundai now has three operating companies, each headed by its own president. In addition to that, Hyundai has jointly developed a front wheel drive car with Mitsubishi. A twin model will be produced, built with a Hyundai supplied body shell as was done with its previous collaborative efforts, and will be introduced later in Japan. Moreover, Mitsubishi supplies key engine components to Hyundai. Hyundai is going through a major transitional period, integrating Kia in the bigger scheme of things. Hyundai's strategy is to let Kia remain its own brand.

8.2.3.1 Competition between R&D Departments in Different Countries

As is known, R&D is coordinated from the centralized R&D department of Hyundai in South Korea. As was mentioned before, generally there are two paths for R&D collaboration. In the first model, R&D topics are distributed and results are assembled in the R&D centre. This model resembles the old communist country economic model. However in the second model, which, in general, seems to be widely adopted in the automotive industry, R&D that is conducted is suitable for the plants production programme. The mother R&D center supervises and supports the local center's activities. The R&D department in each country should be working on different subjects. If they work on the same subject, there would be competition with most competitive R&D department taking the responsibility for doing more R&D than the others.

This variable includes the existence of competition between the main R&D department in Korea and the other R&D departments of the same MNE located in

Germany, USA, and Japan. The Hyundai manager was asked if there was any competition between R&D departments in different countries. He said that he was not aware of any competition because the different R&D departments work on unrelated topics.

8.2.3.2 Other R&D Department's Competency for Collaboration

During the interview, the R&D manager stated that Hyundai's other R&D departments are more competent in R&D than Hyundai Assan. He mentioned that they have advanced technology, and they are ready for R&D collaboration.

The R&D manager of Hyundai was asked 5-point Likert scale questions to determine the level of importance of the factors for Hyundai to begin R&D collaboration with Hyundai Assan. Table 8.3 shows Hyundai's responses. (Level of Importance: Very High (5 points); High (4 points); Moderate (3 points); Low (2 points); and Very Low (1 point))

Table 8.3 Hyundai's Evaluation of Factors related to the 'Main R&D Policy of the MNE' and 'Other R&D Departments'

Factors according to Hyundai	Level of Importance
Main R&D Policy of the MNE	
MNE's Criteria for Possible R&D Collaboration	Very High
Openness to R&D collaboration with Foreign Partners	High
Strategic Goals of the MNE	Very High
'Other R&D departments'	
Existence of competition between R&D departments	Very Low
Other R&D Department's Readiness for Collaboration	Moderate

Source: Obtained via e-mail from R&D Manager of Hyundai, 2009.

8.2.4 Local Country Specifities

8.2.4.1 Macro Environment

The influence of the comparative labour cost and of the macro environment and how these factors may affect collaboration between the MNE and Turkey are explored in this section.

R&D Labour Costs

Turkey's R&D labour costs are lower than those of South Korea. In South Korea, the cost of a single R&D staff is above € 40 per hour, whereas R&D labour cost of a Turkish engineer is € 30 per hour at Hyundai Assan.

8.2.4.2 Social factors

In this part, the MNEs perspectives concerning mutual trust and integrity, cultural compatibility, management of conflicts will be studied in order to analyze whether or not these social factors will be a parameter for future collaboration in R&D.

Mutual Trust and Integrity

According to the information obtained from the interviews, Korean and Turkish managers and engineers believe that they have a strong trust relationship for keeping company knowledge inside the organization. Hyundai's managers mentioned that they trust the engineers at Hyundai Assan in relation to technological terms. In addition, they said that integrity is one of the most important characteristics of the Korean culture, and they have never faced any problems working with Turkish engineers. It was observed in company visits that the Korean and Turkish engineers integrated very much.

Level of Commitment

In their production collaboration between Hyundai and Hyundai Assan, managers emphasized that level of commitment in joint projects as an important factor. The manager found Hyundai Assan committed in the timing, schedules and programmes in their partnership. Hyundai manager mentioned that this factor was important for future R&D collaboration.

Cultural Compatibility and Management of Cultural Conflicts

Turkey and South Korea are two countries very far apart. Turkey is both in Europe and Asia while South Korea is a purely Asian country. The habits, attitudes, likes, dislikes and tastes are very different. From time to time, some of Hyundai Assan's staff face compatibility problems and the cultural compatibility level seems to be low. On the other hand, some of the Hyundai Assan's managers think that the central Asian background of the Turks, somehow produces a friendly atmosphere between Hyundai and Hyundai Assan personnel.

The two collectivistic cultures work well together and negotiate in certain areas. From the perspective of the South Korean engineers, Turkish people are easy to work with. They like team-work, they obey the rules, and they respect deadlines. In terms of cultural conflicts, there was no clear cultural conflict mentioned in the in-depth interviews for this case study. After integrity, honour is the most important thing for the Korean people, and Turkish people respect their beliefs. Because these two countries' cultures are similar, Turkish and Koreans engineers and managers work well together. Koreans stated that they liked being part of Turkish culture, they found it very interesting. They found many similarities between their culture and Turkish culture.

The R&D manager of Hyundai were asked 5-point Likert scale questions to determine level of importance for these factors for Hyundai to assume R&D collaboration with Hyundai Assan. Table 8.4 shows Hyundai's responses. (Level of

Importance: Very High (5 points); High (4 points); Moderate (3 points); Low (2 points); and Very Low (1 point))

Table 8.4 Hyundai's Evaluation of Factors related to the 'Macro Environment' of Turkey and Social Factors

Factors according to Hyundai	Level of Importance
Macro Factors	
'Socio-economic Conditions'	Very High
'Infrastructure'	High
'Labor Cost'	Very High
'Government Incentives'	Very High
Social Factors	
'Mutual Trust and Integrity'	High
'Level of Commitment'	High
'Cultural Compatibility and Management of Conflicts'	High

Source: Obtained via e-mail from R&D Manager of Hyundai, 2009

8.3 Conclusion of Hyundai Assan Case Study

Hyundai Assan and Hyundai's production partnership started approximately 20 years ago. They are good production partners, and there is a free flow of information between them, but only for production, as they have never undertaken R&D collaboration. Since the manufacturing technique does not require any know-how about designing the car, Hyundai did not transfer any R&D knowledge to the local partner firm.

The local firm was not ready for R&D collaboration, nor was the mother company willing to do this. Recently, however, this period seems to have come to an end. The local company Hyundai Assan is now demanding to participate in R&D activities and, the Turkish government is providing new incentives for these activities. It is likely that an R&D department will be established in the very near future, and some kind of collaboration will be started. Further forecasting on Hyundai Assan's future role in the main Hyundai group's R&D activities is difficult. However, it could be argued that this role is going to be defined by the factors and parameters studied in this thesis, namely: absorptive capacity, capabilities of production, innovation and R&D, competency in high technology, etc. Whenever Hyundai Assan reaches a certain level for these factors, it will then be ready to perform R&D.

Chapter 9
Analysis of the Case Studies

This chapter includes an analysis of the case studies and the findings. Each factor will be analyzed and the most important factors will be explored for each of the three case studies. The findings of the research questions will also be presented.

9.1 Analysis of the Local Partner Firms

For the local partner firms, there are four factors affecting R&D collaboration, which are production, innovation and R&D capabilities, and absorptive capacity. For Tofaş-Fiat (Case 1) and Ford Otosan-Ford (Case 2) R&D managers gave responses to the factors in terms of the level of importance Very High (5), High (4), Moderate (3), Low (2) and Vey Low (1). For Hyundai Assan-Hyundai (Case 3), the production managers rated the factors assuming that they would have R&D collaboration in the future.

Important Factors for Local Firms

Important factors for the local firms are shown on Table 9.1.

Table 9.1 Important Factors for the Local Partner Firms

Firms:	**Factors**			
	‘Production Capability’	‘Innovation Capability’	‘R&D Capability’	‘Absorptive Capacity’
Tofaş	Very High	Very High	Very High	High
Ford Otosan	Very High	Very High	High	High
Hyundai Assan	Very High	Very High	Very High	High

Source: 5-point likert scale question that local company’s R&D managers were asked, 2009.

