Culture and Innovation: Development of EDI Systems in the Korean Automotive Industry*

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Summary: This paper presents research linking national culture and innovation. The research identifies how key features of Korean culture, collectivism and hierarchical authoritarianism, affect technological innovation. This perspective casts new light on cultural research that, while generally confirming national culture-innovation ties at the organization level, has had less success accounting for culture barriers to innovation in collectivist nations, especially at the interorganizational level. The data for this study was obtained from interviews and written sources.

The paper introduces the concept of the social shaping of technology, with which the influence of culture on technological innovation is analyzed, and highlights the development of EDI systems in the collectivist Korean society. It draws attention to the interorganizational basis of collectivism and authoritarianism in the technology innovation process. Finally, Korean innovation systems are questioned, and some negative effects of the collectivist Korean culture at the interorganizational level are discussed.

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1. Introduction

Innovation has long been a source of economic and social development, but given the pressures from today's global competition, the uncertainties of markets, and the dynamics of new technologies, innovation has become the most important of all industrial activities.

Newer trends toward a rapid production process in industry call for the quick mastering of such subjects as the complex logistics of supply chains, product development under time pressure, and the managing of complete vehicle packages from manufacturers to suppliers. In addition, ongoing improvements in the quality and flexibility of the business process are required to gain new markets and increase market shares, all the while retaining profitability and competitiveness. More significantly, a successful response to these business challenges requires changes in the methods by which trading relationships are maintained. EDI (Electronic Data Interchange) is a powerful tool that enables such changes. As a leading form of IOIS [1] (Interorganizational Information Systems), EDI refers to the seamless electronic exchange of data and information between the computer systems of different business partners, in accordance with agreed-upon message standards. In industry, EDI is viewed as a lever for innovative business processes that integrate transactions between trading partners.

In contrast to interorganizational systems where the user retains ultimate control over the interface between various components and the overall systems operation, the constituencies underlying the development of EDI systems [2] have a very different structure (Suomi, 1992). With EDI systems crossing organizational boundaries, the number of organizations linked to the network is very large indeed

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1) Besides EDI, IOIS includes electronic mail, facsimiles, computer conference systems, file transfer and the opening of host computers for remote data entry via terminals (Suomi, 1992).

2) An EDI system is a heterogeneous technology comprising different kinds of components, including hardware, software, standards and telecommunications technologies as well as organizational and social components.

theoretically infinite. The visions and practices embedded in a system relate not only to models for work organization within individual companies, but also extend to cover the relationships between organizations. Because organizations are affected by the actions of others on the network, and because successful computer-to-computer data exchange demands the compatibility of message standards and communications protocols for transmitting data, cooperation between key players is required.

The qualitatively new process and systems character of IOIS has received attention in at least three areas. The first relates to the fact that such systems can have considerable influence over society by changing the division of labor between organizations, with new organizational forms emerging in industry that soon out-date the boundaries of "traditional" organizations (Miles/Snow, 1986; Malone et al., 1987; Davenport/Short, 1990; Venkatraman, 1991; Hammer/Champy, 1994; Neuburger, 1994; Swatman, 1994; Klein, 1995; Spiardi, et al., 1997). Just-In-Time, BPR, innovative cooperation, and virtual organization, which are based on EDI systems, characterize the new technical and organizational developments. The second area of attention raises specific questions about standardization of information exchange, without which it is impossible to communicate electronically beyond organizational and national boundaries (Esser et al., 1995; Genschel, 1995; Jakobs, 2000). The third area is related to the process of standardisation who and with what interest and strategy participates in this process (Schmidt\Werle, 1994; Kubicek, 1992; Webster, 1995). The social and political process involved in standards development throws light upon debate about who has the most to gain or lose in system development. These considerations all play a role in determining the level of analysis required.

To understand technological innovation, it is insufficient to conceptualize the design and implementation process as isolated from each another. The development of EDI systems necessitates a move towards collaboration, so it is necessary to address relationships between organizations linked by an EDI system. This explains the needed shift in outlook from the organizational level to the interorganizational level in order to access technological innovation (Williams et al., 1995; Kubicek et al., 1989; Monse/Reimers, 1994).

Since the late 1980's in Korea and other countries, the automotive industry's business and technical data has been electronically transmitted between manufacturers and suppliers. Manufacturers, IT-service companies, industry associations, and governmental bodies have attempted to develop an EDI network based on an industry-wide standard for EDI message formats. These efforts, however, failed. Since then, manufacturers' specialized "island" solutions (proprietary or "closed systems") have dominated the Korean automotive industry, so that Korean parts suppliers are forced to communicate with only one manufacturer, with no possibility of industry-wide communication (See <figure 1>).

