Sectoral System of Innovation and Exploring Technological Upgrading Strategies in Late-Industrializing Countries

TUNCEL, Cem Okan

Uludağ Univesity

2012

Sectoral System of Innovation and Exploring Technological Upgrading Strategies in Late-Industrializing Countries: A Comparative Study of Automotive Industry between South Korea and Turkey

Cem Okan TUNCEL Ph.D

Uludag University
Faculty of Economics and Administrative Science
Department of Economics
Görükle Campus, Bursa, TURKEY
cotuncel@uludag.edu.tr

ABSTRACT

Latecomer sectors in late-industrializing economies follow different patterns in their development and growth processes, which largely determine the share acquired from the global value chain. The development and growth process of the sectors is generally argued to be the result of the interaction of macro level specific institutional context and micro level firm strategic choices. In this study I argue that meso-level sectoral systems also play a critical role in the development and growth process of latecomer sectors. Accordingly, I aim to integrate these three theoretical perspectives -resource-based view (RBV) of the firm, sectoral system of innovation (SSI) perspective, and technological capability perspective for late industrializing economies- to explain the relative developmental failure of Turkish automotive industry compared to other successful latecomer industries such as South Korean automotive industry In the light of theoretical framework, I will try to investigate sectoral technological upgrading trajectory and compare between Korean and Turkish automotive industry development path by using case study method. I will end by discussing how a multilevel framework that takes into account the systemic factors can guide research on sectoral development in late-industrializing countries. In the light of a comparative historical analysis of development of Turkish and Korean automotive industries it is argued that a pace of industrial transformation can be accelerated by multilevel proactive state intervention.

Keywords: *Sectoral System of Innovation, Upgrading Strategies, Late-Industrializing Countries, Korean and Turkish Automotive Industry*

1. Introduction:

While Asian newly industrialized Economies (NIEs) were similar to the other developing countries in the sense that they were all late-industrializing countries in the global economy (Hikino and Amsden, 1994, Wong, 1999) some sectors in these economies, such as South Korean automotive industry, exemplify a success story while others, such as Turkish automotive industry, encounter developmental failures (Erdoğdu,1999). The literature on performance of different latecomer sectors in late-industrializing economies suggests that they follow different patterns in their technological catch-up processes (e.g., Lee and Lim, 2001). Explanations of this performance heterogeneity between sectors generally focus on the interaction of macro level specific institutional context and micro level firm strategic choices (Hobday, 2003). A quick overview of the literature, however, reveals a surprising lack of an integrative approach that takes into account not only macro and micro level perspectives but also meso-level sectoral systems approach. In this study I argue that meso-level sectoral systems also play a critical role in the development and growth processes of latecomer sectors. Therefore, an integrative framework that takes into account the meso-level sectoral systems is needed to provide a more comprehensive explanation of sector level performance heterogeneity. Accordingly, I aim to integrate three theoretical perspectives, resource-based view (RBV) of the firm, sectoral system of innovation (SSI) perspective, and research on institutional context for technological capability development for late industrializing economies, to explain the performance heterogeneity of latecomer sectors. Specifically, this paper focus on the Turkish automotive industry and aim to understand and explain the developmental failure it encounters compared to other successful latecomer industries, such as South Korean automotive industry. In this study the path dependent sectoral evolution and lock-in dynamics of Turkish automotive industry will be investigated (David, 1985; Arthur, 1990) by focusing on the local and global linkages, organizational learning and capabilities, interaction among actors, success and failure examples, external and internal knowledge sources, and the roles of new actors.

The foundation of the automotive industry in South Korea and Turkey has started almost in the same period, early 1960s. Progress of this industry in Turkey outdistanced the domestic Korean performance until the second half of 1970s. Since then, thanks to flourishing industrial policies implemented by the state, the Korean automotive industry entered in a booming growth, and turned out to be a prominent industry capable of producing and marketing to every corner of the globe its own global brand today. On the other hand, the industry in Turkey remained localized as a production base developing in parallel to the strategic decisions of global brands,

culminating in the lack of a global automotive industry capable of manufacturing its own brand. Automotive industries of these two countries inaugurated at similar initial conditions followed utterly different paths and scored distinct performances. This study is aimed at exploring the causes underlying these distinct outcomes reached by two late industrialization experiences by means of a multilevel theoretical framework. Root causes of these two discrete performances are believed to be the governmental incentive policies towards industry at macro level, the skills of the late comer firm to exercise its dynamic skills and take strategic decisions at micro level as well as selective policies decisive in technological development routes at meso level.

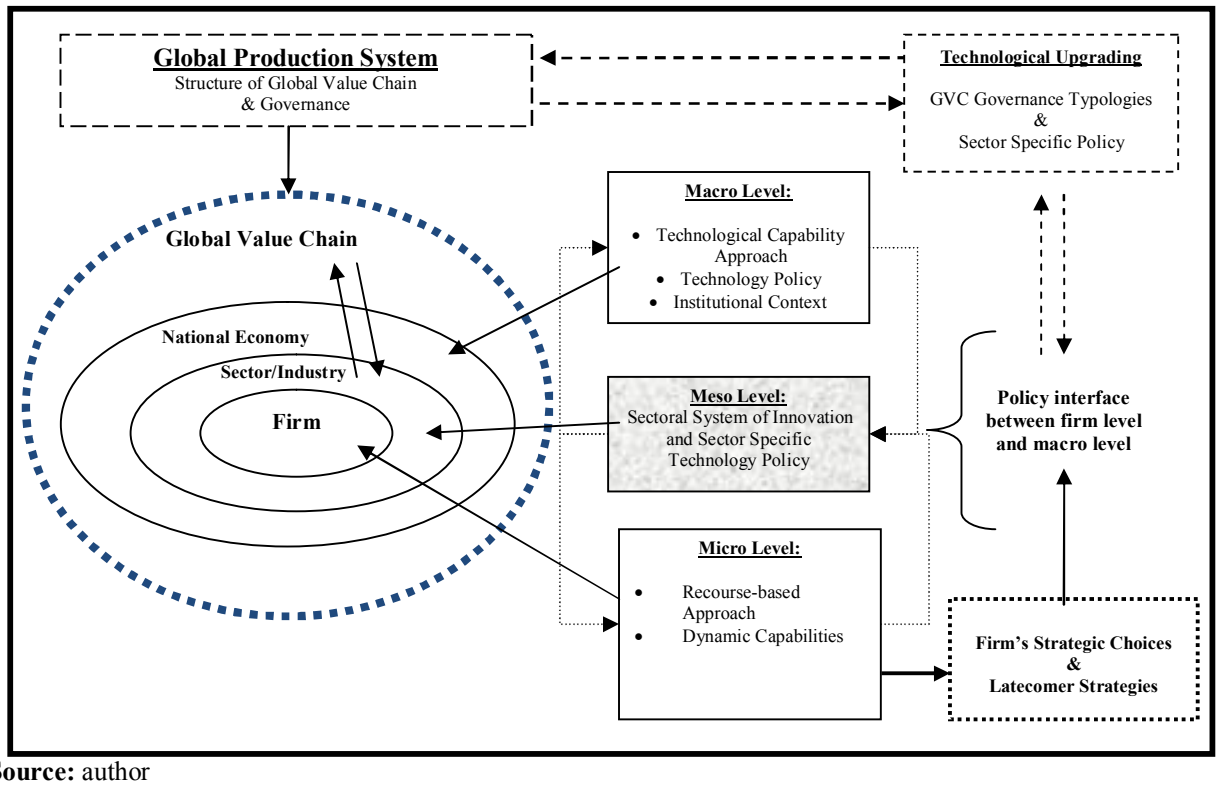
This study consists of main three parts. In first section multilevel theoretical framework technological upgrading process are investigated. Second section is dedicated to comparative analysis of S Korean and Turkish automotive industries. In this section causes of differences between two countries' automotive industry performance are explored via using historical data. In the third section an assessment has been made on Korean and Turkish automotive industry from SSI perspective and main propositions for conclusion are discussed. Finally fundamental characteristics feature of policy space and upgrading relation summarize in conclusion section.

2. Multilevel Analysis of Technological Upgrading in Late-Industrializing Context:

In the 1990s a large body of research studying the catching up processes of newly industrializing Asian countries emerged. These studies particularly focus on the dynamics of firm level learning processes (Kim, 1999; Mathews and Cho, 1999), technological capability building (Lall, 1992; Lall, 2000; Lall and Teubal, 1998) and national institutional contexts defined as national innovation systems (Freeman, 1987; Shin, 1996). These studies were followed by others that adopt a sectoral system of Innovation approach. Most of these SSI studies focus on the specialized supplier and science based sectors, such as telecommunication equipment and services, software, biotechnology and pharmaceutical, petrochemical, and complex machine tool production, electronics, and automation (For EU countries as advanced economies see: Tether and Metcalfe, 2010; on service; Mckelvey et al.,2004; on pharmaceutical, Cesaroni et al. ,2004; on chemical, Steinmueller,2004; on software, Edquist,2004; on Telecommunications, Wengel and Shapira, 2004 on machine tools ; for China as a latecomer economies see: ; Xi et al.,2010 on automobile; Li and Xin Pu on colour TV, 2010). While this growing literature have helped us understand the dynamics of development and performance in the late-industrializing economies, an integrative approach that integrates macro, micro and meso-level perspectives to explain the sectoral level performance heterogeneity is lacking. Accordingly, I draw on the resource-based

view (RBV) of the firm, sectoral system of innovation (SSI) perspective, and research on institutional context for technological capability development for late industrializing economies to explain the sectoral level performance heterogeneity (The theoretical framework is illustrated in Figure 1).

Figure 1: Multilevel Theoretical Framework Technological Upgrading



Source: author

2.1. Late Industrialization:

The macro level perspective in the theoretical framework focuses on the late-industrialization problems. The concept "late industrialization" was formulated by Gerschenkron, the US economist of Russian origin. Countries like Russia and Germany outdistanced by industrializing countries such as UK and France upon the start and growth of the industrial revolution, and therefore referring to state intervention in an aim to catch up with these prosperous countries are defined as late industrializing countries by Gerschenkron (Keyder, 1978). According to Gerschenkron, industrialization evident in UK can be achieved in backward countries only through the existence of some substitution factors. These factors are banks in Germany and principally the government in Russia. (Gerschenkron, 1962). Approaches that may be postulated as second-generation late industrialization theses focus on thriving industrialization processes of Asian countries, primarily Japan, which are called the Asian Miracle (e.g. Worldbank, 1993). Carrying a centric role in early late industrialization debates, the state

preserves its pivotal essence in these new generation discussions (Fagerberg and Godinho, 2006:518). For instance, stressing the significance of the *capitalist developmental state* in Japanese industrialization, Chalmers (1982) argues that the strategic industrial policies effectively pursued by the state constitute the crucial component of this successful late industrialization process. Debates surrounding this Asian development lay the major emphasis on the state's capacity of administrative skills in the industrialization process. And the constituent of this capacity is the state power, the existence of relatively autonomous specialist bureaucracy, and strong cooperation towards strategic objectives between the business world and private sector. This cooperation is what has allowed the implementation of effective industrial policies.

Late industrialization theory focusing on "technological capability" has been conceptualized in the early 1980s (Bell and Pavitt, 1995; Enos 1991; Fransman, 1985; Lall, 1992, 2000). The term "technological capabilities" encompasses the wide range of knowledge and skills required to acquire, assimilate, utilize, adapt, change and create technology (Lall, 1992). These capabilities require a national institutional context that provides certain complementary inputs including *"organisational flexibility, finance, quality of human resources, support services and information management and co-ordination competence"* (Juma and Clark, 2002:8). The industrial policy is studied across a dichotomous approach, namely "functional" and "selective or sector-oriented" interventions. The functional policy set is aimed at eliminating market failures in no favour of a selected sector or business. Unlike the functional policy, the structuralist policy involves targeting specific sectors or activities by means of various policy instruments such as subventions, trade policies, R&D subsidies, etc. (Lall and Teubal, 199) Furthermore, the structuralist policy underlines the necessity to effect both functional and selective interventions for industrial development, and adopts selective interventions as its priority policy set. Consequently, the main process of technological change in late-industrializing countries is performed by acquiring and improving technological capabilities via particularly selective technological policies (Teubal, 2002). The success of strategic and elective industrial policies is underpinned at state freedom from the pressure of interest groups, and collaboration between state and private sector across common goals. The critical factor in these country experiences has been the state's ability to restrict the "market rationale", considered to be the fundamental resource allocation mechanism of neoclassical economics, in line with long-term priorities of industrialization based on the strategic vision of the state (Öniş, 1991). The traditional neoclassical economics custom has a critical approach to the interventionist state pattern, and stresses issues with this intervention including misallocation and productivity losses. Therefore, according to this approach, the core duty of the state in developing countries should be to set up

proper prices that would allow economic actors to act along true stimuli. However, as indicated in Amsden (1993), the state has routed the distribution of resources in these newly industrializing countries and intervened in relative prices by applying distinct incentives with a view to boosting investments and foreign trade, culminating in the formation of wrong prices. The decisive characteristic of newly industrializing Asian countries has been the behaviour avoiding entrusting resource allocation to the market mechanism as posited by neoclassical economics. One of the key factors of accomplished policies pursued in Eastern Asia has been the attempt to close the knowledge gap. These countries have not only resolved the issue of capital shortage but also staged conscious endeavours with the aim of employing modern technologies in production processes in awareness of current knowledge gaps between developed countries (Stiglitz, 1986:297). The companies tended to internalize foreign technologies transferred instead of directly employing them. Such technological learning process has constituted the foundation of technological skill base.