The first factor “Production capability” was found as a very important factor both in the literature and in the preliminary interviews with the automotive companies. Tofaş, Ford Otosan and Hyundai Assan managers all responded as “very high” to the questions regarding production capability.

The second factor “innovation capability” was found to be a very important factor in R&D collaborations in the literature (Kim, 1997; Burgelman *et al*, 2004). Innovation capability was also found to be a very important factor for Tofaş, Ford Otosan and Hyundai Assan’s managers as they responded to the relevant questions as “very high”.

The third factor “R&D capability” was also found to be a very important factor in R&D collaborations in the literature (Pearce 1994; Ansal and Soyak, 1999; Huq, 1999; Trott, 2005; Zhao *et al*, 2005; Emden *et al*, 2006; Bader, 2006). Tofaş and Hyundai Assan’s managers responded as “very high” where as Ford Otosan R&D director has responded as “high” to questions relating to this factor. Ford Otosan’s R&D director gave more importance to production and innovation capabilities than R&D capability.

The last factor “Absorptive capacity”, or learning capacity, was mentioned as an influencing factor in R&D collaborations by many scholars in the literature, especially by Cohen and Levinthal 1990, Minbaeva *et al* 2003; and Nielsen 2005. We found similar results for the absorptive capacity in all three of the cases. Managers of Tofaş, Ford Otosan and Hyundai Assan responded as “high” to questions regarding the factor of absorptive capacity.

The managers responded to all of the factors as important but especially production and innovation capabilities are found to be more important factors than R&D capability and absorptive capacity.

9.2 Analysis of the MNEs

For the MNEs, there are three factors affecting their R&D collaboration decisions; the main R&D policy of the MNE, other R&D departments of the MNE, and the local country specifities. For Tofaş-Fiat (Case 1) and Ford Otosan-Ford (Case 2), the R&D managers of the MNEs rated the factors in terms of their level of importance. For Hyundai Assan-Hyundai (Case 3), the production manager for Hyundai rated the factors assuming that they would have R&D collaboration.

Important Factors for MNEs

The important factors for the MNE's R&D managers in terms of R&D location decisions in local partner firms are shown on Table 9.2.

Table 9.2 Important Factors for MNEs

Factors:	**Fiat**	**Ford**	**Hyundai**
'Main R&D Policy of the MNE'			
MNE's Criteria for Possible R&D Collaboration	Very High	Very High	Very High
Openness to R&D collaboration with Foreign Partners	Very High	High	High
Strategic Goals of the MNE	Very High	Very High	Very High
'Other R&D departments'			
Competition between R&D Departments in Different Countries	Moderate	Moderate	Very Low
Other R&D Department's Competency for Collaboration	Moderate	Moderate	Moderate
'Local Country Specifities' **'Turkey's Macro Environment'**			
Socio-economic conditions	High	High	Very High
Infrastructure	Very High	High	High
Labor Cost	High	Very High	Very High
Government Incentives	Very High	Very High	Very High
'Social Factors'			
Mutual trust and integrity	Very High	High	High
Level of commitment	High	High	High
Compatible cultures	High	Moderate	High

Source: 5-point likert scale question that the MNE's R&D managers were asked, 2009.

The first factor, "The Main R&D policy of the MNE" including MNE's criteria for possible R&D collaboration, openness to R&D collaboration with foreign partners and strategic goals, were all mentioned in the literature (Baranson, 1970) as factors for R&D collaboration. Three R&D managers responded to the first and third factors, which are "Main R&D Policy of the MNE" and "Strategic Goals of the MNE", as "very high". On the other hand, Fiat's R&D manager responded as "very high" to "being open to R&D collaboration with foreign partners" where as Ford and Hyundai's R&D managers responded as "high".

The second factor "Other R&D Departments of the MNE" in different countries is subtitled as: 'Competition between Other R&D departments in different countries' and 'Other R&D departments' competency for Collaboration'. This factor was found in the preliminary interviews with the R&D managers of the local company and they stated that this was one of the important factors for R&D collaboration. However; the situation indicates directly the opposite. Fiat and Ford's R&D managers responded to 'competition between other R&D departments in different countries' as "moderate" and Hyundai's R&D manager responded as "very low". In addition, all three of the R&D managers responded to the factor of 'other R&D departments' competency for R&D collaboration' as "moderate".

The third factor "Local Country Specifities" includes 'Turkey's Macro Environment (macro factors)' and 'Social Factors'. "Macro factors" including the local country's socio-economic conditions, infrastructure, labour costs and government incentives (Baranson, 1971; Cassiman and Veugelers, 1998; Hagedoorn, 2001; Finne, 2003; Bader, 2006; Stevenson, 1999; Monteiro *et al*, 2004; Bakır, 2006; Bogers, 2004; Monteiro *et al*, 2004; Mora-Valentin *et al*, 2004) were all mentioned as important factors in R&D collaborations. Both Fiat and Ford's R&D managers responded as "high" to the socio-economic conditions in Turkey, whereas Hyundai's R&D manager responded as "very high". The Fiat R&D manager responded as "very high" to infrastructure, whereas Ford and Hyundai's R&D managers responded as "high". Fiat responded as "high" for "R&D Labour Costs", whereas Ford and Hyundai responded as "very high". Fiat, Ford and Hyundai's R&D manager's all responded "very high" to government incentives.

Social factors were stated as important factors in the literature, and were mentioned by many scholars under various headings, such as, mutual trust and integrity (Finne 2003; Mora-Valentin *et al*, 2004; Nielsen, 2005; Bader, 2006; Lyles 2007); commitment of the employees (Baranson, 1970; Bogers, 2004; Mora-Valentin *et al*, 2004); and compatible cultures (Finne, 2003; Bogers, 2004; Emden *et al*, 2006). Fiat's R&D manager responded to mutual trust and integrity as "very high" and Ford's manager responded to the compatible culture as "moderate" and all the rest of factors received a response of "high" from all the R&D managers.

The major important factors affecting the R&D location decisions of the R&D managers are the 'MNE's Criteria for Possible R&D Collaboration', 'Strategic Goals of the MNE' and 'Government Incentives of the local company'. All three R&D managers gave responses to the questions relating to these factors as "very high".

On the other hand, there are some factors, which R&D managers did not view as important and gave a response of "moderate" and "very low". These factors were under the title of 'Other R&D Departments' and subtitled 'Competition between R&D Departments in Different Countries' and 'Other R&D Department's Competency for Collaboration'. According to the R&D managers, the factor of 'Other R&D Departments' is less important than the 'Main R&D policy of the MNE' and the 'Local Country Specificities'.

Chapter 10
Conclusion

Being innovative is crucial in today's environment, there is a high level of competition in the business world and individuals, companies, states and even societies are converting their structures to new innovative systems. The primary route to being innovative is performing R&D and improving the ability of the company to develop original products and processes. In today's global technology competition, R&D investments are increasing and at the same time governments are providing more incentives for innovative firms and R&D activities.

On the other hand, there is an internationalization of R&D movement throughout the world in which companies are undertaking R&D collaborations (inter-firm relationships) using strategic alliances, joint ventures, mergers and acquisitions or contracting. The expanding internationalization of R&D is reflected in key measures, including an increase in foreign owned shares of domestic R&D, rises in overseas R&D expenditures, growth in the number of R&D facilities established or acquired by MNEs, and an increase in the staff size of these overseas R&D facilities in the local partner countries (as cited in Serapio and Hayashi, 2004).

As a result of the internationalization movement, there has been a significant increase in R&D collaborations all over the world (OECD, 2002). Nowadays, especially among Multinational Enterprises (MNEs) which have large financial resources and immense research tasks, there is a preference for R&D collaboration in order to decrease R&D expenses as well as, to develop competitive, high quality products. As has been researched in this thesis, R&D collaborations can be undertaken with partner firms, suppliers, and universities/research institutes and even competitors. This thesis concentrates on the MNE and partner firm R&D collaborations which are relevant in the Turkish Automotive Industry. In this thesis, the factors affecting the R&D collaboration of MNEs and local firms in the Turkish Automotive Industry were explored.

