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Analytical Framework

Supplier Systems in Late-Industrializing Economies

This chapter discusses the framework for analyzing supplier systems, with a special emphasis on conditions in late-industrializing or developing economies. From the perspective of mechanisms of risk management and capability upgrading promotion, supplier systems can be roughly divided into two types: united-type and isolated-type systems. A model is presented here for determining which type applies in a particular case, using various conditions involving the competitive environment and the capability of firms. I will then present the assumption that, in today's developing economies and particularly in China, the supplier system is more likely to be inclined toward an isolated type.

I. Objectives and Mechanisms within the System: Risk Management and Promotion of Capability Upgrading

According to agency theory, a supplier system is an institution made up of many incentive mechanisms set up by the principal to get its agents to achieve various objectives. Assuming that the maker is the principal and that the suppliers are its agents, the maker tries to accomplish diverse objectives, including ensuring the quality, cost, and delivery (QCD) of suppliers; promoting their rationalization; and strengthening cooperation on product development. At the same time, suppliers, through the same system, pursue objectives such as securing payments from the maker, ensuring stability in orders, and upgrading their own manufacturing and development capabilities. Methods for achieving those objectives are also diverse and a variety of mechanisms can be included concurrently in a single system.¹

This study focuses on two of these mechanisms: risk management and the promotion of capability upgrading.

Risk management involves measures, both prior and ex post facto, used by both makers and suppliers to minimize risks. I take particular notice of the methods used to minimize the risks to the overall system through cooperation between the parties rather than having each side work to reduce its own risks. Risk reduction for each agent is considered to lead to an increase of profits.² For each side, the promotion of capability upgrading means supporting or encouraging the upgrading of the transaction partner's capability in order to increase its own profits (or those of the system as a whole). This study looks primarily at the promotion of capability upgrading directed by the maker toward its suppliers.

1. Risk Management

The primary risks assumed here are: (1) the risk that a partner will fail to fulfill the contract (contract risk), and (2) the risk that the final product will not be valued in the market and therefore will fail to sell (market risk).

Risk (1), from the perspective of the maker, includes such events as the discovery of technological defectives among the products provided by the suppliers and the failure of delivery as contracted, while the risks from the perspective of suppliers include, for example, the refusal of the maker to purchase the parts they have developed or to make payment as contracted.

Makers, in particular, exercise ingenuity to minimize "supplier failure." The *ex ante* arrangements include setting parameters such as quality standards, management standards, operation standards as well as parameter enforcement via monitoring through inspections, the provision of incentives, and penalties (Humphrey and Schmitz 2001, p. 20).

As for risk (2), the failure of a new product leads to the loss of the investment into development. Such failures can be caused by a variety of reasons including economic downturns, changes of consumer preference, competition with rivals, and wrong projections of market needs (marketing failure). Generally speaking, the greater the uniqueness of the product compared with existing products prevailing (valued) in the market, the greater the risk.

Risk (2) is affected by risk (1). If a supplier has a quality problem, the market valuation of the final product may decrease. Delays in the delivery of parts can cause a delay across the board in launching the new product and thus to a failure to sell at the appropriate time. Thus, a reduction in risk (1) can lead to a reduction of risk (2). Suppliers are far from immune to risk (2). If the relationship between them is one that focuses on mid- to long-term profits, unfavorable sales on the part of the maker will have an impact on their transactions in the coming periods. Considering the connections described above, risks (1) and (2) both confront the system at large.

The maker is in the leading position not only for coordinating interfirm ex ante arrangements to minimize the risk of the system, but also to determine ex post arrangements such as the distribution of risk among the maker and suppliers. The arrangements for risk distribution vary from full absorption by the maker (providing perfect insurance) to risk sharing between the maker and suppliers (partial insurance) and to the full shifting of risk by the maker to its suppliers.

2. Promotion of Capability Upgrading

The promotion of capability upgrading is mainly discussed in the context of makers providing such promotion to suppliers. Upgrading suppliers' capability is a very important ex ante arrangement used to reduce risks. In order to reduce risk (1), a variety of know-how, technologies, and skills are needed in order to promote quality control and cost reductions. These can be provided directly by makers to suppliers or indirectly, by encouraging suppliers to learn them. Furthermore, as makers develop products that rely upon the expertise held by suppliers, upgrading the engineering capability of suppliers leads directly to the reduction of risk (2). Intentional efforts by buyers to improve supplier capability and performance are called "supplier development" (Leenders 1965, Krause 1997).

