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Koichi Nakagawa
Komazawa University, Japan

Won-Wook Song
The University of Tokyo, Japan

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東京大学ものづくり経営研究センター
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Business transaction, insufficient trust, supplier's relational skills, LCD panel

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Purpose of the study

The paper discusses a new problem in interfirm transactions and proposes a solution to it. In this study, we named the phenomenon “customized component transaction with insufficient trust” (CCTIT). Trust is important in customized component transaction because it enables makers and suppliers to coordinate broadly and thoroughly. However, at present, not only makers but also suppliers often face situations in which they are unable to build trustful relationships with their business partners. In the global supply chain, players have different perspectives, rules of competition, commercial institutions, and strategies. In such a supply chain, makers and suppliers have to conduct transactions despite having the feeling of the potential risk that customer or supplier's may engage in unexpected conducts, even though a transacted component must be technically coordinated with customers’ products. Here we define such transactions as “CCTIT,” and explore the features, problems and solutions in a case study of the Liquid Crystal Display (LCD) panel industry.

In this study, we focus on the supplier-side responses to CCTIT, although the maker-side is also important. The chief reason for our focus is that component suppliers have larger impact by CCTIT than makers. This is true in several industries such as electronics and automobiles. In the past, transaction network was closed within a specific developed country and its structure was limited and relatively stable. However, present-day makers in newly industrialized economies have grown up while suppliers have not relatively. As a result, component suppliers in developed countries gradually increased the volume of transactions with such newcomers. In this sense, the situation of the supplier-side has changed more than the maker-side. This raises the question of how supplies respond to CCTIT.

Literature review: Customization, partnerships, trust, and relational skills

According to transaction cost theory, there are three basic alternatives for governing a transaction relationship; 1) vertical integration, 2) arm’s length relationships, and 3) partnerships (Mahoney, 1992; Williamson, 1975). Vertical integration is preferred when the components must be highly customized because the buyer reduces transaction costs, such as the risk of opportunism. In contrast, when components are highly standardized, firms should use arm’s length relationships with the suppliers

who focus on a particular component. Consequently, partnerships fall in between vertical integration and arm's length relationships. In partnerships, makers and suppliers collaborate technically to improve total product performance in production and development (Clark and Fujimoto, 1991). Partnerships are preferable when specialization is important and firms can create value through customization. Thus, partnerships are often used in making technically complex products such as automobiles and computers, because such products need component customization as well as component specialization (Dyer, 2000; Iansiti, 1998).

In order to build and maintain partnerships, trust is very important (Dyer, 2000; Sako, 1991). Here, we define trust as one party's confidence that the other party involved in the exchange will fulfill its promises and commitments. If both buyers and suppliers are trusted, each feels that there is less risk of opportunism, and as a result they enhance their commitment to the partnership. Firms can share knowledge and cooperate with trustful partners. As a result, interfirm trust contributes to the development of partnerships.

To focus on the supplier side, another important aspect is relational skills (Asanuma, 1989). Relational skills are to be possessed by the supplier to respond efficiently to the specific needs of the buyer. Relational skills comprise the base of technological capability and accumulation of know-how for technical collaboration in product development and manufacturing. Thus, even if both makers and suppliers have trust, they cannot collaborate effectively without relational skills.

Relational skills promote the flow of information (or knowledge sharing) from makers to suppliers (Takeishi, 2002). Information about product technology and product concepts helps suppliers customize their components in accordance with maker's final product. Firms that have relational skills can acquire more information from customers, interpret it adequately, and embed it into their component design.

In summary, in the technically complex product industry, partnership collaboration between the maker and the supplier contributes to total product performance. Interfirm trust and relational skills are two essential characteristics for effective partnerships because both promote the flow of information used in customizing component design (Figure 1).