Finally, what underlie the success of late industrialization experiences observed outside Europe in twenty first century is strategic industrial policies based upon state and private sector collaboration. On the other hand, Asian economies have scored major growth achievements by implementing comprehensive industrial policies deviating from standard liberal policies besides these general principles (Rodrik, 2009). Indeed, similar policies were also practiced in Latin American countries in the import substitution period. However, the major difference between Eastern Asia and Latin America is not anything caused by industrial transformation led by state in one, and by the market in the other. The actual reason is that industrial policies formulated in Latin America are not as serious and interrelated as the policies in Eastern Asia, culminating in a poorly entrenched transformation in Latin America unlike Eastern Asia (Rodrik, 2009). East Asian countries attached major importance to setting vision on economic progress and targets in collaboration with private sector. Rather than a detailed planning based on state control, these countries have built development schemes with state acting as a catalyst (Stiglitz, 2010:302). Therefore, while the state is administering the industrialization process, it should pursue a strategy where private sector actors are strictly involved in the decision-making process. Such involvement process has offered opportunities to public and private sector in setting objectives and selecting the instruments to be employed to attain these objectives.

2.2. Latecomer Firm and Technological Upgrading Strategies:

The micro level analysis in my framework focuses on firms in latecomer economies. At the micro level resource-based view of the firm provides the analytical tools for analyzing

latecomer firm behavior (Mathews, 2002). Classical RBV theory was developed by Penrose (1959) almost half a century ago. She assumes that firms compete on the basis of internal "resources" that takes time to develop (Penrose, 1959). More recent contributions of RBV theory of the firm came from Barney (1986, 1991), Dierickx and Cool (1989), and Peteraf (1993). These studies assume that each firm is a collection of key resources and capabilities that determine a firm's strategy. Recent research in the RBV focuses on the dynamic aspects of capabilities (Kogut and Zander, 1992; Teece et al., 1997; Eisenhardt and Martin, 2000). Dynamic capabilities are conceptualized as firm's ability to build and/or extend basic capabilities in order to deal with changing environments (Teece et al., 1997). These firms are argued to be affected by the institutional context of their national economies and global producing networks and they effect the environment in which they operate.

The enterprises of countries in late industrialization process consequentially seem to be the latecomer firms of the global economy. Firms coming late due to historical conditions face significant restrictions in accessing different sources and technology in early period of articulation with global economy. These restrictions limit the access of these firms to foreign marketplaces. These firms strive to benefit from advantages such as low labour cost during initial periods with a view to catching up with leading companies and turning out to be a global trader. Therefore, latecomer firms have some advantages and disadvantages at the start up those leading and mature enterprises of current industry do not normally suffer. Opportunities that early comer firms have such as customer loyalty, scale advantages inducing learning effect, and smooth access to technology and strategic inputs constitute disadvantages for latecomer firms. In addition, remoteness to consumer markets with high level of income particularly in developed countries and to technology sources produced by various organizations (universities, research institutions, etc.), and the paucity of resources that the host country can allocate to infrastructure represent other major disadvantages. On the other hand, in addition to these disadvantages that latecomer firms suffer, they enjoy certain advantages brought by making late appearance in the industry. Of them, low switching costs that a latecomer firm has contrary to mature enterprises represent the foremost one. Economic life sees a rapidly changing set of tastes, preferences and production processes (Cho et.al., 1998). Mature companies cannot smoothly demonstrate skills of adaptation to environment during the whole rapid environmental transformation due to the process which the economics tradition calls "routinised behaviours" (e.g. Nelson and Winter, 1982). This situation offers advantages to latecomer firms for adaptation to new conditions. Additionally, latecomer firms have the opportunity to benefit from the knowledge externality and experiences of leading enterprises. In particular, mistakes committed by leading companies

during the early period constitute a knowledge source for latecomer firms without any cost burden. In addition, low-cost input sources available for newcomer firms constitute another major advantage (Cho et.al., 1998). As a result, latecomer firms make their appearance in the industry as accompanied with both disadvantages and some advantages (. For latecomer firms to catch up with leading enterprises of the industry, these firms should both cope with disadvantages associated with late coming and make good use of available advantages. Firms capable of successfully employing their dynamic skills and resources in hand catch up with leading enterprises and have the opportunity of technological upgrade. The major decisive factor in such technological upgrading process is to build up the technological skill based on learning process.

Decision on strategic decisions of latecomer firms for technological upgrading are the conditions surrounding the national economy in which these firms are involved as well as the global value chain composition of the industry concerned and the industry's technological regime characteristics. For its distinctive aspects, each industry presents separate technological upgrading paths for firms. On the other hand, states have the opportunity to manage the technological upgrading process along these paths through available selective policy instruments. The catching-up process displays a character dependent upon the path determined by historical facts and corporate relationships rather than being a linear and unidirectional route. However, by making good use of opportunities offered by national and industrial characteristics available to them in their operational domain, firms may pursue distinctive catching-up strategies.

Achievements scored by latecomer firms in global marketplaces have been discussed particularly within the context of Asian countries. Whether these catching-up strategies involve certain typologies or not is being explored. Analyses aimed at classifying these typologies are carried out on firm scale at micro level. However, since these classifications focus both on the characteristics of industries and the role of public policies during this upgrading process, they put into play the meso- and macro-level as well. To this end, Hobday (1995) developed a tripartite technological upgrading typology upon his researches on the Korean electronic industry. In this typology, firms go through three different phases, enhance the technological skills they gain at each phase and turn out to be pioneering players in the global marketplace. At the first phase, “Original Equipment Manufacturing (OEM)”, firms start by undertaking contact manufacturing or contracted installation jobs for the major buyer within an environment where detailed properties of the product design are provided. The second phase attained by the firms is defined as “Original Design Manufacturing (ODM)”. At this phase, firms enhance their product design capabilities in parallel to the skill growth introduced by learning dynamics, and upgrade to the

phase of design customization according to product specifications provided by buyer firms. The final phase is "Original Brand Manufacturing (OBM)" where the firm appears in global marketplaces with its own brand. Own brand development is the last step of the technological upgrading process. Thanks to the technological capabilities gained, firms initially standing as merely manufacturers become capable of producing under their own brands and entrust manufacturing jobs with low added value to their suppliers.

Wong (1999) criticized Hobday's typology for it generalizes the transformation in the electronics industry and suggests the process of manufacturing the own brand as a common final objective for all firms. Wong developed five different technological upgrading typologies predicated on the source-based firm approach arguing that firms can enter distinctive growth processes by mobilizing their specific sources (Wong, 1999:6-10).

1. Reverse Value Chain Strategy:

The tripartite technological upgrading model developed by Hobday constitutes the first typology of Wong's approach. Namely, firms evolve from the OEM phase to the OBM phase.

2. Reverse Product Life Cycle Strategy:

In this strategy that is a major type of the reverse value chain model, the latecomer firm may turn out to be a fast follower in the product market, close the gap between and even exceed the leading firm. Latecomer firms start with manufacturing mature products by either acquiring technology license or learning processes through mimicking. Initial products of these firms are those not containing state-of-the-art technologies and generally targeting low-opportunity market segments. Such sort of a market penetration strategy gives the firms the opportunity to preserve low-cost manufacturing advantages against the pioneer. With the development of mature products and process technologies, firms seek ways to manufacture more technology-intensive products. As a result of following the development path of the technologically pioneer firm through highly-concentrated learning processes and mimicking its R&D operations, the firms start to close the technological gap between the pioneer firm. For this upgrading process to come up with success, unlike the reverse value chain model, the firm has to develop its product and process technologies simultaneously. The Japanese and Korean automotive and telecommunications industry may be suggested as an example to such kind of an upgrading strategy.

3. Process Technology Pioneering Strategy:

So as to avoid the risks caused by investments for product development, branding and marketing to be made with the aim of producing their own brands, the firms may specialize in production processes and adopt only the specialized producer status. The firms may turn out to

be specialized producers by means of acquiring the latest process technologies and employing these capabilities in production processes such that the best performance demanded by the market is demonstrated instead of allocating resources to product development technologies. Firms need process R&D efforts to become technology pioneers. Best example to this strategy is the production-specialized electronic suppliers active in Singapore.

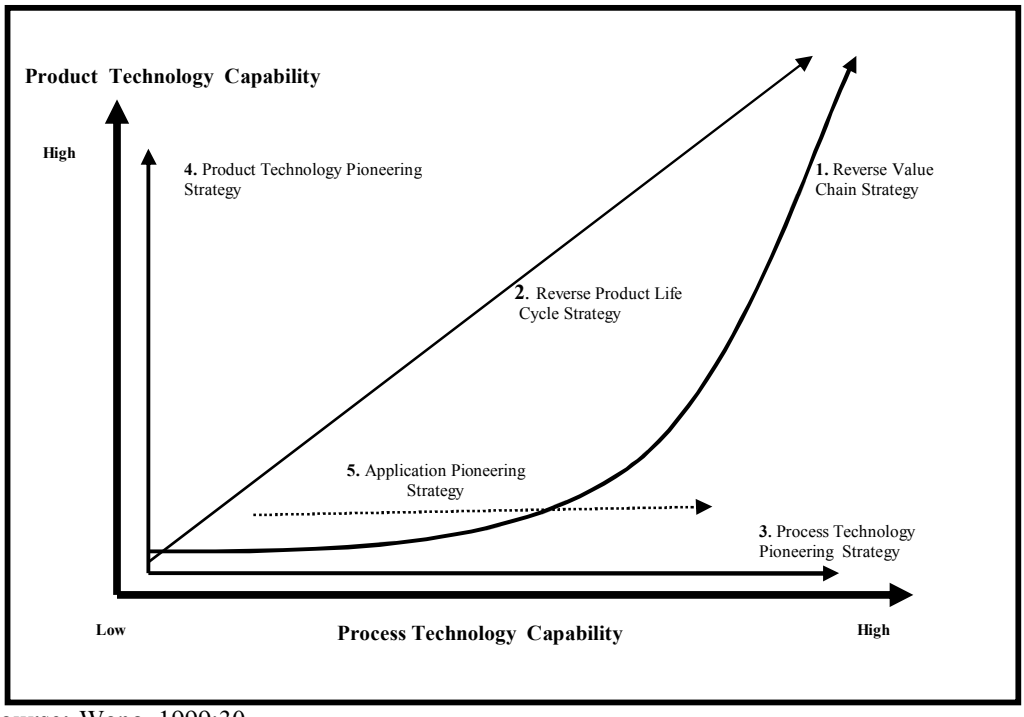
4) Product Technology Pioneering:

In developing countries, most of the firms tend to avert from a process as tough as developing product technologies. This strategy is characterized with the common behaviour of the firms to endeavour to outdistance each other through the products they develop thanks to radical product innovations, or to enhance their existing products across progressive innovations.

5) Application Pioneering Strategy:

In this strategy, firms head towards technological upgrading through adapting current technologies to new areas instead of acting in new product areas.