Supplier development is generally divided into direct transaction-specific arrangements and infrastructural arrangements that enhance the effects of the former. The former includes target setting for suppliers, support for human resource development, and the provision of technological guidance, investment, and personnel interchanges, while the latter includes the sharing of strategic objectives, increased communication, continuous commitment, trust building, and so on (Humphreys, Li, and Chan 2004, pp. 132–34). In China we frequently observe a unilateral and simple method under which makers force two or more suppliers to compete against each other on the same playing field.

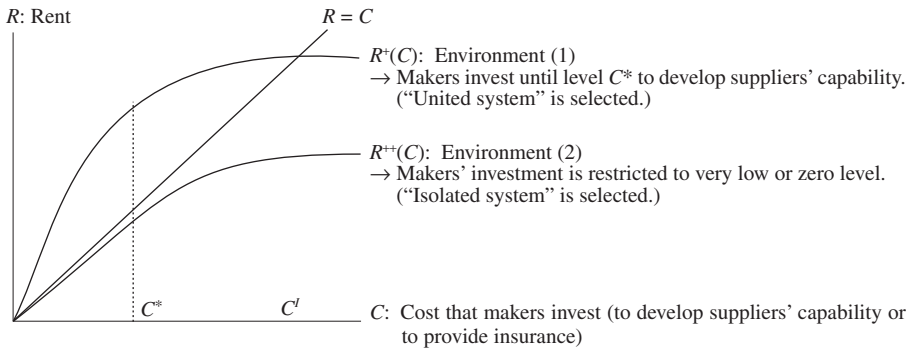
In this study, transaction-specific arrangements are called "nurturing," while broader arrangements combining them with infrastructural arrangements as well as the burden of unilateral competition pressure are termed "promotion of capability upgrading."

II. Selection and Change of the System: Isolated Type vs. United Type

In considering risk management and the promotion of capability upgrading, the supplier system can be roughly divided into the isolated type and united type. The type of system is determined by the competitive environment surrounding firms and by the quality and level of the capabilities both of their own firm and their transaction partners. The mechanism of the selection and change of the system can be described as follows:

When a maker plans a transaction system with suppliers, the following options are available: The maker, by absorbing the risks of suppliers and exerting nurturing efforts (i.e., by paying the costs for providing insurance and nurturing, C) draws a commitment (Cm) from suppliers to strategically upgrade their capabilities. Commitment in this context means the will to upgrade their own capability from the status quo in order to meet the partner's expectations, along with efforts made to this end. Let us assume that this generates a "relational quasi-rent" (hereafter called "rent," denoted by R)³ between the maker and its suppliers. In cases where the capabilities of the maker and the suppliers are highly complementary, enhanced capability among suppliers will strengthen the position of the maker in development, production, and sales,

Fig. 1-1. Selection of United- and Isolated-Type Systems



- Notes: 1. C is the investment that makers make to develop suppliers using the profit of the primary period. C will bring about a rent and net profits to makers in the second period. Inflation and interest rates are assumed to be zero. Decreasing marginal returns are assumed
2. $C^* = \text{Maximized point of net profits } (R - C)$,
 $C' = \text{Procuring cost of the supplier (integration cost).}$

in that a stable supply can be secured, quality can be upgraded, development speed can be accelerated, and new technologies of suppliers can be utilized. This is the main source of R .

However, the maker does not pay the cost C in every case of supplier development. Especially in developing countries, such investment is not likely to be undertaken, for various environmental and capability-related reasons.

In the case where C of the current term is greater than R to be generated in the next term, meaning that $(R - C)$ (the net profit) < 0 , which is the case of R^{++} in Environment (2) in Figure 1-1), the maker, rather than bearing such a cost, will conduct a spot-market-type transaction. In the case of $(R - C) > 0$ (the case of R^* in Environment (1) in Figure 1-1), the maker will bear the cost to the point where net profit is maximized (C^* in Figure 1-1). If C^* exceeds C' , the cost of fully purchasing the supplier, the maker will integrate it into its firm. When C is very small and approaches zero, I call the supplier system an isolated-type system. When the level of C is large, I call it a united-type system.⁴

The amount of R derived from the maker's C differs depending upon the competitive environment surrounding firms and the capabilities of both the maker and suppliers. I will discuss this by dividing it into the effect through which the maker's C draws forth suppliers' C_m (effect of commitment acquisition) and the effect through which C_m generates R (effect of rent acquisition) [$R = R(C_m(C))$].