Some of the benefits of R&D collaborations are gaining access to new skills and technologies, realizing economies of scope through exploitation of complementarities, sharing costs and risks, and controlling competitive forces, as discussed in Chapter 2. Companies involved in R&D Collaboration are hardly on an equal footing. The MNE is the more powerful and dominant partner compared to the local partner firm, and more often the MNE side manages the R&D collaboration. In this respect, the MNEs of Fiat and Ford have allowed their local partner firms access to their skills and technologies. There is a distinct difference between Tofaş-Fiat and Ford Otosan-Ford collaboration: In the Tofaş and Fiat's (Case 1) the R&D departments are becoming more integrated as there is a continuous rotation of engineers between Italy and Turkey.

On the other hand, in the Ford-Ford Otosan (Case 2) collaboration, the mother company delegates the "R&D project" directly to Ford Otosan. R&D departments are not integrated as in the Tofaş-Fiat Case. However, Ford Otosan uses the same software system with the U.S. Ford, so they are integrated within the system. Hence Ford Otosan's R&D activities seem to be carried out more independently than Tofaş. These differences seem to be related to the distinct company policies of the MNEs. One of the similarities between the two cases is that Tofaş and Ford Otosan have both accumulated significant R&D knowledge through the years, and they continue to improve their R&D capability independently without any major contribution from the mother companies. However, in both the Tofaş-Fiat and the Ford Otosan-Ford collaborations the costs and risks of doing collaborative R&D are shared equally.

Despite some apparent benefits, most collaboration efforts carry a disturbingly high risk of failure. As stated in the literature, firms expose, transfer and develop valuable know-how within these collaborative R&D ventures. This may enable some host countries to strengthen their technological and innovation capabilities. It is clear that only a small number of developing countries and economies in transition are participating in the process of R&D internationalization. From the host country perspective, R&D internationalization opens the door, not only for the transfer of technology created elsewhere, but also for the technology creation processes itself.

There is no doubt that having R&D collaboration with MNEs is one of the strengths of the Turkish Automotive Industry. There are many options and alternatives for the MNEs to choose partners in other countries to establish collaborative R&D since the partner companies in other countries are eager to perform more R&D work with their MNE. For example, Fiat's R&D center in Brazil is a strong competitor for Tofaş since both the Turkish and the Brazilian partners would like to have close R&D collaborations with Fiat. Hence to have established collaborative R&D is a major asset for Turkey.

10.1 R&D Collaboration of Tofaş-Fiat

When Tofaş and Fiat were only production partners, Tofaş managers were very eager to start R&D in Turkey. Establishing an R&D department, which was capable of solving the daily problems of the production process, is a good indication of this eagerness. The mother company, Fiat, recognized the benefits of these activities and let Tofaş establish its own research team. **Government incentives**, **R&D costs** in Turkey and **experienced and skilled labor** were some of the other factors that affected R&D collaboration with Tofaş.

Tofaş has developed its R&D capability throughout the years and could easily generate new product developments. **R&D capability** was found to be one of the high level important factors affecting Tofaş-Fiat R&D Collaboration. R&D Capability that includes producing innovative products, patent applications and developing new designs. As presented in Chapter 6, at Tofaş, the number of engineers working in the department is 420, their level of education and years of experience are high. In terms of the **infrastructure** of the R&D department, it is well developed and this is stated to again indicate that Tofaş is highly capable. This was stated to be one of the important factors affecting R&D collaboration.

Tofaş's **innovation capability** includes the ability to make adaptations for the local market and for the new products idea development system. The R&D manager of Tofaş rated this factor as very high in terms of level of importance. Tofaş is capable of making R&D adaptations and modifications to the Turkish market and innovations on future technologies. There is an innovation management programme that promotes innovation within the company.

Tofaş's **absorptive capacity** has developed over the years. After 10 years of R&D experience, the department has increased their absorptive capacity and their experience. Today there is full integration in R&D because Tofaş is capable of absorbing the technical knowledge transferred from Fiat at a maximum level. Fiat trusts its partner in every aspect, and their R&D collaboration was based upon mutual trust. The integration and good relationship between the R&D departments of Tofaş and Fiat is unexpectedly high. Some Fiat researchers are already located in Bursa (Turkey) and some Tofaş researches are residing in Turin (Italy) working cooperatively on projects. There is full integration between the R&D departments. They use video conferencing every day.

Lastly, Tofaş and Fiat's success in R&D collaboration was based upon mutual trust, commitment to deadlines in projects and having a relationship without thinking who is Turkish or Italian. The **social factor** was found to have a high level of importance in affecting the R&D collaboration of Tofaş-Fiat. .

10.2 R&D Collaboration Ford Otosan-Ford

Ford Otosan's R&D policy is more challenging and independently minded. This challenging and somehow individualistic R&D policy gets its motivation from the social and cultural heritage of the nation, as well as, the visible technical and economic reasons. There have been significant changes occurring in the relationship between the mother company, Ford, and local partner, Ford Otosan, relevant to the R&D collaboration. It was planned originally that the R&D center in TÜBİTAK Marmara Research Center (MRC) Technology Free Zone would have a maximum of 200 researchers. However, it was recently decided that this number should be increased to more than 1000. This is a significant change that assists in understanding the threats and opportunities for the R&D center of local partner.

Ford Otosan conducted two research projects related to Hybrid Electric Vehicles (HEVs), in collaboration with the Marmara Research Center's (MRC) Energy Institute and Istanbul Technical University's (İTÜ) OTAM and Mechanical Engineering Faculty. As a result of these projects, Ford Otosan improved its **innovation capability**. Ford's R&D centers are located in various parts of the world, but are reluctant to accept the quality of the work of Ford Otosan. Recently however, as result of successive efforts, Ford's managerial board and the Ford R&D center in the USA has acknowledged the value of these projects and decided to support HEV research projects in Turkey. This is one reason behind the decision to improve the capacity of Ford Otosan's research center in the Technology Free Zone. A direct conclusion that may be drawn from this example is that the equal base R&D collaboration between partners, or shifting some of the R&D work responsibility and leadership to the local company, will never be possible unless the local partner proves its competency to implement cutting edge technology and show its **R&D capability** and its skills to develop new products.

Even the mother company's appreciation, acknowledgment and satisfaction are not adequate to shift some of the R&D responsibilities to the local partner. Another major factor affecting R&D collaboration for Ford was **governmental incentives**. The new R&D law and **labour costs** in Turkey have also encouraged the mother company to delegate some of the R&D responsibilities related to Hybrid Electric Vehicles and Fuel Cell supplied Electric Vehicles to Ford Otosan.

As with the Tofaş-Fiat R&D collaboration, mutual trust and the level of commitment in collaborative R&D projects were important **social factors** affecting the R&D collaboration of Ford Otosan and Ford. According to Ford's R&D manager, cultural compatibility was rated less important than the factors of trust and commitment.

10.3 Hyundai Assan-Hyundai

Today, there are some technical activities undertaken by R&D in Hyundai Assan; but so far R&D department of Hyundai Assan has not been established. The collaboration of Hyundai Assan and Hyundai is based on a production joint venture partnership. Customers' technical problems are solved, both in the manufacturing plant and the after sales department. Vehicle modifications are not being done in Turkey. Hyundai's main goal is to perform mass production in Turkey. To date, Hyundai has not involved Hyundai Assan in their R&D activities.

On the other hand, Hyundai Assan is currently in a negotiation status with the mother company in their attempts to establish an R&D department in Turkey. In the same manner as with the Fiat and Ford Otosan, Hyundai Assan thinks that establishing R&D will assist them in improving their product quality, but would also increase the added value in new models. Turkey's recently introduced new R&D Law which makes additional incentives available to the MNE, has worked to increase the pressure on the mother company in persuading them to establish an R&D center in Turkey. In this respect, **government incentives** on joint R&D activities remain one of the most important factors for establishing an R&D center.