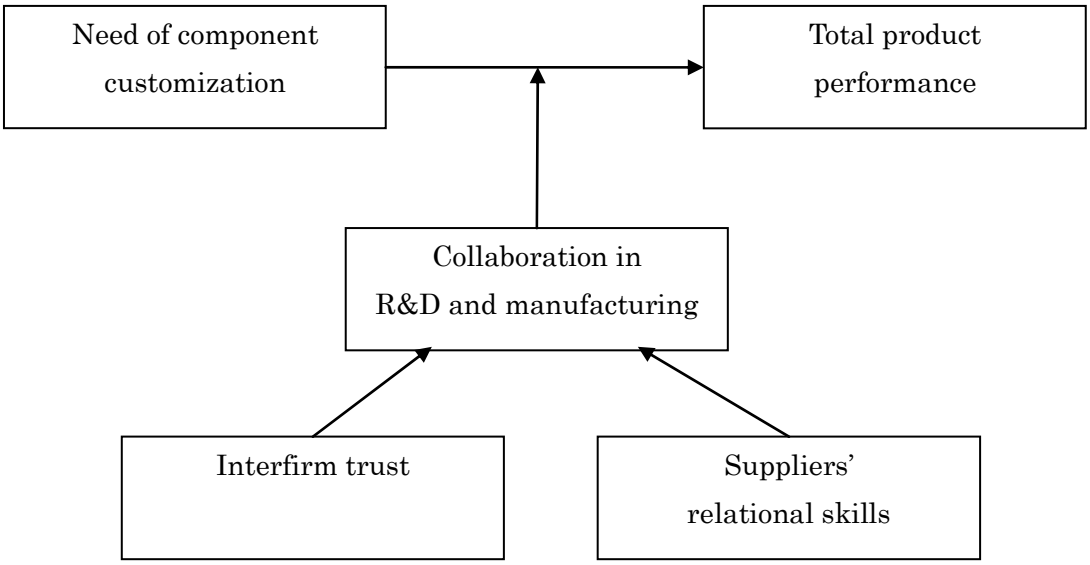


Figure 1 Structure of maker-supplier partnerships

Research question: Insufficient trust resulting from globalization

Although it may be well-known that establishing partnerships is an advantageous approach in making complex technology products, present-days firms sometimes did not choose establishing partnerships. The chief reason for this is the globalization of the supply chain. In the past, makers and suppliers had a limited number of business partners. This was particularly true in Japan, where transaction networks were very limited and remained unchanged in the long-term (Asanuma, 1989). However, since around 2000, the period in which globalization hastened, entrants of makers and suppliers in the newly industrialized countries have restructured the supply chain and threatened the traditional long-term stability. Newcomers in newly developing countries have different perspectives, rules of competition, commercial institutions, and strategies. Thus, transactions with such newcomers are risky as to whether they include an intuition of opportunism. Therefore, we can conclude that firms often transact with others with insufficient trust in the globalized supply chain.

Thereafter, there are three essential problems that appear: What is CCTIT like? What is its most important problem? How do suppliers cope with CCTIT? Researches have not yet considered this issue; this paper attempts to become one of the first to do so.

In this paper, we focus on the flow of information between makers and suppliers as well as their relational skills. As discussed previously, trust is meaningful in business relationships because it enables greater exchange of information in a transaction. An insufficient amount of trust decreases the flow of information and disturbs effective component customization. In this case, suppliers would have to change their relational skills to improve the flow of information or compensate for acquiring only small amounts of information.

The case study of LCD panel industry

Research method

We examined CCTIT through a case study of the LCD panel industry. We used the LCD panel industry because the maker-supplier relationships are not entirely trustworthy in the industry. Currently, the LCD panel makers are located in various countries. They are Korean (Samsung and LG), Taiwanese (AUO and CMO), and Japanese (Sharp). By contrast, many LCD component suppliers are located in Japan. Transactions between those makers and suppliers often have CCTIT. Historically speaking, firms in the industry often experienced opportunistic conduct like technology leaks by transaction counterparts and felt that a substantial risk of opportunism existed in transaction (Shintaku, 2008; Shintaku, Shu, and Su, 2006). Through our observation of the industry, we tried to obtain basic understandings of the features, problems, and solutions for CCTIT.

To assess the actual situation of transactions in the LCD panel industry, we conducted a questionnaire survey and field research with Japanese and Korean suppliers during 2009 - 2010. In the questionnaire survey, we received responses from 28 Japanese suppliers and four Korean suppliers. In the field-based research, we interviewed nine Japanese suppliers and three Korean suppliers.