Figure 2: Generic Technological Capability Development Strategies of Latecomer Firms from Late Industrializing Economies



Sourse: Wong, 1999:30

Such distinctive development strategies may display transitions throughout the process. The thriving latecomer firms of East Asia have implemented the policy sets of different strategies at different times. While some firms switch to a strategy from one another in the course of time,

most prefer pursuing the same strategy in the long-term. Implementing different strategies as a whole would provide mutual benefits due to the relationships of complementarities. Clustering of the firms capable of demonstrating technological upgrading of a country in a certain industrial line, and enhanced position of that country's firms in the global value chain may be described as the occurrence of technological upgrading at industrial level. For instance, technological upgrading achieved by certain Korean firms such as LG and Samsung in the electronics industry trigger the technological upgrading of the Korean electronics industry as a whole. While this industry turns out to be one of the major sectors of the country in terms of value added generated and employment export income, decisive standing of domestic firms in global value chain also makes it possible for the Korean state's decisions for supporting these firms as a whole to act on the governance composition of the value chain.

2.3. Sectoral System of Innovation and Technological Upgrading from Late-Industrializing Perspective:

Sectoral System of Innovation approach provides theoretical background for meso-level conceptualization for technological upgrading. Some studies in the literature adopt a perspective that focuses on the relationship between "sectoral specificities" and "value chain governance" while analyzing upgrading (Humphrey and Schmitz, 2000). A SIS is a set of new and established products for specific uses and the set of agents carrying out market and non-market interactions for the creation, production and sale of those products. "A sectoral system has a knowledge base, technologies, inputs and an existing, emergent and potential demand" (Malerba, 2004: 16). The SIS approach contributes to the crucial idea that regarding all technological or sectoral systems as homogenous is not true. In SIS perspective, the conditions for innovations; one industry in one country has much more in common with the same industry in another country than with another industry in its own country. Moreover, SIS approach suggests that different industries may not have only different competitive advantages, interactive and organizational boundaries but also different sources of innovation and users' needs (Chang and Chen, 2004: 22).

As a result, it is claimed that there are two starting points about industrial sectors (Malerba, 2002):

1. Sectors are characterized by specific knowledge bases, technologies, production processes, complementariness, and demand by a population of heterogeneous firms and non-firm organizations and by institutions.
2. Sectors greatly differ from each other in several of these dimensions.

All innovation systems have building blocks. Sectoral innovation system is composed of three main building blocks **(**Malerba 2004:10-12):

a. Knowledge and technological domain

b. Actors and networks

c. Institutions

a. *Knowledge and technological domain:*

Any sector or industry could be characterized by a specific knowledge base, technologies and inputs. All of them shape the dynamics of a SSI and its spatial boundaries s defined as a technological regime (Breschi and Malerba, 1997: 132).It is composed by the opportunity conditions (likelihood for innovations), the appropriability conditions (possibilities of protecting innovations), the cumulativeness of technological knowledge (relation between today's and future innovation in specific sectors and along technological trajectories) and the relevant knowledge base. The latter relate the nature of the knowledge leading innovation at firm level. It involves various degree of specificity, tacitness, complexity. Each sector operates under a different regime. In respect to spatial aspects they emphasize the geographical concentration of innovators and their 'knowledge spatial boundaries', the search space for relevant knowledge that firms require for their innovation process Technological which regime is the main determinant of sectoral pattern of innovation coming from Schumpeterian tradition .Schumpeterian legacy focus on differences market structures and innovation dynamics among industries (It summarize in Table 1). Technological regime can be divided into two main types as Schumpeter Mark I and Schumpeter Mark II. Schumpeter Mark I is characterized by "creative destruction" with technological ease of entry and a fundamental role played by entrepreneurs and new firms in innovative activities. Schumpeter Mark II is instead characterized by "creative accumulation" with the prevalence of large established firms and the presence of relevant barriers to entry to new innovators (Breschi, et al, 2000:388).

b. Actors and networks.

A sector is composed of heterogeneous agents that are organisations and individuals (e.g. consumers, entrepreneurs, scientists). Organisations may be firms (e.g. users, producers and input suppliers) and non-firm organisations (e.g. universities, financial institutions, government agencies, trade-unions, or technical associations), including sub-units of larger organisations (e.g. R-D or production departments) and groups of organizations (e.g. industry associations) (Malerba,2006).

Table 1: Schumpeterian Modes of Technological Regimes

	Schumpeter Mark I **Creative Destruction**	**Schumpeter Mark II** **Creative Accumulation**
Fundamental Factors of Technological Regimes	• High opportunity conditions • Low appropriability conditions • Low Cumulativeness (Firm level) • Knowledge base (specific, codified, simple)	• High opportunity conditions • High appropriability conditions • High Cumulativeness (Firm level) • Knowledge base (generic. tacit, complex)
Main Features of Industry	• Low concentration of innovative activities • Many innovators • Highly turbulent population of innovators • Many SMEs • High entry to industry • Low concentration of capital • High instability in the hierarchy of innovator	• High concentration of innovative activities • Few innovators • Rather stable population of innovators • Large scale firms • entry barriers to industry • High concentration of capital • Stability in the hierarchy of innovator
Source of Technological Change	• Entrepreneur-based technological change	• Routinized technological change,
Examples	• Machine Tool • Fabricated Metal Products Industry • Furniture Manufacturing Industry • Textile and Apparel Industry	• Chemical Industry • Automotive Industry • Electric Machine Industry
Root Literature	Schumpeter (1912) ; Schumpeter (1928)	Schumpeter (1942)

Source: Prepared from Breshi and Malerba 1997, Malerba and Orsenigo 1995, Audretsch 1997

c. Institutions:

Institutions are defined by North (1991) as "t*he humanly devised constraints that structure human interactions"*. They involve formal constraints (e.g rules, laws, and constitutions), informal constraints (e.g norms of behavior, conventions, self –imposed codes of conduct) and their enforcement characteristics". (North, 1994: 360). Institutions have important affects on economic performance through history. Three sets of institutions are defined in SSI) .Institutions deal with the provision of the basic good use in innovation activities namely scientific and technological knowledge (The System of Intellectual Property Rights) and organize the financing of innovations and corporate governance mechanisms in innovations (Financial market or banks) finally it concern with the provision of human resources and the ways that can be used

in different industrial relation systems (Labour market regulations, Education system). (Coriat and Weinstein 2004: 332)

These building blocks approach draw broad framework for understanding sectoral development dynamics which would aid policy formulation from economic development perspective. The most important conclusion of his approach emphasizes on the need for sector-specific technology policies which should aim to build SSI in selective industries. SSI as a development strategy provides various policy tools for increasing innovation capacity at sectoral level. In sum, because of technological spillover, SSI especially in science-based sectors, accelerates not only sectoral performance but also whole economic performance.

As a result, different industries have different technological regimes and sources of innovation. For this reason, designing sector specific policies is required. These sector specific policies are also influential on upgrading Global Value Chain. GVC based analysis provides an analytical framework which heeds to the structure and power relations within a network of firms involved in the development, production and marketing of a product(s) created in a global production system (Gereffi and Korzeniewicz 1994; Gereffi, 1994; 1999; 2003; Gereffi et al.2005).“*The value chain theory of governance suggests that relationships between leading firms and suppliers differ across sectors due to the particular characteristics of the production processes and the organization of the sector, such as the sophistication and availability of the technology involved, the existence or absence of (technical and process) standards, and the extent to which rapid turnaround time or speed to market is essential to competitiveness”* (Bair, 2005: 163). The goal is to explain variation across sectors in terms of how global production is organized and managed and how firms improve their technological level. In this framework, technological upgrading of late-comer firm is achieved through learning dynamics and technological capability building. This global business environment provides context for firms in which they can make technological upgrading in global value chain by using dynamic capabilities. Gereffi *et al*. (2005) attempted to develop a typology of five governance structures that describe the network relationships linking suppliers in global industries to lead firms. This typology is based on the possible combinations resulting from variations (measured as ‘low’ or ‘high’) in three independent variables: the complexity of transactions, the codifiability of information and the capability of suppliers. The value chain theory of governance suggests that relationships between leading firms and suppliers differ across sectors due to the particular characteristics of the production processes and the organization of the sector, such as the sophistication and availability of the technology involved, the existence or absence of (technical and process) standards, and the extent to which rapid turnaround time or speed to market is

essential to competitiveness. The goal is to explain variation across sectors in terms of how global production is organized and managed and how firms improve their technological level (Bair, 2005: 163).

GVC framework, in addition, is fruitful for the crafting of effective policy tools concerning industrial upgrading. The concept of upgrading—making better products, making them more efficiently, or moving into more skilled activities—has often been used in studies on competitiveness (Kaplinsky and Morris, 2001; Porter, 1990).Following this approach, upgrading is decisively related to innovation. So upgrading is defined as innovating to increase value added. Enterprises achieve this in various ways, such as, for example, by entering higher unit value market niches or new sectors, or through undertaking new productive functions. The concept of upgrading may be effectively described for enterprises working within a value chain, where four types of upgrading are singled out (Humphrey and Schmitz, 2000):

- Process upgrading is transformation of inputs into outputs more efficiently by reorganizing the production system or introducing superior technology (Schmitz, 1999).
- Product upgrading is moving into more sophisticated product lines in terms of increased unit values (Gereffi, 1999).
- Functional upgrading is acquiring new, superior functions in the chain, such as design or marketing or abandoning existing low-value added functions to focus on higher value added activities (Bair and Gereffi, 2001).
- Intersectoral upgrading is applying the competence acquired in a particular function to move into a new sector. (Humphrey and Schmitz, 2002).

4. A Comparative Analysis of Automotive Industry between Korea and Turkey:

4.1. The South Korean Automotive Industry: Development and Current Situation

Today, the Korean economy stands out with its taskforce functioning as research and development-oriented and its highly sophisticated industrial infrastructure in plenty of fields ranging from textile to chemistry, from heavy industry to IT technologies (Chung, 2003). While standing as a basically underdeveloped country in late 1950s, Korea today displays the position of a country manufacturing state-of-the-art products to every corner of the world through a thriving growth strategy. The review of Korea's economical development process reveals three major factors underlying this achievement. These are the state's inarguable role in shaping the

business world, the finance system under stringent control of banks, and the monopoly created by prominent family enterprises called cheabol[1] (Hahm, 2003:79).

The Korean[2] state intervened in resource distribution through industrial and technological policies it pursued. Investment schemes developed through state coordination determined the priorities of long-term development plans. All incentives extended by the state to the private sector were tied to distinctive performance criteria, and state consistently transferred data to the private sector through the technical competence framework it has. Such kind of competence exchange has allowed efficient data transfer through social networks built between the private sector and public institutions. The state made available to chaebols both its financial resources and loans acquired from the abroad through state banks at interest rates that are much favourable compared to the free market. Consistently receiving incentives through various mechanisms, chaebols started to control the Korean economy. Chaebols became the driving motive for industrialization in labour-intensive sectors particularly during the initial phases of the industrialization process. And Korean state supported the set-up of Cheaobol-type enterprise organizations for the sake of ensuring rapid economical development. Such kind of enterprises attract the best trained and qualified human source, and enjoy major advantages in technology transfer, assimilation of the technology transferred, and financing. In addition, as Cheabols incorporate several subsidiaries, they could avail of cross-financing opportunities by reflecting a particular profit derived through a subsidiary involved in a sector into another sector for investment purposes (Won-Young, 2000).

Thanks to the organizational, technical and financial sources they have, these giants assumed critical roles in the international expansion process of the Korean economy.

The development quest of Korea displayed an evolution from imitation to innovation. Throughout its development process where we initially see efforts for imitating products in developed countries, Korea proceeded with putting forward an authentic model without dependency to foreign investors, and prioritizing the learning of technology (Mathews, 1999). Methods including endeavours to figure out the technology product, workbenches and machines through reverse engineering were also employed in technology development. Local research and development initiatives played a decisive role in enhancing the technological know-how acquired

[1] The chaebol are the large, conglomerate family-controlled firms of South Korea characterized by strong ties with government agencies. The chaebol means "business association" in Korean language. There were family-owned enterprises in Korea in the period before 1961 but the particular state-corporate alliance came into being with the regime of Park Chung Hee (1961-1979). Park modeled this arrangement on the zaibatsu system which developed in Japan during the Meiji Era. There were significant differences between the zaibatsu and the chaebol, the most significant of which was the source of capital. The zaibatsu were organized around a bank for their source of capital. The chaebol in contrast were prohibited from owning a bank.

during the early period. Particularly throughout the process to date since 1980s, both the noteworthy rise in R&D expenditures and rapid switch to advanced technological products yielding high value added in both production and export buttressed these developments in the R&D system (Hobday et. al., 2004).