1. Effect of Commitment Acquisition

From the viewpoint of suppliers, the effect of commitment acquisition is affected chiefly by "profitability," "credibility of transactions," and the "substitutability of transaction partners." If the expected return to be brought about by the transaction is low (e.g., market risks are high due to rapid changes in technologies and demand, and

there are other transactions from which higher returns can be expected), and transaction rules are yet to be established in the industry (e.g., a judicial system is not in place to enforce contract fulfillment, or the industry is riddled with opportunism and transaction partners are not sufficiently trustworthy), the level of C_m acquired by investing a given level of C will be low. This point is important in developing economies, where official and unofficial institutions for ensuring contracts in modern market transactions are generally immature. In contrast, in a market where the expected return is high and disciplined transaction rules are in place, the level of C_m acquired by a given level of C is high, and thus the merit of cooperative action will be greater.

2. Effect of Rent Acquisition

The effect of rent acquisition is determined by the “exploitation effect of capability” of both the maker and suppliers and the “type of product technology” demanded by the market.

(1) Exploitation Effect of Capability

The exploitation effect of capability has the following two meanings: Firstly, it indicates the “possibility of capability upgrading” of suppliers in response to encouragement by the maker. When a supplier’s potential is low and the speed of capability upgrading is slow, the level of R to be acquired should also be low. The result is the same when the maker’s leadership is weak and there are very limited measures available to upgrade supplier capability.

Secondly, it represents the “possibility of exploitation by rivals” of the supplier’s capability. If the supplier, making use of the capability enhanced by the maker’s nurturing efforts, provides a rival maker with improved parts, the rival’s market position might be enhanced, which in turn might lead to a decrease in the maker’s R . And yet, nurturing efforts are in fact exerted, possibly for the following reasons:

If the “degree of transaction specificity” of the supplier’s capability to the maker is high,⁵ the possibility of its being exploited by rivals is low. At the same time, there are few suppliers equipped with such capability, and therefore, makers will actively nurture them. However, this situation is not common.

In fact, makers frequently nurture basic and general-purpose capabilities that are likely to exert merits for any transaction partner.⁶ They do so (1) when the maker can restrict the transaction scope of suppliers by other measures, and (2) when the capability’s complementarity⁷ to the maker is greater than to other makers, or in other words, when the exploitation of the supplier’s capability by rivals cannot become a source of competitive advantage for the rivals as it is with the maker.

An example of case (1) is when the supplier’s scope of transaction can be restricted by capital affiliation, or the supplier is so small in scale that it cannot afford to develop transaction partners other than the maker.

The following is a possible example of case (2). Maker A, whose source of product differentiation is the capability to achieve good product planning and high quality, can differentiate itself from its competitors by excellence in product concept and the quality of the most important parts α , which are manufactured in-house, whereas the

product cannot be perfected unless the quality of externally made complementary parts β (to be purchased from supplier B) is secured. And if the rival maker, even if it purchases parts β from the same supplier B, is unable to make as good a final product as that made by A, A will nurture B. It is presumably on the basis of this assumption that in developing economies, foreign makers nurture indigenous suppliers in terms of basic general-purpose capabilities, such as quality management.

The implications of (2) with regard to the industrial development of late-industrializing economies are significant. The great majority of makers in late-industrializing economies are homogeneous, in that they commonly have few internal technologically and managerially original resources⁸ that can be sources of long-lasting competitive advantage, and they are heavily dependent upon the quality and originality of external resources (e.g., purchased parts) to offset this weakness. In this case, important parts are not made internally, but are predominantly purchased from outside. In this situation, the source of decisive competitive advantage can easily be exploited by rival makers, and investment into qualitative improvements of suppliers is unlikely to be made since it might benefit rivals. The more the rival firms are homogeneous in terms of technological capability, the more unlikely it is that nurturing efforts will take place.

The problem of technological capability building, where many firms in late-industrializing economies, especially in China, are likely to share a homogeneous technological capability, will be discussed in Chapter 3.