The contents of this case study are as follows: First, we explain the history of the LCD panel industry to understand the reason for its insufficient amount of interfirm trust; second, we investigate the actual situation of maker-supplier relationships in the LCD panel industry by checking the questionnaire and field survey; finally, we examine the problem and potential solutions to it through an in-depth firm analysis.

History: Why do makers and suppliers not have trustful relationships?

To understand why makers and suppliers do not have trustful relationships, we must analyze the history of the LCD panel industry. In the early stage of the LCD panel industry, firms had trustful relationships because such technical collaboration led to competitiveness. However, since the late 1990s, when Asian newcomers tried to compete with Japanese incumbents, relationships got worse in terms of trust because technology leaks and thefts often occurred in transactions.

In the 1970s and 1980s, which are considered the nascent days of the LCD panel industry, competition occurred between Japanese and U.S. firms, with Japanese firms eventually winning by taking advantage of their trustful and long-term relationships with suppliers. To develop an LCD panel, the integration of electronics, chemicals, semiconductors, and other technologies are necessary. The partnerships of each area's specialists were suitable for that technical integration. While U.S. LCD makers formed arm's-length relationships with their suppliers, Japanese rivals chose to establish long-term trustful relationships. As a result, Japanese LCD makers, including Sharp, became the leaders of the LCD panel industry (Numagami, 1999).

In this early stage, important backgrounds of CCTIT were prepared: First, technical knowledge was dispersed among each maker and supplier and no one had whole LCD technology; second, there were relatively small number of LCD panel makers and their suppliers remained. In other words, every LCD panel maker had to depend on a small number of the suppliers which had specific technology of LCD component.

In 1990s when Korean firms like Samsung and LG entered into the LCD industry, maker-supplier relationships within Japan changed. During that era, the LCD industry grew rapidly because of the innovation of the large panel. The LCD panel started to be used in more products such as notebook PCs, monitors for desktop PCs, and TVs. Korean makers were convinced the growth of the LCD industry and attempted to enter into the sector. In contrast, Japanese makers had a pessimistic view about the growth of the industry and were passive about making big investments. Because of this, the Japanese suppliers gradually included their customers from Japanese to Korean firms. At the time, Japanese suppliers shared considerable information, educating Korean makers on several technologies, and established good relationships with them. The Koreans did not have enough technology and had trouble with the mass production of LCD panels. Moreover, Japanese suppliers would not be able to earn revenue if their

Korean customers could not start production; thus, they gave technologies which they accumulated on which they transacted with Japanese customers. However, as a result, the relationships between Japanese makers and Japanese suppliers became worse by those technology transfers. The Japanese LCD makers regard these transfers as unwilling technical leaks. Thereafter, Japanese LCD makers were strictly prohibited from sharing information and technology with their suppliers.

In the 2000s, the relationships between Korean makers and Japanese suppliers deteriorated. Starting around 2000, Korean makers began vertical integration to cut costs and got technical and business leadership. At the time, competition in the LCD panel industry intensified, and every LCD maker tried to beat competitors by gaining a cost and technological advantage. Korean makers attempted to develop certain important components of LCDs, including polarizers, glass panels, and back-light units. Korean makers took advantage of the component technology that had been brought to them through transactions with Japanese suppliers when they started making those components. Then Japanese suppliers began to feel that there were risks in transacting with Korean makers. In particular, Japanese suppliers hid their core technology from customers to protect themselves against technology leaks.

An overview of maker-supplier relationships in the LCD panel industry

Next, we examine the maker-supplier relationships currently formed, as shown in the questionnaire and field research. In this section, we reconfirm that transactions often became CCTIT in the LCD panel industry and other types of transactions also existed.

First, we assess the overall situation of the suppliers. The average component supplier has around 200 million dollars in sales and a few hundred employees. While two thirds of the suppliers are chemical manufacturers that make optical plastics or films, the rest of them are sub-assemblers and electric component manufacturers. Essentially, they sold their products to all customers in the LCD panel industry. There were very few who restrict number of customers.

Next, we observe the situation of the maker-supplier relationships. Here, we stress that both the degree of customization and the degree of relationships are varied. In Table 1, we show how the degree of customization ranges from a standardized commodity to full customization.