Germany	Korea
VDA-Standard Car Maker	Proprietary Standards Car Maker
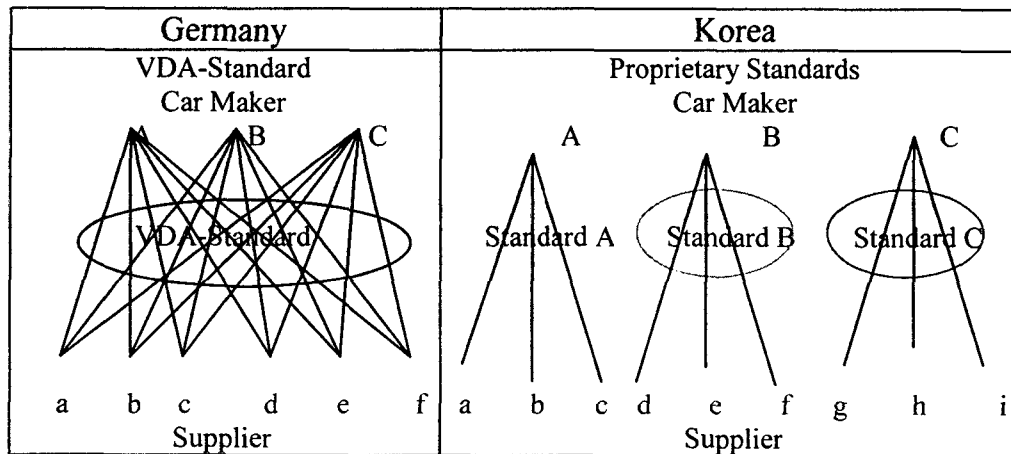
<Figure 1> EDI Systems in the Korean and German Automotive Industry

<Figure 1> contrasts the communication systems of the Korean and German automotive industries. As early as the mid-1970's, the German automotive industry strove towards national standardization of data communication, mainly supported by the VDA (association of German automotive industry) (Manske/Moon, 1998). As a result, the VDA systems developed to exchange data between manufacturers and suppliers made it possible for all participants to communicate with each other.

It has become apparent that the production and adoption of innovative technology requires certain internal behavior and external relationships. Countries vary in their ability to meet these requirements, and it can be hypothesized that these variations result from cultural differences. A vital element in this hypothesis

on the nature and causes of the different technological capabilities of nations is information on national cultures, a set of stylized facts on present cultural particulars. By looking at Korea's culture and its automotive industry' EDI systems, this paper tests the hypotheses that Korean culture is reflected in the features of its automotive industry's EDI systems.

The remainder of this paper is organized in four parts. The first briefly introduces the theoretical framework for explaining the relationship between innovation and culture, and the second part deals with the socio-culture of Korea. The third part involves an analysis of the manufacturer-supplier relationship, the EDI systems in the Korean automotive industry, and their development process. The fourth and final part, the conclusion, provides a short prospect of the innovation system of Korea.

2. Culture and Technological Innovation

In the economic literature on innovation, there are, broadly speaking, two main streams of research about the effects of culture on innovation. One tends to focus on the processes and in particular on the origins of innovations. The national innovation systems (NIS) approach finds that differences in innovation systems among societies are due to inherent differences in the factors of production, culture and history, geo-political variation, and general orientation of the economy (Freeman, 1997; Lundvall, 1992; Nelson, 1993). Bearing in mind the importance of social factors when considering technological developments supports a full understanding of the innovative process and why different societies operate under different systems. The main question, therefore, is how to bring about technological and institutional change so as to establish new micro- and macro-economic adjustments. This first stream, oriented toward the economic growth dynamic and competitive capacity, is narrowly associated with the national competitive advantage approach of Porter (1991).

The other stream analyzes the different cultural configurations of national and regional economies (Hofstede, 1992; Herbig, 1992; Nakata/Sivakumar, 1996).

Economic culture studies focus on the social, political and cultural contexts in which economic activities take place. They find that the natures of economic cultures are reflected in the capacities of national and regional economies.

Although these economic approaches can explain the link between culture and economic success by means of relatively coarse categories, the precise connection between culture and specific technical innovations (such as EDI systems) still remains unclear, and the question of how a culturally different normative framework influences technological innovation is still unanswered. There is yet no study that addresses this question at the meso, interorganizational level, i.e. under the social structure and beyond an organization.

In newer social studies of technology, there is an attempt to link technology development to the social process (Biker/Hughes/Pinch, 1987; McKenzie/Wajcman, 1985; Williams/Edge, 1996; Dierkes/Hoffmann, 1993). That is, technology does not develop devoid of environmental influence, it is deeply affected by the social context in which it is developed and used. Every stage in the generation and implementation of new technology involves a set of choices influenced by various social, economic, cultural, and political factors, as well as technical considerations. Based on this assumption, much attention has been focused on the question of why complex technical systems may develop differently in different country-specific contexts. In order to answer this question, studies have concentrated on which social actors with which interests, resources, power and strategies are involved in the process of development. In addition, structural factors are identified that are of essential importance for the design, the construction, and the diffusion of technical systems. More fruitful for the study of technology development and of innovation is a combination of both aspects: actor and social structure. Some theoretical approaches try to integrate the structure-based and actor-centred concepts. According to actor-centered institutionalism (Mayntz/Schneider, 1995; Mayntz, 1997), actors who have their own interests, strategies, and motives are bound by structures that enable them to engage in activities, while at the same time imposing constraints on available options to them. Structural contexts include culture, values, economic systems, political power, the law and institutional rules, and the technology pool. This integrated approach has offered a theoretical

framework to study large-scale technical systems, such as telecommunication system, videotext system, and EDI system (Moon, 2001).