Hyundai Assan's production manager and Hyundai's R&D managers were asked to rate the importance of factors relating to R&D collaboration, assuming that they were involved in such an event. Hyundai Assan rated capabilities (production, innovation and R&D) very high and absorptive capacity as high.

It is understood that, similar to the other mother companies, Hyundai became open to R&D collaboration with its foreign partner firms when the cost of R&D was low and there were benefits from the partner's experiences and knowledge.

10.4 Policy Implications

Any R&D study in an industrial firm is conducted to create or gain technologically useful knowledge, which brings commercial advantages over its rivals. The R&D

collaboration between an MNE and its local partner should be handled in this respect. Thus, mutual benefits must be sought.

1) Since the main objective is to create new, original and commercially useful knowledge, the local partners' technological level, its research competence, its innovation and R&D capabilities should be sufficient to create such knowledge. One of the main tasks for the local company is to improve its position from being a "Manufacturing Center" to **"Knowledge Creation Center"** or **"Becoming a Centre of Excellence"**. If we relate this discussion to the automotive industry, which covers variety of complex parts and components, the local automotive partner must try to be the best in at least one of the components such as engine, powertrain, body, interim design or even seats. If the local firm proves that it has sufficient R&D capability, the MNE will hand over responsibility for an R&D study to its local partner, which means that some of the added value will be transferred from the MNE to the local firm.

2) One of the important tasks of the local firms' top level managers is to establish a team to study the **"Technology Foresight"**. Carefully following the technological developments and trends and predicting future technologies would provide an opportunity for the local partner to start researching promising technologies earlier than even the MNE. If the local firm's R&D department managed to produce technological knowledge related to one of the emerging technologies, implement it to an industrial product and then protect this knowledge with patents, this certainly would be a decisive factor for persuading the MNE to adopt this technology.

The recent crisis in the automotive industry in the USA is a good example of how important technology forecasting and conducting can be for a correct R&D policy. There is immense pressure on automotive companies to consume less petroleum and emit less pollution. A brief review of the R&D activities of the major automotive companies yields some significant results. It can be seen, that there are differences between the three major automotive manufacturing regions, USA, Europe and Japan.

Japanese firms focused their R&D activities on hybrid electric vehicles. Europeans concentrated on highly efficient small diesel engines. Americans, mainly General Motors and Chrysler, however, could not convert their technology from big engine vehicles to small ones. They tried to import hybrid technology from Japan. It can be clearly seen that the Japanese firms have taken the leading role in this respect. Thus, it is not surprising that Toyota has become the biggest automotive company in the world.

Electric Vehicle Technology is another very active area of research. The electricity may either be produced by fuel cells by using hydrogen and oxygen, or it can be directly plugged in and stored in batteries.

Ford Otosan, as a local partner of Ford, has conducted R&D projects on hybrid and full electric vehicles in Turkey. They have reached the “knowledge creating” phase. This is one reason why Ford USA has chosen Ford Otosan’s R&D center in the Marmara Research Center as a pilot place for developing fuel cell and hybrid electric vehicles in Turkey.

3) Another important factor for local company managers is to produce and sustain good relationship with the MNE. The **“social factors”** definition covers mutual trust, integrity, willingness to solve problems together, being ready to share responsibility, acknowledging the other’s knowledge and expertise and so on. The “social factors” definition also covers social contacts and hospitality. There is no doubt that the infrastructure of the local company is also a must for good relations. Collaborative R&D work could only be successful when both parties communicate easily and understand each other. Without establishing a proper working environment between researchers, successful results would be hard to achieve.

4) The volatility of the financial and technological market is also a **threat or an opportunity** for the local partner firm. The latest developments in the world economy show that, it would not be surprising if the mother company makes a joint venture with other MNEs or is even sold. All of a sudden, a new R&D group/firm might enter the research circle with the expertise that local firm was trying to achieve. This is a **threat** because when this expertise is injected into research circle, there would be no need for local company's R&D departments' particular unit, which was only formed to develop this knowledge. The volatility of the technological market is also an **opportunity**. When a company is faced with financial problems, they close some of their R&D units and prefer to get R&D service from their local firms, if the local firms' R&D capability is sufficient and its R&D cost is lower.

In either direction, there are both positive and negative developments, the R&D department of the local firm should work on cutting edge technologies and must keep themselves up to date.

5) In addition to the aforementioned policy implications, the local firm and its R&D department should be careful about being **self sufficient**, which is particularly important for the automotive industry. The local company should improve its competences in designing the whole vehicle. This competence will protect the local company from unexpected adverse events caused by the MNE. If the MNE changes its R&D policy, and reduces the R&D share of the local company, then the local R&D department could act independently and continue to implement its R&D policy. A recent advance in Electric Vehicles is one example. If the local firm believes that a new design type of electric vehicle has a market chance, but MNE does not share this belief, the only way for the local firm to continue on this project is to act alone. Hence, it is crucially important for local firms to become self sufficient in R&D studies.

6) Geographically Turkey is located between the East and the West, not far from the European markets and with close proximity to international transportation (sea, rail, road and air) lines. There is fierce competition between developing countries to attract MNEs to invest in their country in the automotive industry. Being an R&D location, Turkey has some competitive advantages and also some disadvantages. Turkey's economy is developing and the GDP per person is increasing. Labor costs are no longer the lowest. The MNEs may prefer to produce their cars in other countries where the costs are comparably lower. The other countries that Turkey is competing with are China, Brazil, Lithuania, Slovakia, the Czech Republic and Poland. In order to be competitive in the car industry in the future, it can be clearly seen that being innovative in designs and having an **innovation capability** is a must and could only be reached through research and development.

7) The last policy implication objective for the local firm is to reduce the **cost of R&D** per capita so that it is much lower then that of the MNE. There are two ways to achieve this. The first one is trying to provide substantial **governmental incentives**. Although the level of incentives is defined by the government and not the local firm, it is important to put pressure on the government by forming industrial chambers and using publicity to draw public attention to this topic. The second, and probably more important way to reduce the R&D cost, is the optimization of the R&D process. There are a number of phases between idea generation and final product. In automotive jargon this process is called "well to wheel". The R&D department must create a system to create know-how more efficiently (less time and less labour).

8) Finally it should be expressed that, the future of the Turkish automotive industry depends heavily upon the R&D policy of the company and the incentives of the Turkish Government. It was found that, the R&D departments of Tofaş and Ford Otosan have reached sufficient absorptive capacity and R&D capability, and they have almost reached the knowledge creating phase. It is believed that, carefully studying cutting edge technologies, and selecting the most appropriate technology for R&D, would give Turkish automotive companies a chance to be successful in R&D collaborations. This success is highly dependent upon the talent and experience of the directors and R&D managers, predicting future technologies and implementing a correct pattern for them.

10.5 Limitations of the Study

The most important limitation of the face-to-face interviews was the difficulty in obtaining some important company information. Especially for R&D, which by itself is a subject that contains confidentiality. As a result, it was difficult to obtain answers from the R&D directors concerning their ongoing R&D projects and collaborations.

Although, the internationalization of R&D, MNE's role in R&D collaborations, international joint ventures and knowledge transfer, have been studied in the R&D collaboration literature as well as by MNEs-suppliers, MNEs-universities/research institutes and MNEs-MNEs R&D collaboration, the R&D Collaboration between an MNE and its local partner has not sufficiently researched in the literature. This has, in a way, generated some limitations for the researcher in exploring new research topics. However, it was also a source for the originality of this work.

10.6 Implications for Further Research

An attempt was made to identify the main factors that affect R&D collaboration in the Turkish automotive industry in this thesis. For further research, each factor can be developed as hypotheses, and then they can be tested empirically. Examples of hypotheses could be: "There is a positive relationship between the R&D capability of the local company and R&D collaboration" or "If absorptive capacity of the local firm is high, then R&D Collaboration is high". An appropriate measurement scale should be developed or adopted from similar empirical research to test such hypotheses.

R&D collaboration between rival firms within the same industry, which was called "pre-competitive R&D collaboration", could also be further researched. In addition, this research could also be applied to other industries in Turkey. Whether R&D collaboration or internationalization of R&D exists in other leading industries is another research question that could be studied in further research.