Table 2: The Current Status of Auto Manufacturers in Korea (2010)

	Hyundai	Kia	GM Korea*	Ssangyong Motor	Renault Samsung**
The year of foundation	1967	1944	2002	1954	2000
Initial License for Production	--	Ford&Mazda	Honda	Mercedes-Benz	Nissan
Location	Ulsan, Jeonju, Asan	Gwangmyeong, Hwaseong, Gwangju	Gunsan, Changwon, Bupyeong	Pyeongtaek, Changwon	Busan
No. of employees	56,482	32,599	17,030	4,698	7,582
Types of vehicles produced	Passenger cars, SUV, CDV, buses, trucks, CSVs	Passenger cars, SUV, CDV, buses, trucks, CSVs	Passenger cars, CDV,buses, trucks	Passenger cars, SUV	Passenger cars, SUV
Sales (KRW billion)	36,769	23,261	12,597	2,070	5,168
Net income (KRW billion)	5,267	2,254	586	8	36
Production capacity(Korea, 1,000 units)	1,858	1,580	915	110	30
Production (1,000 units)	1,743	1,417	744	80	275
Domestic demand (1,000 units)	660	485	126	32	156
Exports (1,000 units)	1,073	920	611	48	116
Overseas factories	China, India, Turkey USA, Czech Republic	China, Slovakia, USA	-	-	-

* Daewoo Motors (established in 1972) was bought by General Motors Corporation in 2002 and the company was renamed GM Daewoo. GM Daewoo renamed itself to GM Korea in 2011, all GM Daewoo products are sold in South Korea as Chevrolets. **Samsung (1998) sold a seventy percent stake in the company to Renault in September 2000, and the company was renamed Renault Samsung Motors

Source: Korea Automobile Manufacturers Association (KAMA), *2011 Korea's Automotive Industry*

The automotive industry has a special standing in this highly-accomplished industrialization experience of Korea. After USA, Europe and Japan which one can depict as the prominent base of the automotive industry, Korea is the first country to build up an automotive industry staging a

global brand. Through policy sets based upon the internalization of learning processes and targeting the development of technology, South Korea has turned out to be a global manufacturer in the automotive industry (Kim, 1998). Current progress attained by Korea in the global automotive market pushed the country to the fifth rank after China, USA, Japan and Germany in the classification of prominent global manufacturers with a manufacturing capacity of 4,657,094 vehicles as at 2011. The biggest automotive giant of Korea, Hyundai-KIA is ranked fourth after Toyota, GM and Volkswagen among biggest automotive enterprises of the world with a total manufacturing capacity of 5,764,918 vehicles as at 2010 (OICA,2011). The Korean automotive industry owes this achievement to an industrial development plan well managed by the state from the very beginning.

In the Korean automotive industry, the first prominent step was taken when the Five-Year Plan for the Car Industry was elaborated in 1962. So as to support this plan, the state enacted the Car Industry Conservation Law on the same year. The plan introduced rules as to penetration into the automotive sector, car and spare part quality, regulation of production costs, prohibition of car imports and duty-free imports of replacement parts not domestically manufactured. Furthermore, the state imposed the rule requiring majority share of domestic manufacturers for car assembly, and paved the way for the foundation of the Korean Car Manufacturers Society. The maiden car assembly plant was put into play under technical collaboration with Japan's Nissan, and started production in 1962. The state selected one manufacturer for the manufacturing of each of low and medium-volume car segments and diesel engines.

The “Car Industry Development Plan” was proclaimed in 1964. Regulations proposed in the plan included associating spare part manufacturers with a single assembler, state subsidies for spare part manufacturers, and requirement for the domestic demand to be met by a single assembler. In 1966, the domestic contribution tariff was elaborated, and incentives were associated with domestic contribution rates. In 1967, the assembler monopoly was liquidated, and other firms were also allowed to set up assembly lines. However, the requirement ruling that firms should be linked with developed countries to set up an assembly line was imposed. Same year, foundation of Hyundai Motor Company was permitted subject to the requirement of setting up a car plant under cooperation with Ford. In 1969, the "Master Subsidy Plan for the Car Industry" was proclaimed. The plan suggested the set-up of a motor plant, car body construction, manufacturing of spare parts fully by domestic producers, and development of a single car model. In the plan, estimated schedule of fully domestic manufacturing would be 1972 for small cars, and 1974 for standard cars (Green, 1992).

When efforts for collaboration with foreign firms failed, Hyundai, commissioned with the mission to upgrade the automotive sector, decided to develop its own model in 1973, and transferred technology from Japan's Mitsubishi for manufacturing 1,2 l engines. The "Long-Term Car Industry Plan" was adopted. The plan was suggesting a domestic contributory share of more than 90% in late 1970s, and the rise of a pioneering export industry in early 1980s. Passenger car manufacture was limited to three companies. Import of parts that can be domestically manufactured at a satisfactory level of quality was banned. Through technologies transferred from Japan, UK and Italy, Hyundai succeeded to manufacture the maiden Korean car, Pony, in 1976. Korea started to export cars below cost due to market failure. Late 1970s saw the export of Pony cars to a vast global network of 46 countries primarily represented by developing countries. Starting with the second half of 1980s, Hyundai, developing its design technology in Excel, succeeded to market Accent, its own model, to the whole world under the affordable car segment. 1980s saw the globalization of the Korean automotive industry (Kim, 1998).

Table 3: Spiral Process of Organizational Learning In Catching-up a Hyundai Motor

	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**
Cars produced	Ford Cortina	Pony	Excel	Accent
Technology mastered	Assembly technology	Initial design technology	Deepening design technology	Own design
Time period	1967–1976	1973–1985	1980–1994	1984–1995
Learning Stages				
Preparation	Poaching experienced personnel, literature review, observation tours	Literature review observation tour, hiring foreign expatriates	Literature review observation tour	Poaching scientists literature review
Acquisition	Packaged technology transfer, hiring foreign expatriates	Unpackaged technology transfer	Unpackaged technology transfer	Acquisition by research overseas R&D, hiring foreign Expatriates
Assimilation research	Learning by doing	Learning by doing	Learning by doing	Learning by research
Improvement/Application	Learning by doing	Learning by doing	Learning by doing	Learning by research

Source: Kim, 1998:514

In 1986, Japan introduced voluntary export restrictions under the pressure of the US state. Such practice emerged as a major opportunity for Korea, and the country scored a substantial growth within the US market in the low-cost vehicle segment.

After the development of the first own-design vehicle, Hyundai, the steam engine of the Korean automotive industry, prioritized in-house R&D efforts. In particular, the R&D investments towards the development of the engine technology played a decisive role in the success of the catching-up strategy. What underlies the technological upgrading process achieved by the Korean automotive industry under the leadership of Hyundai is the assignment of a great deal of resources to R&D projects directed to a particular objective. Through its R&D project for engine development, Hyundai managed to catch up with pioneer enterprises in the industry. At the time the engine development project was inaugurated, the carburetor-based engine technology was a standard in the world. However, across the awareness that the growing trend is in favour of injection-based engine technology, the firm devised a R&D initiative oriented towards developing this sophisticated engine. When this R&D project came up with success, the then current engine technology gap between the pioneer enterprises of the sector could be closed in a short time (Lee and Lim 2001).

By applying consistent, systematic and well-targeted interventions in the sector, and implementing sector-specific exhaustive industrial policies, the state supported the learning processes in the sector and ensured the internalization of the technology. For instance, when the Asian Motor company suffered a financial trouble in 1976, the state induced pressure on KIA to acquire this company with a view to pulling the latter out of the passenger cars market. Again with a similar method, the state inhibited the collective investment scheme proposed between Samsung and Chrysler. The strategic standing of the sector in favour of country's development led to inhibition by state of the decisions of companies that would result in the deviation of long-term development plans.

During the period of support, the Korean state and the officials of economy bureaucracy collectively employed distinct policy instruments to convey the industry to long-term development targets. Such policy practices were pursued and finalized along a particular sectoral plan. Policies aimed at routing the sector are determined also by external global dynamics. Nonetheless, in the Korean case, this situation has not caused a weakening administrative capacity of the state. For instance, the Korean state put into play a scheme for the liberalization of foreign trade scheme to kick off a trade war with USA. The officials of the Ministry of Trade and Industry advised the firms on and preliminarily prepared them for the prospective liberalization and deregulation period. In addition, triggered by liberalization in foreign trade in 1980s, the customs tariff rate of 200% on passenger vehicles was dropped below 15% in 1990s, yet the conservation of domestic trade remained under conservation through non-tariff hurdles against foreign luxury vehicles (Erdoğdu, 1999:65). In the Korean automotive industry

demonstrating a substantial enhancement through successful cooperation between the state and private sector, overseas expansion speeded up in 1990s. Triggered by liberalization policies put into play during this period, automotive firms financed their increased capacities through borrowing, yet close state relationships with chebols accelerated the borrowing process. The Asian crisis that broke out in 1997 severely impacted the sector. The industry again went into a restructuring depending on mergers and acquisitions under tough conditions revealed by the financial crisis. Hyundai acquired KIA experiencing financial issues followed by the acquisition of Daewo Motor by US GM, changing its title into GM Korea. And Samsung Motor went into a partnership with France's Renault (KAMA, 2011). Thanks to the acceleration brought into existence by merger with Hyundai and Kia turned out to be the fourth biggest global manufacturer and named to be a prestigious brand with its new vehicles of different segments globally marketed. A prominent indicator of the success achieved by the automotive industry of South Korea, Hyundai developed its own-design car and turned out to be a global car manufacturer.

4.2. Turkish Automotive Industry: Development and Current Situation

During the industrialization process, the state intensively intervened in economy in Turkey too. Through the protectionism and other macro-economic policy instruments applied particularly during the period between 1960 and 1980 called as the import substitution industrialization era, the state intervened in the resource allocation mechanism (Şenses, 1989). However, like in the Latin American countries case, no performance criteria was sought in incentives granted in Turkey. No private sector-public cooperation network that would be capable of setting the balance between the short-term profit impulse of private sector and the developmental state's long-term quest for financial development could be established, and profits generated through interventions in resource allocation mechanism were shared in the private sector depending on relationships with the political government (Öniş, 1992). Such disunity of the state and the private sector, and autonomous nature of economy bureaucracy avoided guiding the economy across long-term strategic targets. On the other hand, while state imposed customs tariffs for the whole economy, it did not opt to implement an industrial policy targeting any strategic sector, but pursued functional policies instead. With liberalization policies kicked off in early 1980, the developmental state paradigm was abandoned and the neo-liberal policy set with its genesis in the “Washington Consensus” was put into play instead. Weak incentive practices far from catching up with the technological breakthrough prevailing around the globe and targeted to sectors that might boost the international competitive edge exhibit the state's failure to

devise strategies and plans in line with development priorities (Atalay and Turan, 2003). Industrial policies followed by the state were concentrated on the redistribution of profits generated instead of focusing on learning dynamics that would elevate the technological skill level. For this reason, private sector enterprises headed towards rant-seeking behaviors rather than building strategies aimed at long-term technological transformation (Öniş, 1998). This situation transformed the Turkish industry into a rather foreign-oriented state; culminating in the fact that overall development of the country was guided by decisions taken by prominent firms of pivotal developed countries. In other words, industrialization proposed by this model occurred in the form of specialization in manufacturing industry activities abandoned by advanced countries like in the "Product Life Cycle Theory" developed by Raymond Vernon (Vernon, 1963). In 1980s, Turkey became the production and export base of textile and garment industry discontinued by developed countries, and then a automotive manufacturing and export base in the second half of 1990s as a result of the fact that global enterprises shifted their manufacturing processes within the automotive industry to developing countries. However, such industrialization patterns taking place in Turkey appeared as a derivative result of new "division of labour" processes occurring in the global manufacturing system rather than being a crop of the domestic technological effort and national industrial policies. Following this industrialization model, the Turkish automotive industry scored a progress in another development path of the Korean automotive industry.

The Turkish automotive sector is one of the economy's pioneering sectors. It is highly international and around 76 percent of Turkish vehicle production in 2011 was exported, mainly to Europe. Turkey produced 1,124,982 motor vehicles in 2010, ranking as the 7th largest automotive producer in Europe; behind Germany (5,819,614), France (3,174,260), Spain (2,770,435), the United Kingdom (1,648,388), Russia (1,508,358) and Italy (1,211,594), respectively (AMA, 2011). There are currently 14 passenger and commercial vehicle manufacturers in the country, in addition to two main tractor manufacturers. The total capacity of the OSD members amounts to 1,561,155 vehicles as of 2010. These manufacturers, together with the spare part producers, employ more than 265,000 people, ranking in the top 10 globally. The four main producers are Ford Otosan (US; mainly Transit commercial vehicles); Oyak-Renault (France;passenger cars only); Tofas, a joint-venture between Fiat (Italy) and the Koc Holding conglomerate (mainly LCVs and also passenger cars); and Toyota (Japan; passenger cars). The four main manufacturers accounted for approximately 88 percent of all vehicles manufactured in Turkey in 2010.