This new integrated orientation toward social shaping of technology sees "culture" as a context factor, and so calls the validity of old concepts into questio n[3] - recall Ogburn's (1972) famous "cultural lag" thesis. From the perspective of technology determinism, technological innovation is usually seen as a machinelike, fixed linear process. Culture, on the other hand, is supposed to be soft and malleable stuff, so the relationship between technology and culture is conceived of as entailing a one-way influence flowing from hard technical facts to soft cultural life forms, from inventions forging ahead to cultural adaptations lagging behind. These old concepts are now criticized for the following reasons. First, new technologies and their development create a circle of uncertainties. Initially, technologies are not fixed facts but flexible combinations. They don't follow a predetermined trajectory, but instead are open to different paths of technical development. The more complex a technical system is, the greater the opportunities for the social shaping of its design. Contingency, openness and flexibility are the characteristics of new technologies, so the hardness and certainty of further development must be generated by social and cultural closure mechanisms, like political bargaining, social negotiation, and cultural consensus formation on an accepted design. A second line of criticism contends that culture consists of strongly held values, norms, orientations, and practices, which become the sources of inventions and the guidelines of technical innovation. Culture is not a diffuse stuff nor a passive sphere in society, it influences the spread and use of new technologies. New technologies develop into successful innovations only if their design and their use have been cultivated. Third, the relationship between technology and culture is better grasped if it is thought of as a process involving twoway interaction between institutionally differentiated systems of society. On the global level, the relation follows a pattern of co-evolution. On the local level, this macro pattern is based on actions like designing and defining a technical system

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3) These old concepts date from the beginning of technology assessment in the 1930s to the actual impact and then future studies on new technologies.

and negotiating its use. These material actions and symbolic interactions can be found in a research laboratory as well as in a business firm, in a political circle and in a private household. There is no one-sided influence, but a reciprocal interactive process.

To view the influence as oneway limits research questions, in that it is only interested in the impact and causal effects of technologies on society and culture. Viewing the interaction as twoway leads to the observation of not only the movements that constitute new technologies and new patterns of space, meaning and life forms, but also the cultural patterns shaping the design and the direction of technical development. Thus we can see that technical innovation is influenced by the values, norms and action strategies of cooperating and competitive social actors. I will concentrate on the effect of culture upon technology because it has been so neglected.

Since many studies on the topic of culture and innovation have been undertaken by examining the perspectives of social shaping of technology, our knowledge of culture has increased. We have not, however, learned much about how culture effects technological innovation resulting from interorganizational collaboration between actors. In fact, while work on the effect of culture on innovation has been conducted mostly at the micro organizational level, there has been no research that has systematically examined the influence of culture on technological innovation at the interorganizational level. Few researchers have noted this lack of empirical work concerning the effect of culture on innovation taking place between organizations.

By focusing on the collaboration between the social actors (manufacturers, suppliers, IT technology providers, associations and governmental bodies), this study explores the link between Korean culture and the EDI systems development in the Korean automotive industry. The novelty of the research lies in its focus on providing empirical evidence for the following: technological innovation includes a culturally-related social process that allows a technical system to take root and to develop in its socio-cultural context.

3. Korean Culture

Literature on Korea offers different socio-cultural tendencies, but this study has chosen the following as important specifics of Korean culture[4] (Manske/Moon, 1998; Kim, K-D 1995):

 · Collectivism

 · Authoritarianism

These cultural elements outstanding, if not entirely unique, to Korean society form a relatively stable framework of interpretation patterns and values that are commonly shared by Koreans and used for the interpretation of the "world." They are reflected in all object fields that the actions of Koreans relate to: the objective world, how things should work; the social world, how people should behave with others; and the subjective world, how people define themselves. Accordingly, these dimensions work as the main principles of social organization in this county, from the traditional times to the present (Kim, K-D 1995).

Collectivism and authoritarianism have the most profound and pervasive influence on the technological innovation process and its innovative capabilities in general. Collectivism functions as a mechanism of both inclusion and exclusion, and together with authoritarianism it explains why EDI systems function as they do in the Korean automotive industry.

3.1 Collectivism

Confucian heritage is still readily visible in Korea. The family is the fundamental social unit and core of society. The Korean family system is composed of existing family members, ancestors and future generations. The father has the absolute

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4) It is important to note that these two aspects of culture are not meant to be an exhaustive list of all the dimensions of Korean culture that may relate to technological innovation. Practical as well as theoretical considerations influenced the decision to explore these two dimensions of culture. The following description of collectivism and authoritarianism is for the most part drawn from Manske and Moon (1998).

authority and power to act, while still fulfilling his duty as provider of the family. The family is the essential base for building collectives.