Table 1 Suppliers' component type in LCD panel industry

Standardized	Semi-customized	Full customized
9	13	9

n＝31.

In addition, the degree of partnerships ranges from mutual collaborative to arm's-length relationships. Table 2 and 3 show the results of the questionnaire survey in regard to technical collaboration with makers. We classified technical collaboration into six types; Advanced R&D collaboration, component development cooperation, customer product development cooperation, technology transfer from customer to supplier, technology transfer from supplier to customer, and technical instruction meeting with customers. Table 2 shows how many suppliers engage in technical collaboration. The results show that while more than half of engage in advanced R&D, only around 35% of suppliers cooperate in customer or supplier product development with makers. Furthermore, these suppliers do not engage in technology transfer or instruction meeting. As a result, suppliers did not engage in many different types of technical collaboration. Table 3 shows that there were no suppliers that engage in all six type of collaboration and most of them (about 40%) engaged in only one type of collaboration. As a whole, the degree of technical collaboration ranges broadly, but its dispersion is concentrated on a relatively low level of collaboration.

Table 2 Suppliers and types of technical collaboration they perform

Advanced R&D collaboration,	Component development cooperation	Customer product development cooperation	Technology transfer from customer to supplier	Technology transfer from supplier to customer	Technical instruction meeting with customers
14 (48%)	11 (38%)	9 (31%)	5 (17%)	10 (34%)	7 (24%)

n＝29.

Table 3 Number of types of collaboration of suppliers

6 types	5 types	4 types	3 types	2 types	1 types	0 types
0 (0%)	1 (3%)	4 (13%)	6 (20%)	3 (10%)	11 (38%)	4 (13%)

n＝29.

Then, we examine the relationship between the degree of customization and that of technical collaboration. To do so, we created respective indexes. To make the index for the degree of customization, we used four variables gathered from our questionnaire: variable X1: “the coverage of customers by one component model.” (1: the entire industry, 2: several customers, 3: single customer); variable X2: “The potential applicability of one component design” (1: applicable directly to several customers, 2: applicable to certain customers with design modification, 3: not the design, but the basic technology of the component is applicable to certain customers 4: not applicable); variable X3: “the number of newly developed models of the component within one year” (1: less than 5, 2: 5~10, 3: 10~50, 4: 50~100, 5: more than 100); variable X4: “subjective evaluation of the degree of customization" (five point Likert scale: 1: fully standardized components to 5: fully customized components). We composed the four variables under one index titled “the degree of customization,” according to the principal component analysis. Finally, we obtain ane index “the degree of component customization” (CC):

$$CC = 0.91\ X1 + 0.52\ X2 + 0.67\ X3 + 0.59\ X4 - 8.33$$

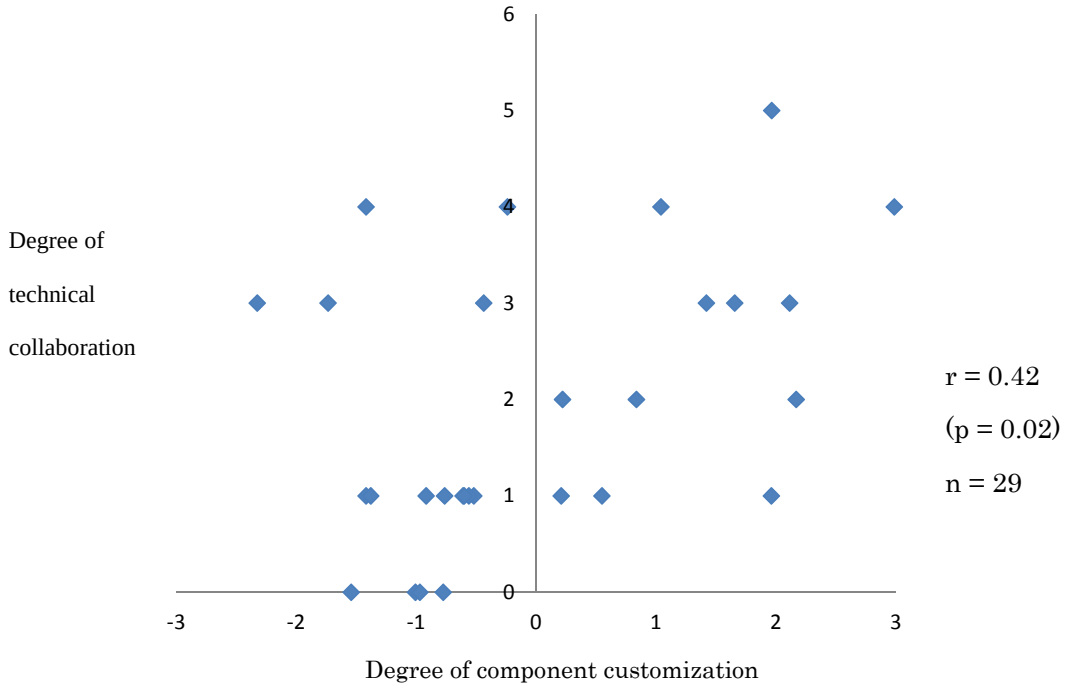
To establish the index of “the degree of technical collaboration”, we use the value in Table 3, i.e., the number of collaboration types performed with the customer. As shown in Table 3, the values ranged from 0 to 5 and higher values mean that the suppliers engage in strong collaboration with their customers.