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Appendix A Question Form Applied to Local Partner Firms

Işık University
Institute of Social Sciences
PhD Thesis
Question Form (Local Firm)

(For the local Turkish partner firms that have R&D collaboration with MNEs in automotive production)

Dear Sir/Madam,

The main objective of this study is to explore the factors that affect R&D collaboration between MNEs and their local partners by studying such collaborative relationships in the Turkish automotive industry. Hence; the main research questions include examining both factors related to the local firms and to the MNEs operating in the Turkish automotive industry and to understand the nature of the R&D collaboration. The answers of the following questions will only be used within the thesis and will not be used for the third parties.

General Information about the Respondent:

Name and Surname:

Position:

Address Information:

Telephone Number:

E-mail Address:

General Company Information:

Company Name:

Company's Web Address:

Questions Regarding the Firm's R&D Activities:

(Note: This section is set up in order to acquire the basic information)

Is there a R&D department in your company? Yes ____ No ____

If yes;

1. When was first the R&D department established? _____
2. What is the total number of employees who work in the R&D department? ___
3. What is the distribution of the employees that work for R&D department?

Engineers	
Engineers with Ph.D.	
Specialist	
Researcher	
Master/Ph.D. student	
Other major graduates (Apart from Engineering Faculty)	

4. What is the employees' level of education and how many years of experience do they have?
5. What is the number of production engineers in your company?
6. What is their level of education and how many years of experience do they have?
7. What is the number of product development engineers in your company?
8. What is their level of education and how many years of experience do they have?
9. What are the current R&D equipments in your company?

If no;

1. Why didn't your firm establish an R&D department?
2. What are the barriers of your company investing in technological R&D researches?

There is no demand from the customer.	
Inadequate legal infrastructure for the protection of intellectual property rights.	
There is no appropriate technical infrastructure in order to perform R&D in our company.	
There is no engineering infrastructure with less technological R&D capability.	
Not enough financial resources for the technological R&D (Because of economies of scale, technological R&D researches found to be risky economically).	
There was no need for R&D because of the nature of our producing item.	

1. Questions Regarding Strategy of Competitiveness, Production and Technological Innovation Competencies:

1.1 How do you evaluate production and design competency level of your company?

1.2 How do you evaluate the competitiveness strategy of your company among the following listed factors?

Competing Factors	Not Important	Important	Very Important
Product Quality and Performance			
Production Cost			
Delivery in Time			
Brand Value			
Technological Innovation			
Product Differentiation			
Specialty Products			
Lean Production			

1.3 How do you define the technology strategy of your company?

2. Questions Relevant to the R&D Activities of the Local Firm:

2.1 When was the first time you thought about establishing an R&D department? How was it established? Why was it necessary?

2.2 As it is known, your firm has a foreign production partner, a MNE. Did your firm get permission from the mother company? Did they encourage your firm to establish an R&D department or did your firm take this decision alone?

2.3 What is the yearly R&D budget of your company for the last 5 years? What are the ratios of your R&D expenditures over the revenues for the last five years?

2.4 What is the ratio of product development expenditures over the total revenue?

2.5 Is there a well defined written corporate technological innovation strategy plan of your company?

2.6 Are there new product developments, product/process innovations, original designs and awarded patents in the last 5 years? If yes, what are their titles?

2.7 Which of the following knowledge sources given below were effective in developing technological innovations related with the previous question?

Knowledge Resources	**Original Design**	**Patents**	**Technological Innovations in Product Technology**	**Technological Innovations in Production Technology**
R&D activities of our company				
From the experiences and advices of the employees in production (assembly line foreman and etc.)				
From the experiences and advices of the top level managers				
From the opinion and advices of the suppliers				
From the mother company's specialty knowledge and advices				
From the rivalry firms knowledge				
From the universities and research institutes knowledge				

2.8 Does your firm have a certain strategy or a plan in order to support knowledge creation and transfer within your firm internally?

2.9 Is there any department or a person that is responsible to evaluate the observations and advices of the employees in which this knowledge is created from the employees' experiences and specialties inside the firm? If yes, when was it established?

2.10 What kind of managerial applications are being handled in order to strengthen and encourage the internal knowledge transfer?

2.11 Which of the following applications are implemented in your firm?

Applications	**Yes**	**No**
Evaluation of the ideas of the employees		
Employees' innovative ideas are couraged by "additional salary, premiums and bonuses"		
Rotation of the technical personnel within the departments		
Collaborative (joint) researches between departments		
Brain storming sessions		

2.12 Have you attended technical educations organized by the mother company in the last year? How many hours totally were these educations?

2.13 Were there any "technical renovation and improvement" projects (machine-equipment, etc.) demanded and financially supported by the mother company during the last 3 years? If yes, what is the number of such projects?

2.14 Were there any "short-term engineer exchange" projects with the mother company during the last three years? If yes, what is the number of such projects?

2.15 During the last year, did the engineers from the mother company visit your company for technical support? If yes, what is the number of such projects?

2.16 Is there any portal or internet system that your firm makes knowledge transfer with the MNE? Do you use video conferencing?

3. Questions Relevant to the Knowledge Acquisition/Transfer from the MNEs:

3.1 Is there any certain strategy or a plan of your firm in order to develop the knowledge transfer to your mother company, suppliers, rivalry firms or universities?

3.2 Is there any responsible employee or a department in your firm who is responsible for the knowledge transfer of the outside information to your company? If yes, when did you start this following up issue?

3.3 What kind of applications did your company perform in order to learn (absorb) the knowledge coming from the mother company?

3.4 Are there any collaborative technology R&D projects between your company and the mother company, suppliers, rivalry firms and universities in the last five years? What are those project's contents?

4. Questions regarding R&D Collaboration with the MNEs:

4.1 When did you start to make production with the mother company?

4.2 What kind of products or product groups do you manufacture?

4.3 Which of the following applications are accomplished within last 5 years?

Collaborative design and product development with the MNE	
Licensing agreements with the MNE	
Technical training provided by the MNE	
Managerial based training provided by the MNE	
Engineer-designer rotation of the MNEs	
Collaboration with the MNE's suppliers	
Other	

4.4 When you think of the developments in the production relationship, in your thought what are the developments that affected the knowledge transfer between your firm and your foreign partner?

4.5 How does developing your firms technological capabilities and using the internal sources for technology development, affected your partner-mother company relationship?

4.6 Does your firm have any product/process innovations, original design or patent applications in the last 5 years according to the R&D collaboration with the MNE?

4.7 Which of the following are true about your relationship with the MNE?

Because of our relationship with the MNE;

Applications:	**Do not agree**	**No idea**	**Agree**
We have learned a new design technique and we applied this technique,			
We gained expansion in our product range,			
We increased our product's quality,			
We have increased efficiency in our production processes,			
We have gained new export opportunities.			

4.8 Have you ever completed a joint R&D project with your mother company? What are the results of these projects? (product and process based innovations)

4.9 Currently are you working on any R&D projects with your mother company?

4.10 Could you please explain us the stages of the R&D project and the collaborative R&D process?

4.11 In which level knowledge transfer emerged while managing in the joint R&D project?

4.12 Which of the following applications are performed with the MNE in terms of knowledge/technology transfer?

Applications:	**1 Never**	**2**	**3**	**4**	**5 Always**
Informal knowledge transfer					
Technical training by the MNE					
Collaborative product development projects with the MNE					
Collaborative R&D researches with the other R&D departments of the MNE all over the world					
Engineer Rotation with the MNE					
Other					

4.13 What are the social factors affecting R&D collaborations of your company? For example: cultural conflicts, mutual trust, and compatibility of the local R&D engineers with the mother company.

4.14 What are the other factors that are not mentioned in this survey but you think that affect R&D collaboration?

5. Questions Regarding with the Rivalry Firms:

5.1 What is the number of collaborative R&D projects in the last three years with rivalry firms?

5.2 What is the number of collaborative product development projects in the last three years with the rivalry firms?

6. Questions Regarding with the Universities:

6.1 What is the number of collaborative R&D projects in the last three years with the universities?

6.2 What is the number of collaborative product development projects in the last three years with the rivalry firms with the universities?