In family-centered collectivism, the behavior of family members is determined by the father or the family, the collective, so that individuality is reduced in order to comply with family norm-oriented behavior. At birth, the new member of the family is already ranked in the hierarchy of the family-collective. Consequently, the most outstanding feature is that very little importance is given to the individual. The family, rather than the individual, is the essential component of Korean society.

3.1.1 Collectivism as Inclusion Mechanism

Family-centred collectivism is not limited to blood relationships, it also relates to the hometown and its surrounding area, to schools attended, etc., as seen in "Yonjul", basic social networks: "Hyulyon" (blood-related network), "Jiyon" (hometown -related network) and "Hagyon" (cohorts network from the same school).

These social networks group Koreans. Due to the closed relationships within these groups, such things as business problems among members, for example, can be resolved much more easily. The feeling of belonging is rooted deeply in a collective society and becomes an essential component of social norms. As a consequence, the social organization principle of "relationship-oriented collectivism" takes effect upon the "evaluation" of a person, so it is often important to know who comes from which family or from which area, or who attended which school or university. The identity of an individual is constituted from group identity. Through affiliations and connections, social proximity narrows, thus helping in social situations, but above all in the economic field. Becoming a member of a leading network is practically a guarantee of social advancement. It is not uncommon that the bulk of Korean firms are staffed by family members, distant relatives, people from the hometown, and graduates of the owner's alma mater, and are managed as quasi-family units. Such networks have an informal but decisive influence on bringing about lateral coordination across organizations.

Collectivism can readily be seen to be relevant to the issue of nepotism, in that a member of a family in a position of power consequently attempts to provide

other family members with a good position. This nepotism can contribute not only to the achievement of a group, but also to its affiliations.

3.1.2 Collectivism as an Exclusion Mechanism

Relationship-oriented collectivism leads to a Korean society divided into closed groups between which considerable competition and tension can exist, so the term "closed collectivism" is appropriate (Shin, Y.-K., 1994; 498). In closed collectivism, Koreans divide the world into "inside" (Nae)- and "outside" (Oe). A consciousness of moral obligation exists only for those in the inside world, while the attitude toward those in the outside world can be characterized as utmost indifference. Results of this can be seen in the many agreements made not by the institutionalized rules, formal prescription, and rational calculations, but on the basis of close and personal relationships. This strong bond working within in-group tie tends to become a barrier to those who do not share the link.

Closed collectivism provides evidence that Korean society is innately homogeneous: There are extremely sharp contrasts between social groups e.g. between white and blue collars, between enterprise groups, or between management and labor that can be understood by the dichotomy of "inside" and "outside".

Relationship-oriented and closed collectivism is directly related to the issue of "trust" in Korean society. Trust is basically limited to those within a group or a collective. Trust across groups or collectives does not necessarily even exist. To the contrary, "clique trust" within a group is based on distrust of other groups. The securing of the economical cohesion of a clique involves both the family-related bond and the group-related bond, which thus play a vital role for Koreans. From an interorganizational point of view, however, the cohesiveness derived from in-group collectivism comes in for criticism because of its tendency to underestimate the value of cooperation with external organizations.

3.2 Authoritarianism

A hierarchical social order is another fundamental characteristic of Korean society. The social distinction is primarily conceived in terms of hierarchical status

differential, such as age, familial relationship like father-son, sibling order, etc, gender, teacher-pupil, superior-subordinate in the workplace, an the like. This notion was institutionalized according to the confucian principles of mutual obligations between persons in such relationships. One has to adapt to this order and fulfill moral obligations corresponding to position. Otherwise, one is committing a serious social mischief often causing trouble for himself or offending the other party.

From this kind of cultural background, Korean authoritarianism has manifested itself in various attitudinal and behavioral inclinations. The superior person can order around the person in subordinate position, can ask service from the other, can claim to certain socio-economic privileges, can enjoy greater amount of powers and authority in social situations, and so on. The person in the subordinate status, on the other hand, is expected to show outward respect to the superior in the form of manner, gesture, and other action patterns, follow the order, provide service as requested, accept the authority and power wielded by the other, and so forth. In such a culture, interorganizational relationships can be seen as a hierarchical relationship where one organization takes the position of authority and other, that of the subordinate.

To summarize, collectivism and authoritarianism are social organization principles having the most profound and pervasive influence on the behavior and beliefs of Koreans. Moreover, these cultural elements are the cornerstone of relationships, both between individuals and between organizations, including relationships between superior and subordinate, between management and labor, between manufacturer and supplier, between Chaebols[5] and the state (Manske/Moon, 1998; Biggart/Guilln, 1999).

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5) Chaebols are Korean large business groups that started emerging around the late 1950s. They played (still play) their role as an instrument to improve the economic scale in mature technologies, to develop strategic industries and to lead exports and economy. The Chaebols are generally owned and controlled by individuals and families.