Table 4: Auto Manufacturers in Turkey

Manufacturers	The Production Place	The year of foundation	License for Production	Foreign Capital (%)	Operation Type	Types of vehicles produced
A I O S	Kocaeli	1966	Isuzu	29,74	JV	Pick Up, Midi-Bus
ASKAM	Kocaeli	1964	Hıno	0	License	, trucks, LCV
B M C	İzmir	1966	--	0	License	buses, trucks, MCV
FORD OTOSAN	Kocaeli Eskişehir	1983	Ford	41	JV	Passenger cars, trucks, LCV
HONDA TURKEY	Kocaeli	1997	Honda	100	FDI	Passenger cars
HYUNDAI ASSAN	Kocaeli	1997	Hyundaı	70	JV	Passenger cars, LCV
KARSAN	Bursa	1966	Peugeot, Hyundaı	0	License	buses, trucks, MCV
MAN TURKEY	Ankara	1966	Man	99,9	FDI	buses, trucks,
M BENZ TURKEY	İstanbul	1968	Mercedes Benz	85	JV	buses, trucks
OTOKAR	Sakarya	1963	Deutz,Landrover	0	License	buses, trucks, CDV,
OYAK RENAULT	Bursa	1971	Renault	51	JV	Passenger cars,
TEMSA	Adana	1987	Temsa,Mıtsubıshı	0	License	buses, trucks
FIAT TOFAŞ	Bursa	1971	Fiat	37,8	JV	Passenger cars ,CDV
TOYOTA	Sakarya	1994	Toyota	100	FDI	Passenger cars, buses, trucks

Source: Automotive Manufacturers Association (AMA)

In Turkey, the automotive sector started manufacturing in the midst of 1950s, and the manufacturing process started to pick speed in midst 1960s. After the manufacturing of some prototype vehicles in 1950s, the first assembly line was set up for the supply of jeep and pickup trucks to armed forces in 1954, followed by truck and then bus assembly in 1955 and 1963 respectively, and assembly plants manufacturing passenger cars (Tofaş-Fiat, Oyak-Renault, Otosan-Ford) started their fabrication activitie within the following three years (Demirer and Aydoğan, 2006). In 1966, the automotive industry started the assembly of its own designs, and the maiden domestic car of that period "Anadol" was manufactured by Otosan. Two major car manufacturers, Tofaş and Oyak-Renault set up their manufacturing lines in 1971 under Italian and French licenses respectively. At the beginning, an import substitution assembly industry was

at the focus. During this period, the domestic market was protected through high customs tariffs, and great majority of the manufacture was devoted to the domestic market. While investments grew the manufacturing capacity of the sector, firms involved in the subsidiary industry started to manufacture the parts previously imported. The sector started overseas expansion in parallel to the liberalization policies implemented in 1980s (Çetiner 1996). State support for the automotive industry started to recede in the second half of 1970s. As a result of the abandonment of import substitution policies in early 1980s and liberalization of the economy, state's role as a guiding actor in economy started to decline. Industries failing to satisfactorily compete in parallel to the abandonment of the developmental state paradigm in Turkish economy headed towards foreign competition, and foreign trade rise in some labour-intensive sectors could only be ensured through incentives. The market role started to rise versus the diminishing state role in resource allocation, and the Turkish automotive industry was shaped not by long-term development objectives but by strategic decisions of global own brand manufacturers in this framework (Tuncel and Olmezogulları, 2011).

Number and production capacities of key industry firms displayed a consistent rise until early 1990s thanks to a strong domestic trade. Through direct investments of global manufacturers such as Toyota, Honda and Opel, the sector started to flourish. And prominent enterprises such as Fiat, Renault and Ford started to acquire the shares of domestic key industry firms. Starting with 1990s, export opportunities rose, yet the 1994 crisis led to a severe shrinkage in the sector (Duruiz, 1999).

The period when the Turkish automotive sector started to become integrated with the global manufacturing system commences with the execution of the Customs Union Convention in 1996. As a result of the shrinking domestic demand due to the impact of the 1994 crisis, domestic manufacturers started to head towards foreign markets (Mckınsey Global Institute, 2003). The sector underwent a strategic transformation and an export-oriented strategy was kicked off. Depending on this strategy, domestic manufacturers followed the global manufacturing system and displayed a faster integration (Azcanli, 1995). Driven by the factors such as proximity to Europe, export potential, qualified taskforce, the sector turned out to be the steam engine of export today. Today, the key automotive industry hosts 18 firms. Almost all of these firms manufacturing cars, light-weight commercial vehicles, heavy commercial vehicles, buses and tractors perform under the license of a foreign giant.

Since the automotive industry was incorporated in the form of an assembly industry of the global own brand manufacturers resident in Turkey, and as its progress took place along the path designated by the initial conditions upon corporate structure, it set its sight on manufacturing

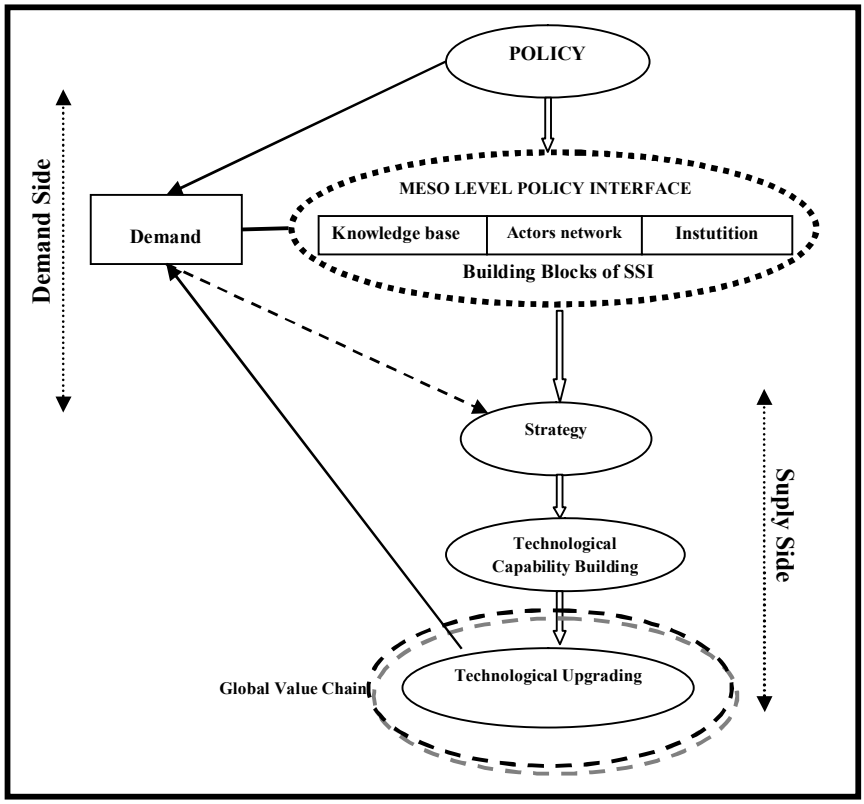
cheap and low-quality vehicles directed to the national domestic market instead of creating a global brand. This vision led to the panorama that, as triggered by overseas expansion starting with the second half of 1990s, the Turkish automotive industry manufacturing under the license of global firms transformed into a manufacturing base shaped in line with the decisions taken by these players instead of a global actor.

4. An Assessment of Technological Upgrading from the conceptual SSI Framework: S Korea and Turkey

The reasons underlying the deep difference between automotive industries of Korea and Turkey with respect to their current progress worldwide will be analyzed by means of the model developed around the sectoral innovation system. As mentioned earlier, the data infrastructure of an industrial innovation system is made up of actors, networks and institutions. Besides this composition, demand to the products of the industry also constitutes a major component of the system. It is argued according to the multi-level approach suggested within the framework of the study that, a technological upgrading process is determined by the sectoral system dynamics of the industry concerned besides macro policy sets and strategic decisions of firms. As illustrated in the Figure 3, the effect of policies in the technological upgrading process on sectoral level is based on how efficient the innovation system is as an interface.

Each technological upgrading process will emerge from the interaction of supply and demand (Xi et al. 2009). In the sectoral innovation system, demand should not be perceived merely as the simple aggregate of the mass of consumers or similar buyers, but as the combination of heterogeneous agents interacting with producers through different means (Malerba, 2006:391). Therefore, it may be depicted as a factor that is both influenced by the policy and also routing the technological development in the sector through effecting strategic decisions of the firms. The supply side of the upgrading process is constituted by the growth of firms based on different set of skills and resources. Macro policies and their meso-level influence channels have impact on the technological skill build-up of the firms. Factors having impact on different development performances of the Korean and Turkish automotive industry are summarized below across this conceptual framework.

Figure 3: The conceptual SSI Framework of Technological Upgrading



Source: Prepared by utilization from Xi et al. 2009 and Tuncel & Olmezogulları, 2010

4.1. Sectoral Latecomer Strategies of S Korea and Turkey: Upgrading vs. Lock-in

The trend of the global automotive industry outside developed countries displays a shape that may basically be discussed by two development path. While the first path involves countries pursuing a successful strategy to catch up developed countries and turning out to be global producers with their own proprietary brands (for example S.Korea, and partially China and India), the second path hosts countries abandoning the import substitution policies and demonstrating the achievement of integrating its key industry set up in the form of joint ventures, and the subsidiary industry surrounding it, into the global production system as a production base (for example South Africa, Brazil, Turkey, Czech Republic). While the share of research and development, and design in value added generated throughout the production process consistently rises, the share of manufacture gradually shrinks. Therefore, those dominating the processes of R&D, production of the idea, and design have the capability to deploy the manufacturing phase of production in any segment of the world that best suits their interests. For this reason, development orientation of the automotive industry in countries involved in the second group is shaped based on strategical decisions of the global licensor giants.

While the South Korean automotive industry has turned out to be a prominent producer running its own global brand, the Turkish automotive industry rather reveals a profile of being the production base of global enterprises. The foremost reason underlying the Turkish automotive industry's failure to display technological upgrading as successful as the South Korean case is the lock-in dynamics of the path taken by the industry at the initial conditions (organization and institutional structure).[3]

The Figure 4 comparatively illustrates the development paths respectively followed by the Turkish and South Korean automotive industries. Of strategies discussed by Wong (1999), the one studied within the context of development strategies for the Turkish automotive industry was implemented by South Korea before, yielding a co-development of process and product technology. Korean automotive industry has pursued the "Reverse Product Life Cycle Strategy" as its development strategy. The root motive of this achievement should be explored in the development policy pursued by that country. Instead of implementing policies as to the whole economy, the state focused on strategic industries and implemented selective policies for flourishing them. Support extended to major enterprises involved in the automotive industry along this prospect has been decisive in the evolution of the industry. Like in the case of Hyundai, the paramount enterprise of the Korean automotive industry today, major licensor firms start manufacturing through mimicking across the vision of developing their own cars rather than standing as installers. Driven by the technological capability background supported by local technological efforts, the firms managed to start developing their own designs. Throughout this period, the state has intervened in the market and assumed a regulating and guiding role across long-term development objectives of the industry.

On the other hand, the Turkish automotive industry has pursued the "Reverse Value Chain Strategy" as its development strategy. It is obvious that, rather than being a designed preference, this represents a development process dependent upon the path shaped by initial conditions Major firms of the Turkish automotive industry were set up through license contracts and started their initial operations on a limited facility scale in line with import substitution policies. Through means of conservation provided by the state, a subsidiary industry surrounding the main industry appeared with a view to nationalizing the inputs employed in production. The subsidiary industry starting to flourish kept running on an inferior scale and at a low technological level.

[3] All development paths which have path dependent features, relate beginnings condition of system. For instance if a firm (or group of firm) select a specific innovation or technological upgrading path at the beginning, it may utilize some advantages (first mover) and achieve upgrading. Because of organizational and instructional conditions, the others may choose different development path. On the other hand, both group risk being lock-in to these specifics path through various self-reinforcing effects (Fagerberg, 2006).