Figure 2 shows the results of the relationship between the degree of customization and that of technical collaboration. The horizontal and vertical axes show the degree of component customization and technical collaboration, respectively. From this figure, we see a gentle slope from the lower left to the upper right (correlation was 0.42 ($p = 0.02$)). From this observation, we can reconfirm the basic understanding that the more

customized the component, the more technical collaboration is necessary. However, we also observe that many samples are concentrated on the lower side of the figure: In the LCD panel industry the suppliers did not engage in much technical collaboration as a whole, regardless of the degree of customization. Half of the samples show less than two collaborative activities. In addition, we observe that certain firms did not engage in much technical collaboration, even though the degree of customization of their product is high.

Figure 2

Relationship between the degree of customization and the degree of technical collaboration



Detailed analysis for CCTIT: A firm-level survey

Next, in the field-based survey of Japanese suppliers, we tried to acquire a more detailed understanding of the features, problems, and potential solutions for CCTIT.

Fujifilm, polarizer protecting film business

Fujifilm is the leading polarizer protecting film supplier, having over a 70% share in the industry and earning around three billion USD sales in 2009. In particular, Fujifilm has a superior competitive advantage through its high-spec product, a viewing-angle widening type (Table 4). Their main customers are Korean polarizer makers, the

largest of whom is LG chemical. The company's chief competitor is Konica Minolta, which has about a 20% share in the industry. Other competitors, including Hyosung in Korea, were small and technologically disadvantageous, enabling us to conclude that Fujifilm has been quite successful in the industry.

Table 4 Sales and share in the polarizer protecting film industry (2009)

	Plain type protecting film (Mil. yen)	Viewing angle w idening type prot ecting film (Mil. yen)	Sum (Mil. yen)	Share (%)
Sum	114,500	160,700	275,200	
Fujifilm	82,000	119,600	201,600	73.3%
Konica Minolta Opt	32,500	33,400	65,900	23.9%
Nihon Zeon		4,400	4,400	1.6%
Nitto Denko		3,300	3,300	1.2%
Avr. Unit price (Yen/ m^2)	272	723		

Sources: Fuji Chimera Soken (2010)

Fujifilm's TAC film business started in 1988 and established their competitive advantage in the mid-1990s. In the early 1990s, Fujifilm established a technical collaborative relationship with a Japanese LCD panel maker. Fujifilm and the LCD maker cooperated to solve the poor viewing angle problem of the TFT-LCD, and in 1995 finally developed a new polarizer protecting film that improved the width of the viewing angle (named wide-view film). Thereafter, Fujifilm became and remained, for a period of time, a technological leader through their collaborating with Japanese LCD makers or polarizer makers.

However, Fujifilm is experiencing difficult business conditions. Since around 2000, the main LCD makers have shifted from Japanese makers to Korean makers. Although Fujifilm's technical lead was built through collaboration with LCD and polarizer makers, the company could not establish strong partnerships with Korean makers. As previously mentioned, not only Japanese parts suppliers, including Fujifilm, but also Korean panel makers felt that there was a risk of technical and marketing information leaks in transactions. This hampered Fujifilm's ability to establish partnerships with Korean customers, which are important to develop a new protecting film.