4. Proprietary EDI Systems as Expression of "Closed Collectivism" and "Authoritarianism"[6]

This section begins to delve into the hierarchical and closed manufacturer-supplier relationships in the Korean automotive industry that have determined to a large degree the EDI systems that have been developed.

4.1 Relationship between Manufacturer and Supplier

The automotive industry has been a major force behind growth in the Korean economy, and suppliers have participated in the industry's prosperity. During the 20-year period from 1975 to 1995, the number of suppliers has increased by tenfold, from 165 to some 1600. They are organized into a "manufacturer-supplier pyramid", with the first-tier suppliers delivering directly to the manufacturers, and the second-tier suppliers delivering to the first-tier suppliers, and so forth. Although almost all car parts used in the assembly of automobiles in Korea today are produced domestically, highly-complex parts such as engines, gears or ABS systems are produced by joint ventures with foreign enterprises. This generally means that the Korean automotive industry, and its suppliers in particular, are weak in innovation. Further, it should be noted that the Korean supplier industry consists mainly of small-and medium-sized enterprises, with just 51 suppliers having more than 500 employees. As of 1995, the 10 largest suppliers controlled 22% of the industry's total turnover, with a sales figure of around 2,6 billion US

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6) This study is based on empirical case studies on the EDI systems of Hyundai Motor Co., Kia Motor Corp., and Daewoo Motor Co. To obtain data about the development of these systems, first, 56 focused interviews were conducted. When interviewing a number of key persons during 1996-1997 I used loosely formulated questionnaires aimed at probing into the current state of the EDI system development, interaction system between actors, and contextual factors in question. These key persons were managers from the three manufacturers, their suppliers and expertise from associations, IT-technology providers, governmental bodies, and universities. The data from the interviews was supplemented by written information such as organizational internal documents, publications, reports, articles in newspapers, and scientific journals

dollars (KGCCI, 1995; 35).

According to data from the statistics yearbook (KAICA, 1996), 58% of suppliers supply only one manufacturer, and a mere 2% supply all manufacturers (see <Table 1>).

<Table 1> The number of manufacturers served by suppliers (1995)

	1 manufacturer	2 manufacturers	3 manufacturers	>3 manufacturers	All manufacturers
Number of suppliers	698	259	95	135	19
Percent of suppliers	58%	22%	8%	10%	2%

Source: KAICA (1996); Interviews

These statistics indicate the heavy dependence of Korean suppliers on the manufacturers they are hierarchically integrated with in such a dependent relationship, it is usual for manufacturers to treat their suppliers as subsidiaries, to such an extent that they can even intervene in the management policies of suppliers. It is of no great concern whether there exist interlaced capital interests with a subsidiary (Tja-Hoesa) or whether the suppliers of the first tier are dependent on the manufacturers, because they (Geyol-Sa) normally supply only one manufacturer. This is a major drag on the development of the supplier industry, particularly with regard to independent product and production innovation. Manufacturers rarely tolerate their suppliers developing business relations with competitors, so suppliers must factor in the loss of sales if they plan to develop business relations with another manufacturer.

Furthermore, supplier dependence on manufacturers, which is based on cultural factors, leads to exclusive business relations in which manufacturers play a father-like or leader role and build a closed collective including suppliers. The personal relationship between the decision makers on both sides plays a central role. During the 1997/1998 Asian financial crisis, a manufacturer's procurement department manager at a leading Korean automaker who had a large turnover problem stressed the "familism" (feeling of solidarity) that played a decisive role

during the crisis: "*The cooperative relationship between the manufacturer and its suppliers survives (proves itself) at bad times, such as nowadays. The suppliers are ready to take over cars and to sell them to their employees and the circle of their relatives and acquaintances. Last year, a supplier sold about 6000 cars. They gladly made an effort to help the manufacturer. Since they understood the manufacturer's predicament, they lowered the contracted prices of their parts on their own initiative. They think it benefits both manufacturer and suppler.*" This statement highlights the typical manufacturer-supplier relationship reflected by Korean culture.

4.2 Proprietary EDI Systems in the Korean Automotive Industry

As seen in <Table 2>, the EDI systems in the Korean automotive industry, HD (Hyundai)-NET, Daewoo VAN System, and Kia VAN System, were developed in the late 1980's.

<Table 2> EDI systems in the Korean automotive industry

Manufacturer[7]	Date of implementation	Name	Partner
Hyundai Motor Co.	1989	HD-NET	Suppliers
Daewoo Motor Co.	1988	Daewoo-VAN	Suppliers
Kia Motors Corp.	1989	Kia-VAN	Suppliers

EDI systems were categorized according to hardware configuration, software, computer connection, standards, functions, system organization, and diffusion.