(2) Types of Product Technology

In the case where the market demands a high level of “product quality,” it can be presumed that stronger mutual coordination and continuous knowledge sharing must take place between the maker and suppliers. Examples are cases where, to achieve optimum quality, a greater level of careful coordination between parts is required at the design phase, and a high level of quality control is demanded in the production phase. The same is true in the case when new products or processes with high novelty are developed jointly with suppliers. In contrast, when there is no demand for high quality, “so-so” products that can be made with a lower level of mutual cooperation are likely to satisfy the demand. The same is true in the case of minor-change type development, with a low level of novelty (Chapter 3).

A different level of mutual coordination is also required in accordance with the difference in product “architecture.” For instance, in transactions involving functional parts for personal computers and bicycles, which are developed and produced based on a highly “modularized” design, the R acquired from a given level of Cm should be small,⁹ whereas in transactions involving parts for automobiles and motorcycles, which require complex mutual coordination among parts at the design phase (called “integral”), it should generate a higher level of R . However, this aspect will have no significant influence upon the discussions in the subsequent chapters of this study, since the motorcycles that will be analyzed are all developed and produced in accordance with a common design between Japan and in China, and they are, in other words, products of the same architecture.

III. Advantages of the Respective Systems and Impact upon Capability Accumulation

Each of the systems has its own merits and demerits. The united system, as described above, has an advantage in terms of offering high quality and novelty. This advantage will presumably increase as the system continues. This is because the accumulation and sharing of knowledge concerning goods that are mutually complementary within the system further contributes to its advantage in product development and quality improvement. In this respect, this system is effective in industries or development phases where “incremental technological innovation” (Chapter 3) plays an important role.

On the other hand, this system cannot respond easily to rapid changes of technologies and business models. The maker has to distribute risks within the system and sometimes to take risks upon itself, and rapid environmental changes can increase risks beyond the level the maker can assume. If excessive risks have to be assumed in order to maintain the system, it can lead to a weakening of its own management.

At the same time, any strategic failure by the maker strongly affects suppliers. Furthermore, the suppliers, while upgrading their technologies as required by the maker, may lose an opportunity to broaden and enhance their skills in other spheres.

The strength of the isolated-type system is its flexibility in responding to technological and environmental changes. Responses to such changes are easier in the sense that the utilization of external resources is free from the “constraints” of the existing business partners. In addition, both the maker and suppliers can more easily circumvent the risk of their partner’s failures. Under this system, new firms that cannot afford to assume risks can enter the market with relative ease.

The technological demerit of this system is that it makes it difficult for firms to share knowledge about complementary goods, which may make it difficult for the maker to develop and produce high-quality products and new technologies. Suppliers move independently toward expanding their scope of technologies, and the maker, who does not have an adequate knowledge of these moves, is unable to evaluate them and thus does not find it easy to integrate the achievements of the suppliers.

What is most important here is the fact that the continuation of the isolated-type system makes it difficult for firms to accumulate complementary knowledge about the overall system of the industry’s technology. This, in the longer run, is likely to decelerate the technological upgrading of the overall system.

IV. Summary

Table 1-1 shows a summary of the above discussion. It must be stressed that the framework of this chapter has been formulated to explain the current status of the present developing economies (China, in particular). Needless to say, each country, each industry, and each targeted market segment has mixed conditions that may lead

TABLE 1-1
FACTORS AND CONDITIONS THAT DETERMINE THE TYPE OF SUPPLIER SYSTEM

	Conditions Leading to a United System	Conditions Leading to an Isolated System
A. Factors Affecting the Effect of Commitment Acquisition		
Profitability per unit	High	Low
Credibility of transactions	Well-formed market transaction order (matured market mechanism)	Disorder of market transactions, rampant opportunism
Substitutability of transaction partners	Limited number of transaction partners with differentiable capabilities	Many, homogeneous transaction partners
B. Factors Affecting the Effect of Rent Acquisition		
a. Exploitation effect of capability		
Possibility of capability upgrading	Strong leadership of makers (wide knowledge on overall product technology, rich financial resources, etc.), suppliers with great development potential	Weak leadership of makers (narrow knowledge on products, especially on suppliers' parts, shallow financial resources), low development potential of suppliers
Possibility of exploitation by rivals	Maker has specific competitive advantages (stronger complementarity with suppliers). Maker has measures for restricting suppliers' transactions (via equity participation).	Maker does not have specific competitive advantages and relies heavily on external resources (weaker complementarity with suppliers). No measures to control suppliers.
b. Types of product technology		
Quality of product demand	Demand for high quality and novelty	Demand is satisfied with low quality and low novelty, demand for standardized products.
Architecture	Integral	Modular

them to become isolated- or united-type systems. However, viewed holistically, in developing economies, the conditions leading to an isolated-type system exist to a greater extent. An economy or industry wishing to achieve a united-type system must overcome such conditions, requiring that the government exercise enforcement and/or provide incentives.