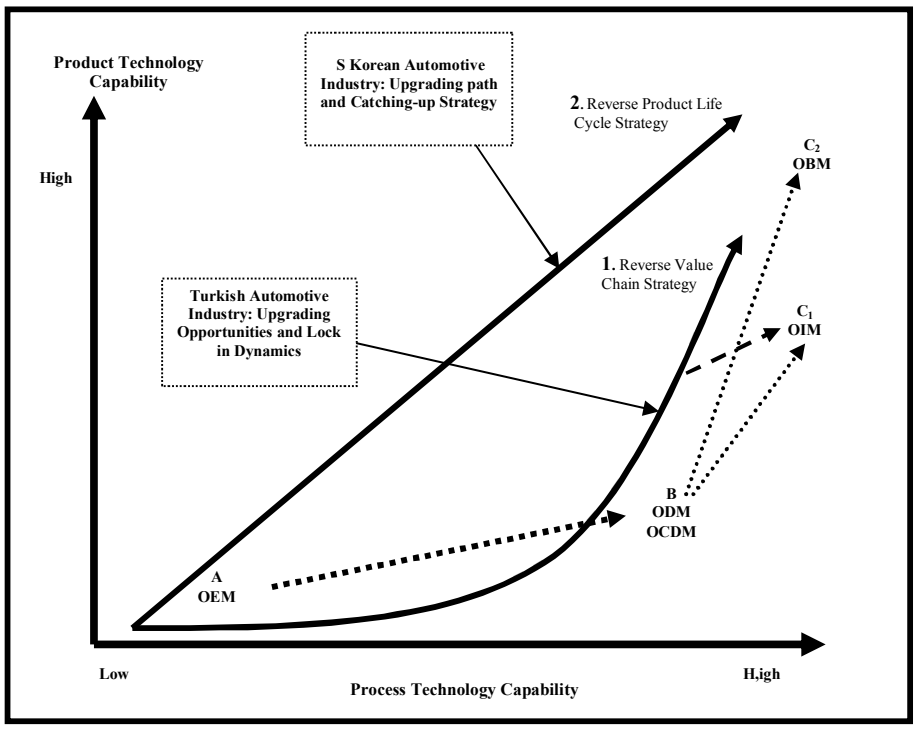
While such inferior scale narrowed down the practical means of technology, it has constituted a barrier to the local technological endeavour. In particular, the common behaviour of firms to start producing through license contracts paved the way for foreign-source dependency in terms of technology that is also experienced as a trouble today. Assembly companies set up first displayed a development on process engineering. And these firms turned out to be thriving manufacturers based on process improvements. In harmony with global trends, they started to target high-quality production starting with the second half of 1980s. And 1990s became the starting era of comprehensive efforts involving product development and design processes. The firms started to reveal a composition where technical departments sprout R&D units, R&D staff is employed and R&D projects are created. Major licensor industries have supported this process as the presence of surrounding manufacturers with the capability of modifying designed products would drop down their costs (Tuncel and Olmezogulları, 2010. While firms, standing as high-quality manufacturers on one side, have turned out to be the major manufacturer and exporter of particular product ranges of licensor enterprises, they have also constituted the part of design and test processes associated with these products. Surrounding firms have started to get articulated into the design processes of licensor enterprises as a co-designer. However, they keep dependent to the major enterprise for technology development, R&D project design and setting of supply policies. Therefore, they have no opportunity to reach the "Own Brand Manufacturing (OBM)" phase that constitutes the final step of the development strategy. They rather keep locked in as a co-designer at the manufacturing phase, the second step along this path. In particular, manufacturing of complicated systems such as motors, gearboxes etc. reveals a higher degree of dependency (Akarsoy.

Current development level and upgrading possibilities of the automotive industry in Turkey should be assessed individually for each different vehicle segment. The development process for the manufacturing of passenger cars seems locked in at phase B. Switch to brand manufacturing appears impossible. Today, neither Turkey nor any other country has the chance of brand manufacturing, particularly as much as passenger cars are concerned. Therefore, resource planning should be focussed on higher added values, particularly in favour of R&D design and associated activities. From this point of view, Turkey has the potential to exceed its standing as a production and export base and turn out to be a design and R&D venue. Enhancing testing means and elevating R&D investments in this process would reinforce the standing of passenger vehicle manufacturers as an “Original Co-Designer Manufacturer”. On the other hand, the bus and truck segment promises a development path deep into further stages. This field hosts both set of firms manufacturing under contract and operating on 100% domestic capital. Turkey has attained a

very crucial standing in global bus manufacturing arena, and has its own designs in this segment. In particular, domestically-financed firms have taken major steps towards branding. There are two potential upgrading paths for this segment:

The first one is the path from phase B to C_1. This is a potential route rather for firms manufacturing under contract. At this stage, the firm produces its own design, introduces the vehicle as an idea, but markets its product under the brand of the licensor. A major restriction along this path is the set of barriers to the elevation of the nationalization rate. In an aura where motors and gearboxes are imported, it seems unlikely for firms to upgrade to "Original Idea Manufacturers (OIM)". However, there are fully Turkish-design diesel motors for use in heavy commercial vehicles (trucks and trailers) segment[4]. These firms need to lay emphasis on co-design efforts with domestic suppliers capable of manufacturing technology-intensive systems besides design processes. The second path is the one from phase B to C_2 that is the own brand manufacturing phase. This route appears possible for domestically-financed own brand manufacturers. In particular, Turkey displays this potential for the bus and minibus segment. The design and branding process is coming up with success.

Figure 4: Upgrading Strategies vs. Lock-in Dynamics of Automotive Industry in Turkey and South Korea



Source: Author

[4] "Ecotorq" developed by Ford Otosan is the maiden diesel engine of Turkey designed from the scratch. The project was run in cooperation with Robert Bosch and Australia's AVL.

Main automotive companies of Turkey have gained competence in conformity assessment (quality, standards, documentation, accreditation, etc.) (Çakar, 2007). However, it is unlikely to argue the same for the capability of developing future technologies on product basis. Such firms, which are failing to conceive the foreign main shareholder as the resource of the technological know-how and mobilize the in-house R&D process or universities in the country as know-how resources, have remained incapable of producing product technologies (Tuncel and Taşkın, 2007). To overcome the lock-in prevailing in abovementioned segments, the industry needs a strategic move that the state will support through selective policies. However, it should be noted that, the Lisbon Strategy, shaping the general framework of EU technology policies that Turkey has to pursue on account of the current EU accession process, constitutes the utmost institutional barrier to implementing such sort of selective policies (Soyak, 2005).

4.2. Tecnological Capability Building and Characteristics of the Technological Regime:

The automotive sector carries the technological regime characteristics of the Schumpeterian Mark II model. The sector has high level of cumulativeness on firm level, systematic information structure based on implicit knowledge, high appropriability conditions and opportunity conditions at medium depth. Technological skill build-up in the sector takes place based on the dynamics of these technological regime characteristics. The automotive sector also stands as an industry where learning by doing, using and interacting has an impact on innovation. Therefore, developing the learning processes within the firm and build-up of the firm-specific "know-how" is of crucial essence. This in turn leads to concentration of innovation in geographical terms. Coordination and management of implicit and codified knowledge within a system at different levels raises the significance of spatial proximity. Efficient transfer of system-specific knowledge becomes dependent upon relationships where face-to-face interactions come to the foreground and proximity between moments grows.

The Korean state has systematically supported industry since the establishment of the automotive industry. The industry was safeguarded by tariffs for the sake of bringing competitive advantages in the sector. Additionally, the state intervened in the market to regulate the market structure. This intervention was aimed at resolving issues hindering the development such as limited scale and excess capacity. Operation of big-scale firms of the automotive sector within a marginally competitive environment has accelerated technological learning processes elicited by scale advantages. Existence of several financially-sound firms in the sector has contributed to the creation of resources that may be allocated to in-house R&D processes. Internalization of technology and developing technologies internalized through R&D expenditures has contributed

to collective development of product and process technologies of high-scale enterprises engaged in the sector like Hyundai. Being initially oriented in domestic market, industry successfully opened up into foreign markets through the technological skill build-up gained in the process of time. In the automotive sector, transfer of the implicit knowledge build-up is crucial for the innovation process. By landing staff with high field experience from foreign enterprises, Hyundai contributed to its own knowledge build-up process. Supporting cooperation efforts between the key and subsidiary industry has speeded up knowledge transfer between the parent company and its suppliers. As a consequence, the country managed to implement a more appropriate policy set capable of contributing to the innovation process in line with the technological regime particularities of the automotive industry. Such appropriate policies have speeded up the build-up of technological capability in the sector.

On the other hand, demonstrating a growth starting with the second half of 1960s, the Turkish automotive sector was set up as an assembly industry aimed at meeting the domestic car demand thanks to the customs shield brought up by the import substitution period. Domestic enterprises such as Oyak Renault, Tofaş, Otosan appearing on the stage under the license of global own brand manufacturers prioritized the development of manufacturing processes. And this priority has accelerated know-how build-up in the sector. Considering the fact that new entries in the global industry are fairly limited, the common behaviour of running the firms incorporated in Turkey as a joint venture has prevented these firms to become independent and build new brands like contrary to the Hyundai case. Turkish firms setting up their manufacturing in reliance to the old production lines and moulds of central countries experienced the issue of undercapacity due to weakness in domestic demand, and could not duly benefit from the learning processes, the decisive factor of technological development in the sector. For this reason, the sector faced a low productivity level and poor product quality (Ansal, 1990). Dependence of Turkish firms to foreign partners prevented these firms from carrying out independent research and development projects, remaining as a major barrier to technological upgrading.

4.3. Actors and Network:

While the innovation process takes place locally within the firm, non-firm actors and relationships built by firms with these actors have a critical influence in this process as well. Non-firm actors that we can classify as universities, public institutions, research organizations, industrial societies and business associations constitute, integrally with the firm, the components of the sectoral innovation system. Particularly public authorities in charge of regulating the

sector, and specialists of these authorities have a major influence on the sectoral development process. The Korean state has regulated the automotive sector, to which it attached strategical priority, through sectoral plans. Networks built between the sate and private sector to route economy across development objectives performed very well. Along with their specialized bureaucracies, public organizations such as the "Economic Planning Board", "Ministry of Trade and Industry" were in charge of elaborating and enforcing the industrial policies of public organizations. These organizations played principal role in equipping the sector with competitive edges through a disciplined and performance-based incentive system. Particularly in 1980s, enhancement of design capabilities became decisive in setting the right move of the Korean automotive industry to foreign marketplaces. Close relationships built with actors such as universities and research organizations at this phase

In Turkey, "State Planning Organization" became the chief actor of economy particularly during the import substitution industry period pursued between 1960 and 1980. Like the planning institution in the Korean case, this institution did not have the sufficient autonomy, and employed policy instruments towards whole industry instead of sectoral policies. Lack of a certain technological policy prevented the sector from producing a technological skill build-up. Actors such as societies and chambers involved in the sector acted as an interest group particularly in sharing the profits yielded by tariff protection. The sector could not carry out thriving cooperation activities with institutions such as universities. As a matter of fact, the Turkish automotive firms could not carry out a serious research and development activity until the second half of 1990s. Efforts for product and process technology development could be initiated only in late 1990s through the support of parent companies. Even today, long-term research collaborations built with universities and research institutions are quite weak.

4.5. Institutions:

Institutions are limitations introduced by people to shape interactions between them, and they constitute a framework for these interactions. Institutions may have sectoral identity as well as a national one. Patent system, financial institutions, education system, labour markets and conducting business culture are major institutions of an economy. The automotive sector also stands as an industry where learning by doing, using and interacting has an impact on innovation. Therefore, developing the learning processes within the firm and build-up of the firm-specific "know-how" is of crucial essence. For this reason, to elevate the "assimilation capacity" that is decisive in the learning process, engineers specialized in automotive technologies and intermediate staff trained on automotive manufacturing should be recruited. In the automotive

industry, particularly privatized labour markets and educational institutions play a very critical role. Through well-done educational schemes, Korea could create a labour market consisting of specialized engineers to be employed in the sector. Additionally, forms of doing business based on mutual trust reduce costs of operation and yield substantial economical gains. Existence of major family enterprises engaged in distinctive business fields has been of crucial essence in a flourishing Korean automotive industry. Both in acquiring and learning new technologies, and thanks to its impact channels, chaebols became influential in the process of overseas expansion. A very significant factor for such sort of collaborative activities, trust has a vital place between firms. Trust factor stands as a crucial illustrative factor particularly in social network topology analyses. In ensuring a successful economical up growth in Asian countries, Confucius highlights the factor of trust based on primary relationships introduced by religion (Fukuyama, 1995). State support for strategic sectors has been the driving power of technological breakthrough in an aura where institution such as venture capital is underdeveloped.