While the manufacturers and the larger suppliers all chose a front-end configuration in which an EDI or VAN minicomputer was linked to a mainframe or host, the smaller suppliers preferred a stand-alone configuration in which a PC functioned as a terminal for EDI purposes. Software for data exchange and

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7) In 1998 there were five automotive manufacturers in Korea: Hyundai Motor Co., Kia Motor Corp., Daewoo Motor Co., Ssangyong Motor Co., and Samsung Motors Inc. Three of those have affiliated companies: Hyundai Precision & Industry Company, Asia Motors Co., and Daewoo Heavy Industries. In this study the EDI systems of the first three were investigated.

applications based on the proprietary standards were developed in-house by the manufacturers. Although suppliers were provided, without charge, the software necessary for the prescribed front-end configuration, the manufacturers installed their own front-end solutions.

All three systems provided more or less the same services and functions. The systems were used to exchange such information as production planning, planning of requirements, delivery schedules, stock receipt, credit notes, and technical data. These data were produced by the manufacturers and then sent to suppliers via the manufacturers' "clearing houses", Hyundai Information System Co. for HD-NET, Korea Telecom for the Daewoo VAN system, and DACOM for the Kia VAN system. This is a process of one-way communication from manufacturer to supplier.

The organization of each Chaebol's system varied. HD-NET was a centralized EDI system controlled by the Hyundai Chaebol. The whole system was maintained by Hyundai group companies, Hyundai Motor Co. and Hyundai Information System Co., Hyundai Motor Co. was responsible for service and subscription be suppliers, and Hyundai Information System operated the communication network. In order to communicate with the manufacturer, Hyundai Motor Co., every supplier was compelled to confer with these central organizations.

In contrast with the centralized HD-NET, the EDI systems of Daewoo Motor Co. and Kia Motor Co. were decentralized to some extent and therefore represented an alternative system organization. The Chaebols did not exclusively control these EDI systems, but involved external partners in system operation. While the Daewoo group member Daewoo Information System Co. ran the Daewoo VAN, an external service company, NAC Computer Co., maintained the systems of suppliers, and Korea Telecom was responsible for the communication infrastructure. This system organization could be categorized as semi-centralized. In the case of the Kia VAN, DACOM hosted the network as a clearing center, and an external service company undertook the system maintenance of the connected suppliers. This system, as a third party system, was more decentralized than the Daewoo VAN System.

However, the three systems had a common feature: the manufactures had played a leading role in designing the organizational and technical framework, so the

systems resulted in electronic hierarchies (Zbornik, 1996; Malone et al., 1987).

The diffusion of the EDI systems was measured on two questions, one about the number of users connected to a system and the other about the degree to which the connected suppliers integrated the received EDI data into their internal application systems. For each Chaebol, at least 85% of suppliers were linked with the systems (HD-NET, 340 of 400, or 85%; Daewoo VAN System, 190 of 200, or 95%; and Kia VAN System, 270 of 274, or 98%). In contrast to the high participation of suppliers, the degree of system integration was low (HD-NET, 40%; Daewoo VAN System, 30%; Kia Van System, 20%). Only the large suppliers usually integrated the EDI functions into their internal systems. Most of the small suppliers printed the EDI data on paper and used them as written documents.

4.3 The Process of EDI System Development

How were the EDI systems developed in the cultural context discussed above? I first assumed that the construction of EDI systems in the Korean automotive industry was the result of interaction between the main players manufacturers, suppliers, and technology providers and that this interaction essentially took place in the cultural context.

In the development process an array of players were engaged, each with different objectives, interests, and strategies. These influenced the process and shaped the technological solutions that were emerging and which have become embedded into the EDI systems themselves. To appreciate the conflicting, as well as the converging, objectives that have guided the development of EDI system, it is worth considering the players and institutions involved.

4.3.1 Main Actors: Chaebol Manufacturers

Korean manufacturers who belonged to the Korean family-managed conglomerates, Chaebols, were the dominant players in developing EDI systems. All in all, the manufacturers expected the EDI system to rationalize business process. The EDI system should have optimized communication and the flow of information, as well as increased chances of success over competitors. In addition,

the EDI system was seen as a prototype for lucrative business in the telecommunication market, as a means of communication for improving corporate relationships within a Chaebol and with outside partners. In the development process, the manufacturers also had expectations that the newly-developed communication system would give their suppliers a stimulus to rationalize.

The manufacturers linked their suppliers in groups and in several stages to their EDI systems. Most suppliers, under pressure from manufacturers (parent companies), agreed to participate with this "collective solution". The unequal nature of this supplier-manufacturer relationship, however, resulted in the system being configured unilaterally and coercively by the manufacturers, which in turn led to incompatibility with the internal system of the suppliers. As a consequence, only about 30% of suppliers made use of the integrated EDI in which the data transmitted by manufacturers was entered into their internal systems without re-keying.