Especially in China, which is undergoing a transition to a market economy and at the same time, in some aspects, remains an underdeveloped country, and which also has a huge population, making it possible for vast numbers of firms to enter the competition (since a single or a few firms are unlikely to occupy the whole domestic demand), the following can be anticipated. Due to the immaturity of institutions that

can encourage and ensure fair market transactions compared to those in the developed economies, there is great room for opportunism. At least until the beginning of the first decade of the twenty-first century, in spite of extremely active new entries, few publicly owned corporations withdrew from the market. As demand is predominantly from low-income sectors, the qualitative requirements for products are relatively low. These factors are likely to lower the effects of commitment and rent acquisition, leading to an isolated-type system (the above-mentioned conditions are chiefly discussed in the next chapter).

Furthermore, the following can be predicted with regard to the technological capabilities of firms. Due to the long history of industrialization, firms have basic manufacturing technologies, but most products were newly launched in the 1980s and 1990s, and therefore, both makers and suppliers have only a narrow knowledge of overall product technologies. In particular, the technological leadership of makers over suppliers is weak. Since there is a large number of internal homogeneous makers and suppliers, the complementarity of capabilities among firms is weak and the substitutability of transaction partners is high, and so is the likelihood of rivals exploiting investment into nurturing. These conditions will tend to lead to an isolated-type system (the above conditions are discussed primarily in Chapter 3).

As such, the study essentially assumes that in China today, with its lack of government intervention and an immature market transaction system, the transaction system is likely to move toward an isolated type.

Chapters 4 to 6 will empirically discuss whether these conditions actually led the supplier system in China to become an isolated type, and how the system changed along with conditions, analyzing the cases of the motorcycle industry from the 1980s to 2004.

Notes

- 1 For contradictions and trade-offs among objectives and the complementarity of various mechanisms, see Itoh and McMillan (1998).
- 2 It is Knight (1985) who attributed the source of the profit of a firm to its specific organizational capability to reduce risk (uncertainty in his terminology).
- 3 A quasi-rent is the added benefit that can be obtained by continuing the transaction with the current partner rather than switching to another partner, and it is different from rent, meaning benefits that increases when the party enters into a new transaction. The former is a proper concept for considering the decisions of longer-term continuous business relationships (Milgrom and Roberts 1992, pp. 269–72). Aoki, clarifying the concept of relational quasi-rent through concrete examples in Japan, argues that it is generated by improved information communication (1988, p. 218). Asanuma argues that it is generated as supplier's "relational skill" is accumulated to meet the maker's demand (1989, p. 25). This chapter follows Asanuma's perspective. For the simplicity of terminology, the relational quasi-rent is referred to as rent in the following parts of this book.
- 4 As shown in the followings chapters, Japanese system, especially as adopted by Honda, is an extreme form of a united system, or "quasi-integrated system," where the level of *C* is

very close to C' ; the maker's leadership is overwhelming, and suppliers are generally subordinate.

- 5 A representative example of this is the capability that suppliers were required to achieve to respond to Toyota Motor Company's "just-in-time system," when it was not yet a common practice.
- 6 Asanuma (1989), stating that the relational skills "always consists of two layers: the surface layer which corresponds to accumulated learning acquired through transactions with a given core firm, on the one hand, and the basic layer which corresponds to general technological capabilities, on the other" (p. 21), emphasizes incentives for suppliers to acquire general and basic skills.
- 7 It is Richardson (1972) that made it clear that the degree of complementarity of capabilities between firms determines the mode of coordination of their activities.
- 8 Such resources are thought to be mainly intangible "knowledge-based assets" that cannot be easily transferred, and can only be obtained through deliberate efforts to access and accumulate them through long-term experiences. See Nelson and Winter (1982), Demsetz (1988), and Amsden (2001).
- 9 "Modularization" means technological ingenuity that aims to curtail the mutual coordination among materials (and among the firms that produce them) that is invariably needed for industrial products that are assembled from a large number of materials. Suggested by Yoshimi Itō. For details of modularity, see Baldwin and Clark (1997).