In Turkey, creation of labour markets suiting both occupational training and sector has failed. Particularly through liberalization policies implemented after 1980s, state's weight on economy diminished, and market became the decisive mechanism entirely in resource allocation. Lack of institutions suitable for the technology finance, poor state incentive mechanisms and paucity of resources hampered technological growth. On the other hand, both the state-private sector collaboration and the internal cooperation within the private sector stagnated due to the failure of creating networks in the business conduct culture. Like in the Korean case, this condition obstructed the formation of catalyst interfaces.

4.6. Demand:

As to Korea, the country set its sight on overseas expansion in the automotive industry that it has considered to be a strategic sector from the very beginning. Poor domestic demand in Korea designated vehicle manufacturers as an export-priority strategy for the sake of utilizing scale advantages. Deep shrinkage of the domestic market caused by loss of profit due to the second oil crisis accelerated the overseas expansion process. Facilitated by state support, Korean firms started to market products to international markets in 1975. Manufacturing cheap and poor-quality vehicles during the initial period, the industry managed to penetrate into the markets of particularly underdeveloped countries through low-price policy. Starting with early 1980s, Hyundai managed to penetrate into the US market. Aspiration to build cars meeting the demands of consumers in the US market speeded up the technological breakthrough of the company. Starting with 1990s, export was directed to new marketplaces such as Europe, Middle East and

South Africa driven by shrinkage in the US market. Particularly triggered by the overseas expansion process, the strong demand factor became a decisive factor in the development perspective of the Korean automotive industry.

Starting with the incorporation period, the Turkish automotive industry set its sight on manufacturing towards the domestic market safeguarded by customs tariffs. Due to insufficient demand from the isolated domestic market, optimal plant scales could not be built and therefore scale advantages could not be availed of. Since domestic manufacturers have inferior income levels, cost effectiveness came to the foreground as a product preference criterion, pushing the quality criteria into the background. Due to the paucity of competitive edges gained, the period of overseas expansion for the industry was delayed. Under isolated domestic market conditions, current firms acquired the obtained the licenses of foreign brands and opted for remanufacturing their old models for the domestic market. Starting with the second half of 1990s, the sector displayed a rapid overseas expansion and enhanced means of export. In parallel to the economic growth, the domestic market also enjoyed an expansion, yet the Customs Union Convention executed with the European Union in 1995 paved the way for an intense inflow of import vehicles into the domestic market. This condition caused an augmented import penetration rate of industry. And this stands as a major issue for the Turkish automotive sector. On the other hand, in the vehicle segment particularly where the design capabilities of Turkey are developed, strong international demand originating from Middle Eastern markets highly contributed to the up growth of the sector. Foreign demand is of great essence in terms of the sector's standing in economy for Turkey, being the manufacturing base of global brands in the passenger car segment.

5. Conclusion:

The assessment of the set-up and evolution of and current progress attained by the South Korean and Turkish automotive industries reveals that, despite similar prevailing conditions at the start up, the efforts for establishing these two distinctive industries displayed varied performances due to factors having influence at macro, micro and meso level. Decisive factors in the outcome are different industrialization strategies pursued by these two countries, distinctive international standings, different industry policy sets implemented and difference in the administrative capacity of these states. This study focuses particularly on the dynamics of meso level, rather ignored to date in discussing the late industrialization process. Since each sector has different development dynamics, they need to be supported by different policy sets. This approach also contributes to considering how selective policies should be designed. Of course, all technological

development processes contain a margin of uncertainty, making it impossible to seamlessly manage the whole process by means of policy instruments. And some random events may cause permanent lock-ins on this technological development process. However, it should be noted that, all efforts for technological development are the outcome of human actions for a deliberative purpose. And each potential action set meant to guide a process is designed to attain particular purposes.[5] And realization channels of this design, links and all actors involved in this process constitute the social, economical and institutional background of the industrialization process. Historical consideration of the matter reveals that all successful moves for economical development have owed to the combination of right policies with right institutions (Chang, 2002). Technology is not merely a practical know-how transforming inputs to outputs in a manufacturing process. Conceptualizing technology in a holistic approach would better enlighten the aspects of technology contributing to the quantitative and qualitative transformation of an economy. This framework also stresses the capacity of right policies and institutions to manage technological developments in a totalitarian approach. As highlighted by Richard Nelson, besides the change in physical technologies during economical development, other decisive factor is social technologies evolving along physical technologies. Social technology is defined as forms of human interactions unlike physical engineering technologies (Langlois, 2007:6). These links and interaction channels appear as policy interfaces shaping the developmental direction of the system. Examining both country experiences from a comparative point of view, it can be observed that Korea, actively implementing the industrial policy interface across the technological upgrading strategy, outperforms Turkey. While the Korean industry has turned out to be a own brand manufacturing sector exporting vehicles to the whole world, the Turkish automotive industry acquired a standing as an assembly base functioning under the license of global enterprises that are own brand manufacturers. Despite a particular achievement for different vehicle segments (buses, midibuses), Turkey much falls behind Korea in terms of the current progress attained in this industry.

[5] For example, Brain Arthur points out that the technology relate to human purpose. "*I will define a technology quite simply as a means to fulfill a human purpose. The purpose may be explicit; or it may be hazy, multiple, and changing. But whether its purpose is well defined or not, a technology is a means to carrying out a purpose"* (Arthur, 2007:276).

References:

Akarsoy A,T (2009) "Vehicle Technologies in Turkey" (In Turkish) www.inovasyon.org

Amsden, A., (1989) *Asia's Next Giant: South Korea and Late Industrialization*. Oxford Univ. Press, Oxford.

Ansal, H. (1990) "Technical Change and Industrial Policy: The Case of Truck Manufacturing in Turkey", *World Development*, 18(11) pp: 1513-1528,

Arslanhan S. Kurtsal Y. (2010) "To what South Korea Owes Success in Innovations? Implications for Turkey" *TEPAV Policy Note*, September 2010

Arthur, B.(1990) "Positive Feedbacks in the Economy" *Scientific American,* 262, pp :92-99,

Arthur,. B. (2007). "The structure of invention" *Research Policy*, 36; 274–287.

Atalay, M., Turan, M. (2003), "Globalization ,Developing Economies and Turkish Manufacturing Industry", *Planlama (Special Issue)* pp:77-110, (In Turkish)

Audretsch D. B (1997) "Technological Regimes, Industrial Demography and the Evolution of Industrial Structures" *Industrial and Corporate Change*, 6(1), 49-82

Automotive Manufacturers Association (2011) *General And Statistical Information Bulletin*

Azcanlı A.(1995), *Historical Development of the Turkish automotive industry*, Panel Mat. İstanbul (In Turkish)

Bair, J. (2005) "Global Capitalism and Commodity Chains: Looking Back, Going Forward" *Competition & Change*, 9(2),pp:153-80

Barney, J. B. (1986) "Strategic factor markets: expectations, luck, and business strategy", *Management Science*, 32, pp. 1512–1514.

Barney, J. B. (1991) "Firm resources and sustained competitive advantage", *Journal of Management*, 17(1), pp. 99–120.

Barney, J. B. (1995) "Looking inside for competitive advantage", *The Academy of Management Executive*, 9, pp. 49–61.

Bedir, A. (2002) *Development Perspective of Automotive Industry in Turkey*, State Planning Organization (SPO) , Ankara (In Turkish)

Bell, M. K. Pavitt (1995). "The Development of Technological Capabilities." *Trade,Technology and International Competitiveness pp*: 69-101

Breschi, S Malerba, F (1997), 'Sectoral Innovation Systems: Technological Regimes, Schumpeterian Dynamics, and Spatial Boundaries', in C Edquist (ed.), *Systems of Innovation: Technologies, Institutions, and Organizations*, Pinter, London, pp. 130-56.

Breschi, S Malerba, F Orsenigo L. (2000), "Technological Regimes And Schumpeterian Patterns Of Innovation" *The Economic Journal*, 110 (April), 388-410.

Chalmers J. (1982). *MITI and the Japanese Miracle*. Stanford, CA: Stanford University Press.

Cesaroni, F. A.Gambardella, W. Garcia-Fontes M.Mariani (2004) "The chemical sectoral system: firms, markets, institutions and the process of knowledge creation and diffusion" Malerba Franco (Ed) *Sectoral system of Innovation :Concepts Issues and Analyses Six Major Sector in Europe* , Cambridge Unv. Press ,UK

Chang, H-J. (2002) *Kicking Away the Ladder – Development Strategy in Historical Perspective*, Anthem Press, London.

Chang, Y. Chen M. (2004). "Comparing Approaches to Systems of Innovations: The Knowledge Perspective", *Technology in Society*, 26, pp. 17-37.

Cho, D. S. (1994). "A dynamic approach to international competitiveness: The case of Korea" *Journal of Far Eastern Business*,1(1): 17–36.

Cho, D.S., Kim, D.J., and Rhee, D.K., "Latecomer strategies: Evidence from the Semiconductor Industry in Japan and Korea", *Organization Science*, 9 (July-August):

Chung, S. (2010), "Innovation, Competitiveness and Growth: Korean Experiences", Annual Word Bank Conference on Development Economics 2010, Global.

Cohen, W. M. D. A. Levinthal (1990) "Absorptive Capacity: A New Perspective on Learning and Innovation". *Administrative Science Quarterly*, 35, 128-152

Coriat B Weinstein O (2004) "National Institutional Frameworks, Institutional Complementarities and Sectoral Systems Of Innovation" in Malerba F. (Ed) (*Sectoral system of Innovation: Concepts Issues and Analyses Six Major Sector in Europe* , Cambridge Unv. Press ,UK

Çakar A. E.(2007) "Global Competition in Auto Industry from Perspective of 9th Development Plan" *Mühendis ve Makina* ,48(568) pp:38-46 . (In Turkish)

Çetiner, Y. (1996) *The Tale of Automobile: How Established Automotive Industry*, Milliyet Yay. İstanbul. (In Turkish)

David, P. (1985) "Clio and the Economics of QWERTY," *American Economic Review*, 75(2), pp:332-37,

Demirer, A. ,Aydoğan Ö. (2006*) Anadol: The Story of First and Unique Mass Production Turkish Design Car* Güncel yay. İstanbul. (In Turkish)

Duruiz L. (1999) "Globalization Efforts Of Turkish Car Industry" *Actes du GERPISA n°29* pp:42-54

Enos, J.L. (1991). *The Creation of Technological Capability in Developing Countries*. London: Pinter Publishers.

Erdoğdu, M. (1999), "The Turkish And South Korean Automobile Industries And The Role Of The State in Their Development", *METU Studies in Development*, 26(1- 2), pp.25-73.

Fagerberg, J. (2006), "Innovation: A Guide to the Literature." *in Oxford Handbook of Innovation, of Innovation,* der. J. Fagerberg, D. C. Mowery, and R. R. Nelson, editors. Oxford

Freeman, C. (1987) *Technology Policy And Economic Performance : Lessons From Japan,* Pinter London

Freeman, C. (1989) "New technology and catching up" *The European Journal of Development Research,* 1(1) pp:85-99

Frobel F. J Heinrichs, O Kreye. (1981) *The New International Division Of Labour: Structural Unemployment In Industrialized Countries And Industrialization In Developing Countries,* Cambridge University Press

Fukuyama, F. (1995) *Trust: The Social Virtues and the Creation of Prosperity*. New York: Free Press.

Fuller, D.A., Akinwande, A.B. and Sodini, C. 2003. "Leading, Following or Cooked Goose? Innovation Successes and Failures in Taiwan's Electronics Industry", *Industry & Innovation,* 10(2),179-196

Gao, X.D, Liu, J.X., Chai, K.H., Li, J.Z. 2007. "Overcoming 'latecomer disadvantages' in small and medium-sized firms evidence from China", *Int. J. Technology and Globalisation*, 3(4), 364-383.

Gereffi, G. (1994). "Capitalism, Development and Global Commodity Chains" in L. Sklair (ed.) *Capitalism and Development*, London.

Gereffi, G. (1999) 'International Trade and Industrial Upgrading in the Apparel Commodity Chain'*,Journal of International Economics* 48: 37–70

Gereffi, G. (2003). "*A Commodity Chains Framework for Analyzing Global Industries*" Duke University (mimeo).