While all manufacturers concentrated on cooperating with their own Chaebol's IT-companies, they excluded their suppliers from the process of development. The suppliers were not handled as partners but as "foster-children". Here, family-centered collectivism is reflected in the nature of "cooperation" between manufacturer and suppliers, with EDI system development coordinated centrally by the manufacturers. The result was an electronic hierarchy in which the suppliers were "virtual" actors, with their task limited to passive participation in the testing of the system's functions. This exclusion of suppliers from the EDI system development process was in keeping with the manufacturers' view of the suppliers and with the role which they ascribed the suppliers in the hierarchical relationship.

No network for cooperation or negotiation formed during the development process, and manufactures applied various enforcement strategies to push suppliers to participate in their systems. Manufacturers dictated business terms to their suppliers and imposed their own in-house information handling practices upon their suppliers. This involved the extension of the manufacturers' own hardware systems onto their suppliers' premises, the dictation of product and inventory coding according to the requirements of the manufacturers' own established in-house information systems, and mandating the type and frequency of data to be

exchanged.

This exclusive and central coordination by manufacturers was responsible for proprietary EDI systems, which not only locked suppliers into the production, information, and technology systems of manufacturers, but also required that suppliers contribute to their perpetuation. Because the suppliers had little or no influence over the EDI system development process, the systems were not geared to their own procedures or business strategies, nor is it likely that a prior consensus will be sought when determining the future structure, function, or design of these systems.

Basing his views on Korean culture, a IT-manager at a large Korean supplier describes the situation in which the development process is carried out: *"'In this hierarchical relationship,' the manufacturer says to us, 'how can you, a supplier, dare to suggest linking your system with my system?' This is typically the behavior of powerful manufacturers. Perhaps a family-relationship exists between manufacturer A and supplier B because their founders were brothers. Nevertheless, the manufacturer pursues only personal business interests. In case of doubt, he handles his subcontractors equally, ignoring whether they are family subcontractors or any other subcontractor. In this respect, his authoritarian behavior toward his subcontractors continues to exist. On the telephone, one becomes aware of arrogant, authoritarian behavior on the part of the manufacturer's representatives. We are never successful with any rational proposition, request, or declaration. The manufacturer is on the top, and we are on the bottom. It stands to reason that if even the biggest subcontractor is handled in such a manner in Korea, smaller suppliers will be handled even worse. Such a one-sided relationship is typical in Korean culture and should be understood."*

Small suppliers who are heavily dependent on the manufacturers had little opportunity to develop their knowledge and expertise in EDI systems, but were confronted with external systems whose functioning they did not fully understand. All that was required was a passive interpretation and response to messages transmitted by partners, and this passiveness led to a neglect of the systems: Although more than 85% of the suppliers were EDI system participants, most of

them received trading data and information printed on paper and handled as a written document. EDI systems simply were not accepted by the suppliers as a reasonable new technology, and consequently they induced huge problems in their internal application.

4.3.2 Failure of an EDI Standard Development by the Industry Sector

The development of an industry-wide EDI standard has also been one of the main objectives of the Korean automotive industry. However, there has been no agreement on a common EDI standard development. Since 1989, KAMA (Korea Automobile Manufacturers Association), KEB (Korea EDIFACTS Board), the network provider DACOM, and the auto manufacturer Kia (which regarded EDI as a part of an organizational and technological innovation of the automotive industry and, in addition, was willing to devote personnel, resources, and time to the innovation process) had all made occasional efforts to negotiate appropriate solutions for the development of industry-wide message standards. However, their attempts have always failed.

The reasons behind this failure are numerous. First of all, reflecting the closed collectivism of Korean culture, government bodies in Korea, such as MOC (Ministry of Communication) and MITE (Ministry of Trade, Industry and Energy), are fierce competitors constantly in conflict. This competition created a barrier between intermediaries (e.g. KEB) working on the EDI standards development under the supervision of the respective governmental bodies. Second, the powerful manufacturers, remaining loyal to their own systems, rejected any suggestion by the intermediaries or the government to develop an EDI standard. For example, any attempt by the government to politically influence designation of EDI network carriers was always countered effectively by the manufacturers. Third, due to their weak position in the economy, the associations KAMA and KAICA, who represented automotive companies, were unable to bring about a common standard for EDI systems. These associations were not only dominated by the agendas of the Chaebols that made up the bulk of their membership, they were also subordinate to government organizations.

Last but not least, these associations were by no means equal, with small

suppliers unrepresented in the development of a technology that would likely have mutually beneficial if it had been mutually agreed upon. In fact, the internal EDI strategies of the smaller suppliers were so poorly-developed (or even non-existent) that those suppliers were unaware of EDI technology and the organizational changes EDI systems might bring, until they were confronted with these facts by the already sophisticated manufacturers. Even if they were aware of the strategic potential offered by standards-based EDI systems, they often lacked the time or resources required to even send representatives to meetings on setting standards. Thus standards setting became the domain of larger companies that could afford the process. Small suppliers were locked into systems developed by, and for, the larger manufacturers, and electronic trading was on the terms of those manufacturers.