6.3 Which of the following applications are performed?

Attending university trainings	
Technical consultancy by the academicians in order to solve the technical problems	
Using the universities' technical opportunities	
Joint master/Ph.D. thesis researches	

(Thank you for your help and support.)

Appendix B Question Form Applied to Multinational Firms

Işık University
Institute of Social Sciences
PhD Thesis
Question Form (Multinational Enterprises)

(For the foreign MNEs that have Turkish partner firms in automotive production)

Dear Sir/Madam,

The main objective of this study is to explore the factors that affect R&D collaboration between MNEs and their local partners by studying such collaborative relationships in the Turkish auto industry. Hence; the main research questions include examining both factors related to the local firms and to the MNEs operating in the Turkish automotive industry and to understand the nature of the R&D collaboration. The answers of the following questions will only be used within the thesis and will not be used for the third parties.

General Information about the Respondent:

Name and Surname:
Position:
Address Information:
Telephone Number:
E-mail Address:

General Company Information:

Company Name:
Company's Web Address:

1. Questions Related with the MNE's R&D Activities:

1.1 What is your firm's main R&D policy? Does your firm open to R&D collaboration with other firms?

1.2 What is the criterion for possible R&D collaboration?

1.3 What are your firm's strategic goals regarding R&D collaboration for the next five years?

1.4 How many R&D departments do you have in other countries? What are their specializations in terms of R&D?

2. Questions Related with the MNE's R&D Collaboration with Turkish Partner:

2.1 Do you have R&D collaboration with your Turkish partner? To what extend?

2.2 How many collaborative R&D projects so far realized with your Turkish partner?

2.3 Could you please give information about current R&D projects?

2.4 In the past 5 years, which one of the following has been accomplished?

Collaboration with Turkish partner on joint product development and design	
Licensing agreements with your Turkish partner or its suppliers	
Technical Education to your Turkish partner's engineers and staff	
Managerial Based Education to your Turkish partner's engineers and staff	
Rotation of engineers and designers to your Turkish partner	
Collaboration with your Turkish partner's suppliers	
Other	

2.5 What is your firm's R&D budget allocated specifically for collaborative R&D activities in Turkey for the last 5 years?

2.6 What are the factors affecting R&D collaboration with your Turkish partner?

- **2.6.1** Infrastructure of the Local Country
- **2.6.2** Ease of transportation
- **2.6.3** Ease of communication
- **2.6.4** Comfortable living standards
- **2.6.5** R&D cost

2.6.6 Competency level of local engineers (education, creativity, experience and etc.)

2.7 What are the social factors affecting R&D collaboration with your Turkish partner? For example: mutual trust & integrity, commitment of the local R&D staff and cultural compatibility.

2.8 Apart from those factors, are there any others factors that may effect R&D collaboration of your firm and your local partner firm?

(Thank you for your help and support.)

Appendix C Question Form Applied to Local Partner Firms (in Turkish)

Işık Üniversitesi
Sosyal Bilimler Enstitüsü
Doktora Tezi
Soru Formu (Yerel Firma)

(Menşei Türk olup, çokuluslu yabancı bir otomotiv firması ile ortaklık kurmuş ve Türkiye'de üretim gerçekleştirmekte olan otomotiv firmaları için)

Sayın yetkili,

Uygulamakta olacağımız bu soru formunun amacı, Türkiye'de üretim faaliyetinde bulunan çok uluslu otomotiv firmalarının yerel ortağı olan Türk firmalarıyla müşterek Ar-Ge faaliyetlerinde bulunup bulunmadıklarının, eğer böyle bir faaliyet varsa bunun boyutlarının ve bu faaliyeti etkileyen faktörlerin araştırılmasıdır. Türk otomotiv firmalarının değişen teknolojik ve ekonomik koşullara ne ölçüde uyum sağlayabildikleri ve hatta bu değişikliklerin oluşturduğu tehditleri ortak Ar-Ge çalışmalarıyla nasıl fırsata dönüştürebilecekleri değerlendirilmeye çalışılacaktır. Bu soru formunda cevaplandıracağız soruların cevapları hiçbir şekilde başka taraflara verilmeyecek, bazı bilgiler tez içersinde kullanılırken firma sırlarının açıklanmamasına özen gösterilecektir.

Anket Uygulanan Kişi ile İlgili Genel Bilgiler:

Sorumlu Kişinin Adı Soyadı:

Görevi:

Adres Bilgileri:

Telefon Numarası:

E-mail Adresi:

Genel Firma Bilgileri:

Firmanın Açık Adı:

Firmanın Web Adresi:

Firmaya İlişkin Ön Sorular:

Firmanızda Ar-Ge'den sorumlu bir bölümünüz bulunmakta mıdır?

Evet ____ Hayır ____

Evet ise;

1. Ar-Ge bölümünüz hangi yılda kurulmuştur? _____
2. Firmanızda Ar-Ge bölümünde toplam çalışan sayısı nedir? _____
3. Ar-Ge bölümünde çalışanların sayı olarak dağılımı nedir?

Mühendis	
Doktoralı Mühendis	
Uzman	
Araştırmacı	
Master/Doktora öğrencisi	
Diğer bölümlerden mezun (Mühendislik Fakültesi dışı)	

4. Kaç yıl deneyimleri bulunmaktadır ve eğitim düzeyleri nedir?
5. Firmanızda üretimden sorumlu olarak çalışan mühendis sayısı nedir?
6. Kaç yıl deneyimleri bulunmaktadır ve eğitim düzeyleri nedir?
7. Firmanızda ürün geliştirmeden sorumlu olarak çalışan mühendis sayısı nedir?
8. Kaç yıl deneyimleri bulunmaktadır ve eğitim düzeyleri nedir?
9. AR-GE Bölümünün mevcut ekipmanları nelerdir?

Hayır ise;

1. Eğer Ar-Ge bölümünüz yok ise; neden kurmayı düşünmediniz?
2. Firmanızın teknolojik araştırma-geliştirme çalışmalarına yatırım yapmasının önündeki en önemli engeller nelerdir?

Müşteriden bu yönde talep gelmemesi
Fikri mülkiyet haklarının korunması yönünde hukuki altyapıdaki yetersizlikler
Araştırma geliştirmeye uygun teknik altyapımız bulunmaması
Teknolojik araştırma-geliştirme yeteneğine sahip mühendislik altyapısı bulunmaması
Teknolojik araştırma-geliştirme için yeterli finansal kaynak ayrılamaması (Ölçek ekonomisi sebebiyle, teknolojik araştırma-geliştirme çalışmaları ekonomik açıdan riskli bulunmaktadır.)
Üretmekte olduğumuz parçanın doğası gereği, teknolojik araştırma-geliştirme yapmamıza gerek duyulmaması

1. Firmanin Rekabet Stratejisi, Üretim ve Teknolojik Yenilikçilik Yetkinliğine İlişkin Sorular:

1.1 Firmanızın, üretim ve tasarım yetkinlik seviyesini nasıl değerlendiriyorsunuz?

1.2 Aşağıda listelenmiş faktörlerin, rekabet stratejileriniz için önemini nasıl değerlendirirsiniz?

Rekabet Faktörleri	**Önemli Değil**	**Önemli**	**Çok Önemli**
Ürün Kalitesi ve Performansı			
Üretim Maliyeti			
Zamanında Teslimat			
Marka Değeri			
Teknolojik Yenilikçilik			
Üründe Farklılaşma			
Belirli Ürünlerde Uzmanlaşma			
Esnek Üretim			

1.3 Firmanızın teknoloji stratejisini nasıl tanımlarsınız?

2. Firmanın Ar-Ge Faaliyetlerine İlişkin Sorular:

2.1 İlk aşamada, Ar-Ge bölümünü kurma fikri nasıl doğmuştur ve nasıl gerçekleşmiştir? Bu bölümü kurmaya neden ihtiyaç duyuldu?