Gereffi, G. Korzeniewicz, M. (1994) *Commodity Chains and Global Capitalism*, Westport, CT: Praeger

Gereffi, G., Humphrey, J ,Sturgeon, T. (2005). "The Governance of Global Value Chains". *Review of International Political Economy*, 12(1), 78-104.

Green, A. E. (1992) "South Korea's Automobile Industry". *Asian Survey*. 37, 411-428.

Gershenkron, A. (1962), "Economic Backwardness in Historical Perspective", in; *Economic Backwardness in Historical Perspective: A Book of Essays,* Harvard Ünv. Pres.

Hahm, J.H. (2003), "The Government, the Chaebol and Financial Institutions before the Economic Crisis", in: Haggard, S. Lim, W. and Kim, E., *Economic Crisis and Corporate Restructuring in Korea: Reforming the Chaebol,* Cambridge University Press, Cambridge

Helfat, C. E. and Peteraf, M. A. (2003) "The dynamic resource-based view: capability lifecycles", *Strategic Management Journal*, 24,pp. 997–1010.

Henderson, J., P. Dicken, M. Hess, N. Coe, H. Wai-Chung Yeung (2002) "Global Production Networks and The Analysis of Economic Development" *Review of International Political Economy* 9(3) August: pp:436-464

Hobday, M. (1995), 'East Asian latecomer firms: learning the technology of electronics', *World Development,* 23,(7), pp.1171-93.

Hobday, M. (2003) "Innovation in Asian Industrialisation: A Gerschenkronian Perspective *Oxford Development Studies*," 31 (3). pp. 293-314

Hobday, M. Rush, Howard R. Bessant, J. (2004) "Approaching the Innovation Frontier in Korea: The transition phase to leadership" *Research Policy*, 33 (10). pp. 1433-1457.

Humphrey, J Schmitz, H. (2000) "Governance and Upgrading: Linking Industrial Cluster and Global Value Chain Research", *IDS Working Paper* 120, Brighton: IDS

Juma C. Clark N. (2002) "Technological Catch-Up: Opportunities and Challenges for Developing Countries" *SUPRA Occasional Paper*, Research Centre for the Social,Sciences, University of Edinburgh

KAMA (2011) *2011 Korea's Automotive Industry*

Keyder, Ç. (1978), "Rostow, Gerschenkron, Capitalism, Proto-Industrialization", *METU in Development* , 20, pp:66-89.

Kırım, A. (1990), *Technological Change in Turkish manufacturing Industry*, TOBB Yay., Ankara.

Kim, L. (1993). "Korea's National System in Transition " in (eds), L Kim and R Nelson *Technology, Learning, & Innovation - Experiences of Newly Industrializing Economies*, Cambridge University Press, Cambridge, pp. 335-360

Kim, L (1998) "Crisis Construction and Organizational Learning: Capability Building in Catching-up at Hyundai Motor" *Organization Science*, 9 (4) pp. 506-521

Kim, L. (1999) "Building, Technological Capability For Industrialization: Analytical Frameworks And Korea's Experience"' *Industrial And Corporate Change*, 8(1) pp:111-36

KPMG (2012) "KPMG's Global Automotive Executive Survey 2012" http://www.kpmg.com/automotive

Kor Y. Mahoney J. T. (2004) "Edith Penrose's (1959) Contributions to the Resource-based View of Strategic Management" *Journal of Management Studies* 41(1) January , pp:183-191

KOTRA (2006) "Korea's Auto Industry - Today and Tomorrow" http://english.kotra.or.kr

Lall, S. (1992) "Technological capabilities and industrialization", *World Development*, vol. 20, no. 2, : 165-86.

Lall S. (2000) "Technological Change And Industrialization In The Asian Newly Industrializing Economies : Achievements And challenges" (eds), L Kim and R Nelson *Technology, Learning, & Innovation - Experiences of Newly Industrializing Economies*, Cambridge University Press, Cambridge, pp. 13-68.

Lall, S. M. Teubal (1998) "Market Stimulating Technogy Policies in Developing Contries: A Framework With Examples From East Asia" *World Development*, 26(8) pp: 1369-1385

Lee K. C.Lim (2001) "Technological Regimes, Catching-Up and Leapfrogging: Findings From The Korean Industries" *Research Policy* 30. pp: 459–483

Malerba, F. (2002). "Sectoral Systems of Innovation and Production" *Research Policy*, 31, 247–264.

Malerba, F. (2003). "Sectoral System and Innovation and Technology Policy", *Revista Brasileirce de Inovucao*, 2, . 329-374.

Malerba, F. (2006), "Sectoral SystemsHow and Why Innovation Differs across Sectors." *in Oxford Handbook of Innovation, of Innovation,* der. J. Fagerberg, D. C. Mowery, and R. R. Nelson, editors. Oxford,pp:380-406

Malerba, F. (2004). "Sectoral System of Innovation Basic Concepts" in Malerba Franco (Ed.) *Sectoral System of Innovation: Concepts Issues and Analyses Six Major Sector in Europe*, Cambridge Unv. Press ,UK

Malerba F., Orsenigo L. (1995), "Schumpeterian Patterns of Innovation". *Cambridge Journal of Economics,* 19, pp 47-65

Malerba, F. and Orsenigo, L. (1996) "The dynamics and evolution of industries", *Industrial and Corporate Change*, 5(1), pp. 51–87

Mathews, J. A. (1996). "High technology industrialization in East Asia". *Journal of Industry Studies,* 3(2): 1–77.

Mathews, J.A. 1999 "National systems of economic learning in East Asia", *International Journal of Technology Management*,

Mathews , J.A (2002) "Competitive Advantages of the Latecomer Firm: A Resource-Based Account of Industrial Catch-Up Strategies" *Asia Pacific Journal of Management* 19(4),467-488

Mathews, J.A. and Cho, D.S. 1999. "Combinative Capabilities and Organizational Learning by Latecomer Firms: The Case of the Korean Semiconductor Industry", *Journal of World Business*, 34(2), 139-156.

Mckınsey Global Institute (2003) *Turkey: Making the Productivity and Growth Breakthrough* ,Washington, D.C.

Nelson, R S. Winter (1982) *An Evolutionary Theory of Economic Change*, Harvard Unv. Press, USA:

North, D. (1991). "Institutions", *Journal of Economic Perspectives*,5(1), pp. 97–112

North, D. (1994), "Economic Performance Through Time", *American Economic Review*,, Vol: 84, No:13, pp. 359-368.

OICA (2011) *2011 Production Statistics* http://oica.net/category/production-statistics/

Öniş, Z. (1991), "The Logic of the Developmental State". *Comparative Politics*, 24(1)

Öniş, Z. (1992), "The, East Asian model of development and the Turkish case: A comparative analysis", *METU Studies in Development*, 19(4), 495-528.

Öniş, Z. (1998), "International context, income distribution and state power in late industrialization: Turkey and South Korea in comparative perspective", in Öniş Z. (1998), S*tate and Market; The Political Economy of Turkey in Comparative Perspective,* İstanbul: Boğaziçi University Press, pp.477-494.

Pavitt, K. (1984) " Patterns of Technical Change: Towards a Taxonomy and a Theory," *Research Policy*,13, 343–74.

Penrose, E. T. (1959) *The Theory of the Growth of the Firm* (Oxford: Basil Blackwell).

Peteraf, M. A. (1993) The cornerstones of competitive advantage: a resource-based view, *Strategic Management Journal*, 14,pp. 179–191.

Porter, M.E. (1990) *The Competitive Advantage of Nations,* New York: Free Pres

Potts, J. (2001) *The New Evolutionary Microeconomis :Complexity, Compentence, And Adaptive Behaviour* ,E.E , UK

Republic Of Turkey Ministry Of Industry and Trade (2010) *Turkish Industrial Strategy Document 2011-2014 (Towards EU Membership)*

Rodrik D. (2007) *One Economics, Many Recipes: Globalization, Institutions, and Economic Growth*. Princeton University Press, Princeton, NJ.

Shin J. (1996) *The Economics Of The Latecomers: Catching-Up, Technology Transfer, And Institutions In Germany, Japan, And South Korea* Routledge, USA

Schumpeter J (1928). "The instability of capitalism", *Economic Journal* pp:361-386

Schumpeter J . (1912) *The Theory of Economic Development*, (1978 ed.), Oxford Unv. Pres. New York,

Schumpeter, J 1942, *Capitalism, Socialism and Democracy,*George (1976 ed.), George Allen & Unwin, London

Soyak, A (2005) "The Main Objective Of Turkey's Industrial Policy Towards EU Membership" *TMMOB Ölçü Dergisi*, Aralık, pp:61–69 (In Turkish)

Steinmueller W. E (2004) "The European software sectoral system of innovation;" Malerba Franco (Ed) *Sectoral system of Innovation :Concepts Issues and Analyses Six Major Sector in Europe* , Cambridge Unv. Press ,UK

Sturgeon, Timothy, Johannes Van Biesebroeck and Gary Gereffi. (2008) "Value Chains, Networks, and Clusters: Reframing the Global Automotive Industry," *Journal of Economic Geography*, 8(3), May, pp.297-321.

Sturgeon, Timothy J. Van Biesebroeck, Johannes, 2010. "Effects of the crisis on the automotive industry in developing countries : a global value chain perspective," *Policy Research Working Paper Series* 5330, The World Bank.

Sturgeon, T. (2006) "The Governance of Global Value Chains; Implications for Industrial Upgrading" Global Value Chains Workshop "Industrial Upgrading, Offshore Production, and Labor" November 9-10, 2006 Social Science Research Institute, Duke University

Şenses F. (1989) *Industrialization in Turkey from Post 1980 Period Policy Perspective*, Verso Yay., Ankara. (In Turkish)

Teece, D. J., Pisano, G. and Shuen, A. (1997) "Dynamic capabilities and strategic fit", *Strategic Management Journal,* 18, pp. 510–533.

Tether B S. Metcalfe; (2004) "Services and systems of innovation "Malerba F.(Ed) (2004) *Sectoral system of Innovation :Concepts Issues and Analyses Six Major Sector in Europe* , Cambridge Unv. Press ,UK

Teubal, M.(2002) "Special Issue: What Is The Systems Perspective To Innovation And Technology Policy(ITP) And How Can We Apply It To Developing And Newly Industrialized Economies*," Journal of Evolutionary Economics*, 12(1), pp:233-257

Tezer, E. (2006) "Turkish Automotive Industry is the Most Competitive Production and an Advanced R&D Center in the European Union", *Taysad Magazine*, 6(31) August-September

Tuncel, C. O Taskın Ç. (2007) "Innovation Networks and Learning Dynamics in Economic Development: An Assessment on Turkish Automotive Industry from Sectoral Innovation System Perspective" Paper to be presented at the *2nd International Conference on the Dynamics of Science and Technology Policies"* 25–26 May 2007, Izmir, TURKEY

Tuncel C. O Ölmezoğulları N. (2010) "Technological Capabilities and Innovation Networks in Turkish Automotive Industry: A Proposed Technology Policy from Sectoral Innovation System Perspective" (mimeograph), Faculty of Economics and Administrative Science, Uludag University, Turkey

Tuncel C. O Ölmezoğulları N. (2011) "Exploring Firm-Level Technological Capabilities in the Turkish Automotive Industry and Policy Recommendations for Prospects" Paper to be presented at the *EconAnadolu 2011, 2th Anadolu International Conference in Economics,* 15-17 June,2011*,Eskişehir, TURKEY*

Wengel J. P. Shapira; (2004) "Machine tools: the remaking of a traditional sectoral innovation system" Malerba F.(Ed) (2004) *Sectoral system of Innovation :Concepts Issues and Analyses Six Major Sector in Europe* , Cambridge Unv. Press ,UK

Won-Young L. (2000) "The Role of Science and Technology Policy in Korea's Industrial Develeopment" in (eds), L Kim and R Nelson *Technology, Learning, & Innovation - Experiences of Newly Industrializing Economies*, Cambridge University Press, Cambridge, pp. 269-290

Wong P. (1999) "National Innovation Systems for Rapid Technological Catch-up: An analytical framework and a comparative analysis of Korea, Taiwan and Singapore" *DRUID Summer Conference on National Innovation Systems, Industrial Dynamics and Innovation Policy,* Rebild, Denmark, June 9–12,1999

World Bank (1993*). The East Asian miracle*. New York: Oxford University Press.

Vernon R. (1966) "International investment and international trade in the product cycle". *Quarterly Journal of Economics* 80, pp. 190-207.