5. Conclusion: "Culture Matters" in National Innovation System

The development of EDI systems is summarized by the following:

- Closed collectivism produces a mindset that considers it reasonable for each manufacturer, as part of a Chaebol, to have its own EDI system. Lacking trust in each other, manufacturers fear that open standards will lead to a loss of business secrets and a loss of control over suppliers. The core of the problem is, then, power and a lack of trust.

- Authoritarianism means that suppliers have no realistic chance to influence the development of systems. Although those who supply several manufacturers would naturally benefit from open standards, they have no power to influence the decision of manufacturers.

- The influence of cultural factors is also seen in the failure, up until now, of all efforts of third parties to achieve an economically reasonable standardization of EDI for the entire Korean automotive industry. There is little possibility of their influencing the shaping of systems.

These empirical findings confirm this paper's hypotheses that the character and implications of EDI systems in the Korean automotive industry are emerging not

as features largely shaped by such business goals as efficiency, but as systems socially-shaped by a highly coercive and controlling relationship between manufacturers and suppliers in a particular cultural context, in this case closed collectivism and authoritarianism. What derives from this observation is a proposition that the Korean development of technology follows a model I will call the Chaebol Model, which is severely hierarchical in its internal coordination and cooperation. Manufacturers dominate in establishing and maintaining the relationship between manufacturers and the supplier, so the relationship is characterized as hierarchical rather than cooperative. Consequently, external relationships are characterized by isolation, with individual Chaebols and their suppliers sealing themselves off from the "industrial environment" in which they function. This model, and the kind of innovation that derives from it, corresponds to a particular kind of institutionalized social organization seen in Korean society, "closed collectivism" and an "authoritarian hierarchy".

This Korean innovation model was relatively effective in the 1960's and 1970's, when technology was mature and therefore slow-changing, so its acquisition and assimilation were relatively easy. With the Chaebols and a supportive government as central authorities steering economic and social development, Chaebols were motivated to business and economic success by seeking "the good of the group" (Ralston end of transaction Al., 1997), i.e. group harmony with a hierarchical relationship, as well as the collective welfare. However, this only applied in a limited sense to the Chaebols. Further, from the viewpoint of the good of Korean society as a whole, group orientation places a major obstacle in the way of technological innovation. The collectivism and authoritarianism that seem to guide Korean society to a great extent are responsible for Korea's relatively low level of trust compared to such countries as Japan and Germany (Fukuyama, 1996). Trust is the expectation that arises within a society of regular, honest and cooperative behavior. Trust implies "sociability", the ability to work together and easily associate. The existence and level of "social capital" and sociability depends on the level of trust that exists in a society as a whole.

A low-trust society requires a system of formal rules and regulations that have to be enforced, often by coercion, to bring about interpersonal or interorganizational

cooperation. Even those rules are often not properly enforced due to dishonesty and corruption, which entails high transaction costs. Widespread distrust imposes a kind of tax on all forms of economic activity. If a society is divided into sub-groups that tend to distrust each other, as is the case in Korea, that society will likely suffer broadly from a low level of trust.

Sociability in Korea is limited to the members of a collective. This closed collectivism, as seen in Chaebols, leads to inefficient management, and the resulting predatory behavior in inter-firm relations drastically increases transaction costs. This is exacerbated by the lack of strong intermediaries able to bundle and balance the interests of enterprises. The root factor of all this is the lack of social capital due to the low level of trust in the society that inhibits a wide variety of spontaneous social relationships. This tendency works against the interorganizational technology innovation process.

A collectivist culture generates a lack of trust, which in turn creates barriers to cooperation with outside-groups (Triandis, 1988; 292-6). Low trust toward an outside group leads to a very narrow definition of what is considered to be "good". If something good happens to an "outside-group", it is inevitably bad for the inside group. The idea of getting more goods through the cooperation of all participants does not exist in a collectivist society. People tend to make life difficult for outside-groups instead of working to improve their own conditions. On the other hand, the emphasis on inside-groups leads to the neglect of the individual. Thus, internal control of motivation is synonymous with effective work performance, and obedience is of great importance criticism of superiors is not tolerated. Additionally, the emphasis on harmony within the inside group forbids disagreements with authority. The fear of expressing ideas or of disagreeing with authority can be a massive hindrance in economic development, since it does not allow the toleration of diverse viewpoints.

Korean culture creates barriers that hinder the reform of both formal and informal institutions so they come in line with the rapidly changing market and technological environment of recent decades. A close look at Korean culture shows that building more social capital is a way of overcoming the weakness of the Korean innovation system. This calls for the improving of trusting relations and

the pursuit of cooperation between organizations. In the increasingly competitive global marketplace, where innovation is mandatory, Korea is faced with a transition from "imitation to innovation" (Kim, L., 1997). To accomplish this, a new cultural standard is needed.

Unlike other recent research on the cultural variability of technological innovation that focused on the internal behavior of organizations, the interorganizational viewpoint taken by this paper will provide an important framework for further studies focusing on the link between culture and innovation.

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