2.2 Bildiğimiz gibi firmanızın yabancı bir otomotiv üreticisi ortağı (ana firma) var. Ar-Ge bölümünü bu firmanın isteğiyle veya izniyle mi kurdunuz? Yoksa bu kararı tamamen firmanız kendisi mi aldı?

2.3 Firmanızın son 5 yıllık AR-GE bütçesi nedir? Firmanızın yıllık AR-GE yatırımlarının, toplam yıllık harcamalarınıza oranı nedir? (Devlet teşviki ile ve teşvik olmaksızın)

2.4 Firmanızın son 5 yıllık ÜR-GE (ürün geliştirme) yatırımlarının, toplam yıllık harcamalarınıza oranı nedir? (Devlet teşviki ile ve teşvik olmaksızın)

2.5 Firmanızın kurumsal bazda ve yazılı olarak tanımlanmış bir teknolojik yenilikçilik (inovasyon) stratejisi ya da planlaması bulunmakta mıdır?

2.6 Son 5 yıllık süreçte geliştirmiş olduğunuz ürün yenilikleri, süreç yenilikleri, orijinal tasarımlar ve almış olduğunuz patentler var mıdır, varsa nelerdir?

Bilgi Kaynakları	Orijinal Tasarım	Patent	Ürün Teknolojisindeki Teknolojik Yenilikleri	Üretim Teknolojisindeki Teknolojik Yenilikleri
Firmamızda sürdürülen AR-GE çalışmaları				
Üretimden sorumlu personelin (ustabaşı, isçi vs.) deneyim ve tavsiyeleri				
Yöneticilerinizin deneyim ve tavsiyeleri				
Tedarikçi Firmalarınızın fikir ve tavsiyeleri				
Partner çok uluslu firmanızın uzmanlık bilgisi ve tavsiyeleri				
Rakip firmalarınızın uzmanlık bilgisi				
Üniversite ve araştırma kurumlarının uzmanlık bilgisi				

2.7 Söz konusu teknolojik yeniliklerin geliştirilmesinde, aşağıdaki bilgi kaynaklarından hangileri etkili olmuştur?

2.8 Firmanızın kendi iç kaynaklarıyla organizasyon içerisinde bilgi paylaşımını ve bilgi üretimini desteklemek amacıyla, belirli bir stratejisi ya da planı var mıdır?

2.9 Firmanızda çalışanların uzmanlıklarından ve tecrübelerinden kaynaklanan bilginin tespit edilmesi, gözlem ve önerilerinin değerlendirilmesi ve firma içinde paylaşımının sağlanmasından sorumlu bir birim ya da çalışan bulunmakta mıdır, varsa ne zaman kurulmuştur?

2.10 Organizasyon içi bilgi paylaşımını kuvvetlendirmek ve özendirmek amacıyla, ne tür yönetimsel uygulamalar firmanızda yürütülmektedir?

2.11 Firmanızda aşağıdaki uygulamalardan hangileri sürdürülmektedir?

Uygulamalar	Evet	Hayır
Çalışan yeni ürün önerilerinin değerlendirilmesi		
Çalışan önerilerinin “ek maaş, pirim” gibi uygulamalarla teşvik sistemi		
Teknik personelin birimler arası rotasyonu		
Birimler arası işbirliği çalışmaları		
Beyin fırtınası toplantıları		

2.12 Son 1 yıl içerisinde, söz konusu çokuluslu firma tarafından verilen teknik eğitimlere katıldınız mı? Bu eğitimler toplam kaç saatti?

2.13 Son 3 yıllık süreç içerisinde, çokuluslu firmanın talebi ve finansal desteğiyle yapılan “teknik altyapının (makina–teçhizat vs) yenilenmesi – iyileştirilmesi” çalışmaları bulunmakta mıdır? Bu projelerinin sayısı kaçtır?
2.14 Son 3 yıllık süreç içerisinde, çokuluslu firma ile yapılan “kısa süreli mühendis değişimi” projesi bulunmakta mıdır? Bu projelerinin sayısı kaçtır?
2.15 Son 1 ay içerisinde, çokuluslu firma tarafından yapılan teknik destek amaçlı firma ziyareti bulunmakta mıdır? Bu ziyaretlerin sayısı kaçtır?
2.16 Çok uluslu firma ile çevrimiçi olarak bilgi paylaşımında bulunduğunuz bir portal ya da sistem bulunmakta mıdır? Video konferans uygulaması kullanılmakta mıdır?

3. Firma Dışı Bilginin Transferine İlişkin Sorular:

3.1. Firmanızın, çok uluslu partner, tedarikçi, ya da rakip firmalar ile veya üniversitelerle işbirliğini ve bilgi transferini geliştirmek amacıyla, belirli bir strateji ya da planlaması bulunmakta mıdır?
3.2 Organizasyon dışı bilginin takip edilmesi, değerlendirilmesi ve firma içine transfer edilmesinden sorumlu bir birim ya da çalışan bulunmakta mıdır, varsa ne zaman kurulmuştur?
3.3 Organizasyon dışından edinilen bilginin, organizasyonunuz içinde yayılımını ve özümsenmesini sağlamak amacıyla, ne tür uygulamalar yapılmaktadır?
3.4 Son 5 yıllık süreçte, firmanızın çok uluslu partner, tedarikçi, ya da rakip firmalar ile veya üniversitelerle yapmış olduğu ortak teknoloji araştırma geliştirme çalışmaları bulunmakta mıdır, söz konusu projelerin içeriği nedir?

4. Çokuluslu Firma ile Teknoloji (Ar-Ge) İşbirlikleri İlişkin Sorular:

4.1 Çokuluslu firma ile aranızdaki üretim ilişkisi hangi yılda başlamıştır?
4.2 Çokuluslu firma ile hangi ürün ya da ürün gruplarını üretmektesiniz?
4.3 Son 5 yıllık dönemde, çokuluslu firma ile aşağıdaki uygulamalardan hangileri gerçekleştirilmiştir?

Çokuluslu firma ile ortak tasarım ve ürün geliştirme işbirliği	
Çokuluslu firma ile lisans anlaşmaları	
Çokuluslu firma tarafından sağlanan teknik eğitimler	
Çokuluslu firma tarafından sağlanan yönetim temelli eğitimler	
Çokuluslu firma ile mühendis – tasarımcı rotasyonları	
Çokuluslu firma’nın diğer tedarikçileri ile işbirlikleri	
Diğer	

4.4 Çokuluslu firma ile sürdürdüğünüz üretim ilişkinizin gelişim süreci göz önüne alındığında, partneriniz ile olan bilgi paylaşımını etkilediğini düşündüğünüz gelişmeler neler olmuştur?

4.5 Teknoloji yetkinliklerinizi geliştirmeniz ve organizasyon içi kaynakların teknoloji geliştirme amacıyla kullanımı, çokuluslu firma ile sürdürdüğünüz çok uluslu firma – partner ilişkinizi nasıl etkilemiştir?

4.6 Son 5 yıllık dönemde, çokuluslu firma ile olan ilişkiniz sayesinde geliştirilmiş olduğunuz ürün yeniliği, üretim sureci yeniliği, orijinal tasarım ya da patent başvurunuz bulunmakta mıdır?

4.7 Çokuluslu firma ile olan ilişkiniz göz önüne alındığında, aşağıdaki önermelerden hangileri doğrudur? Çokuluslu firma ile olan ilişkimiz sayesinde;

Önermeler	**Katılmıyorum**	**Kararsızım**	**Kesinlikle Katılıyorum**
Yeni bir tasarım tekniği öğrendik ve uyguladık.			
Ürün gamımızda genişleme sağladık.			
Ürün kalitemizi artırdık.			
Üretim süreçlerimizdeki verimliliğimizi artırdık.			
Yeni ihracat imkânları sağladık.			

4.8 Şu güne kadar çok uluslu firma ile ortak Ar-Ge projeleriniz oldu mu? Bu projelerin sonuçları ne oldu? (ürün ya da süreç bazında yenilikler?)
Şu an çok uluslu firma ile birlikte çalıştığınız Ar-Ge projeleri var mıdır?

4.9 Bir Ar-Ge projesindeki aşamaları ve ortak Ar-Ge sürecini anlatabilir misiniz? Ortak Ar-Ge projesinin yürütülmesi surecinde bilgi paylaşımı ne düzeyde gelişiyor?

4.10 Çok uluslu firma ile aşağıdaki bilgi/teknoloji paylaşımı uygulamalarından hangileri gerçekleştirilmektedir?

Önermeler	**1 Çok ender**	**2**	**3**	**4**	**5 Çok sık**
Enformel bilgi paylaşımı					
Çokuluslu firmalar tarafından verilen teknik eğitimler					
Çokuluslu firmalar ile sürdürülen ortak ürün geliştirme projeleri					
Çokuluslu firmaların yurtdışındaki Ar-Ge merkezleri ile yapılan ortak teknoloji geliştirme çalışmaları					
Çokuluslu firma ile karşılıklı mühendis rotasyonu					
Diğer					

4.11 Firmanızın Ar-Ge işbirliğini etkileyen diğer faktörler nelerdir? örn: kültür uyuşmazlığı, yerel Ar-Ge personelinin diğer ana firmadakilerle uyumu, karşılıklı güven?

4.12 Ar-Ge işbirliğini etkileyen ancak bu soru formunda yer almayan diğer hususlar nelerdir?

5. Rakip Firmalara İlişkin Sorular:

5.1 Rakip firmalarınızla, son 3 yıllık süreç içerisinde yapmış olduğunuz ortak Ar-Ge projelerinin sayısı nedir?

5.2 Rakip firmalarınızla, son 3 yıllık süreç içerisinde yapmış olduğunuz ortak ürün geliştirme projelerinin sayısı nedir?

6. Üniversitelerle İlişkilere İlişkin Sorular:

6.1 Üniversitelerle, son 3 yıllık süreç içerisinde yapmış olduğunuz ortak Ar-Ge projelerinin sayısı nedir?

6.2 Üniversitelerle, son 3 yıllık süreç içerisinde yapmış olduğunuz ortak ürün geliştirme projelerinin sayısı nedir?

6.3 Firmanızda aşağıdaki uygulamalardan hangileri sürdürülmektedir?

Üniversiteler tarafından verilen eğitimlere katılım	
Karşılaşılan teknik sorunların çözümü için, akademisyenler tarafından verilen teknik danışmanlıkla	
Üniversitelerin teknik imkânlarının kullanılması	
Ortak yüksek lisans/doktora tez çalışmaları	

(Yardımınız ve desteğiniz için teşekkür ederim.)

Appendix D Question Form Applied to Multinational Firms (in Turkish)

Işık Üniversitesi
Sosyal Bilimler Enstitüsü
Doktora Tezi
Soru Formu (Çokuluslu Firmalar)

(Türk otomotiv üreticisi firmalarla ortak olan yabancı çokuluslu firmalar için)

Sayın yetkili,

Uygulamakta olacağımız bu soru formunun amacı, Türkiye'de üretim faaliyetinde bulunan çok uluslu otomotiv firmalarının yerel ortağı olan Türk firmalarıyla müşterek Ar-Ge faaliyetlerinde bulunup bulunmadıklarının, eğer böyle bir faaliyet varsa bunun boyutlarının ve bu faaliyeti etkileyen faktörlerin araştırılmasıdır. Bu soru formunda cevaplandıracağız soruların cevapları hiçbir şekilde başka taraflara verilmeyecek, bazı bilgiler tez içersinde kullanılırken firma sırlarının açıklanmamasına özen gösterilecektir.

Anket Uygulanan Kişi ile İlgili Genel Bilgiler:

Sorumlu Kişinin Adı Soyadı:

Görevi:

Adres Bilgileri:

Telefon Numarası:

E-mail Adresi:

Genel Firma Bilgileri:

Firmanın Açık Adı:

Firmanın Web Adresi:

1. Firmanın Ar-Ge Faaliyetlerine İlişkin Sorular:

1.1 Firmanızın temel Ar-Ge politikası nedir? Firmanız diğer firmalarla Ar-Ge işbirliğine açık bir yapıya sahip midir?

1.2 Olası bir Ar-Ge işbirliği için kriterler nelerdir?

1.3 Ar-Ge işbirliğine ilişkin, ileriki beş yıllık süreç içinde firmanızın stratejik amaçları nelerdir?

1.4 Firmanızın Ar-Ge bölümleri hangi ülkelerde bulunmaktadır? Ar-Ge açısından uzmanlık alanları nelerdir?

2. Firmanızın Türk Ortağı ile Geliştirdiği Ar-Ge İşbirliğine İlişkin Sorular:

2.1 Türk ortağınızla Ar-Ge işbirliğiniz var mıdır? Hangi derecede bir işbirliğiniz bulunmaktadır?

2.2 Geçmişte Türk ortağınızla beraber kaç tane Ar-Ge projesi geliştirdiniz?

2.3 Şuan çalışmakta olduğunuz Ar-Ge projeleri ile ilgili genel bir bilgi verebilir misiniz?

2.4 Aşağıdakilerden hangileri firmanız tarafından son 5 yıl içinde gerçekleştirilmiştir?

Türk ortağımızla ürün geliştirme ve tasarımda işbirliği	
Türk ortağımız ve onun tedarikçi firmalarıyla lisans anlaşması	
Türk ortağımızın mühendislerine ve çalışanlarına teknik eğitim	
Türk ortağımızın mühendislerine ve çalışanlarına yönetim temelli eğitim	
Türk ortağımızla mühendis ve tasarımcı dönüşümü	
Türk ortağımızın tedarikçi firmaları ile işbirliği	
Diğer	

2.5 What is your firm's R&D budget allocated specifically for collaborative R&D activities in Turkey for the last 5 years?

2.6 Ar-Ge işbirliğni etkilediğini düşündüğünüz faktörler nelerdir?

- **2.6.1** Ortak firmanın bulunduğu ülke
- **2.6.2** Ülkenin ulaşım altyapısı ve kolaylığı
- **2.6.3** Ülkenin haberleşme altyapısı ve kolaylığı
- **2.6.4** Ülkenin rahat yaşam standardı

2.6.5 Ülkedeki Ar-Ge ücretleri

2.6.6 Ülkedeki mühendislerin yetkinlik seviyesi (eğitim, yaratıcılık, deneyim)

2.7 Ar-Ge işbirliğini etkilediğini düşündüğünüz sosyal faktörler nelerdir? Örneğin: karşılıklı güven & dürüstlük, ortağımızda çalışan Ar-Ge mühendislerinin bağımlılığı ve kültürel uyuşabilirlik.

2.8 Yukarıdaki faktölerin dışında, firmanız ve ortağınızın Ar-Ge işbirliğini etkilediğini düşündüğünüz başka diğer faktörler var mıdır?

(Yardımınız ve desteğiniz için teşekkür ederim.)

Appendix E Locations of the Automotive Companies in Turkey Map

Figure E.1 Locations of the Automotive Companies in Turkey Map

Curriculum Vitae

Aslı Tuncay Çelikel was born and raised in İstanbul, Turkey. She graduated from Işık University, Management Department in 2001. Afterwards, she started to work as a research assistant and studied MBA at Işık University. She has assisted new product development, international marketing, principles of marketing, public relations and publicity, marketing communications, marketing research and organizational behavior courses and lectured introduction to business course to undergraduates. In the meantime, she has prepared her masters thesis called "Critical Evaluation of Innovativeness of Turkey with respect to European Union Integration". Upon completion of her MBA of in the year 2003, she started her PhD in Contemporary Management Studies at Graduate School of Social Sciences of Işık University. In 2006, she won DAAD (German Academic Exchange Service) a PhD research scholarship and went to Berlin, studied at Social Science Research Center of Berlin "WZB" for one semester in 2006-2007. She is a member of Academy of International Business (AIB) and International Society for Professional Innovation Management (ISPIM).

International Conference Proceedings:

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