In fact, Korean panel makers seldom shared technical and marketing information with

parts suppliers. If Fujifilm received any such information, it would be able to make a well-designed protecting film that was technically coordinated with a customer's need. However, LCD panel makers give Fujifilm only the spec requests for the protecting film, and that is not enough for Fujifilm to integrate protecting film technology to the customer's panel design. "We cannot understand the true technical needs of customer behind the spec requests (sales manager of Fujifilm LCD department)."

In order to develop a new protecting film without partnerships, Fujifilm used tapered integration of a small polarizer maker, Sanritz. In 2005, Fujifilm acquired over 30% of stock in Sanritz. The purpose of the tapered acquisition was not to start the polarizer business but to learn about polarizer technology. "Fujifilm improved the efficiency of protecting film development by the integration of Fujifilm's optical film technology and Sanritz's polarizer technology[1]."

Sanritz was a middle-class polarizer manufacturer that had about a 10% share of the market in 2005. In addition to polarizer manufacturing technology, Sanritz knew what improvements polarizer manufacturers wanted protecting film suppliers to make. The tapered integration of Sanritz enabled Fujifilm to develop a new protecting film that fitted customer needs better than before. "When Fujifilm developed the new protecting film for polarizer, Sanritz evaluated a trial model by using it for their new polarizer. From such a strong collaboration, Fujifilm studied the way of thinking of polarizer makers. It enabled us to guess the true concept and specification of customer's new product (Sales manager of Fujifilm LCD department)."

Japanese chemical material supplier (Company A)

Company A develops and produces a variety of polymer film materials for LCD panels and has sales of several hundred million dollars. It had certain material models that had a top share in certain niche areas in the LCD industry. To increase its sales, Company A tried to sell such niche materials to almost any potential customer, including Japanese, Korean, and Taiwanese panel makers.

Similar to Fujifilm, Company A also had trouble in developing customized materials because their customers who made optical films did not provide enough information about their products. To solve this problem, Company A gathered information about

[1] Fujifilm corporation press release, June 20th, 2005.
http://www.fujifilm.co.jp/news_r/nrj1385.htm

customer products from sources other than the customer. To gather information about what the customer wanted, Company A's sales forces often contacted other component suppliers, the "customer's customer," such as back-light unit makers, or the "customer's customer's customer," such as panel makers. Company A, as if playing jigsaw puzzle, compared information from several sources and estimated the direct customer's needs. "We tried to know the panorama of the new panel development project, and inferred what we should make from the information about the whole panel development project (Sales department manager of Company A)."

An understanding of veteran sales engineer

To obtain hints for customization from an insufficient information flow, LCD component suppliers used veteran sales engineers to interact with the customer. As Table 5 shows, about one-third of sales personnel are sales engineers who have the requisite know-how of LCD technology, and about 60% of sales personnel have worked in the LCD business for more than ten years. Thus, we can say that in the LCD industry suppliers often use veteran sales engineers who have basic technological skills and have worked in the industry for several years.

Table 5 Characteristics of sales personnel of an LCD component supplier

	Number of sales personnel (number)	Ratio of engineer-based sales personnel (%)	Length of service (year)	Ratio of the firms in which sales decides technical target in development program (%)	Technical understanding about their component (five-point scale, 1 – do not know, 5 – know well)	Technical understanding about customer product (five-point scale, 1 – do not know, 5 – know well)
Average	14.14	31.39	10.36	51.6	3.37	3.53
Standard deviation	11.80	-	4.53	-	0.79	1.01

N = 29

These sales engineers studied customer product technology and used it in developing new components. Table 5 also shows that sales personnel had more knowledge about

customer technology than about the suppliers own component technology (the score of understanding about customer technology is 3.53, while that of supplier component technology is 3.37). More than half the number of samples included a statement that the sales department decided the target of the product development program. In summary, veteran sales engineers are one of the most important people for integrating component technology into customer products.

Discussion

In this section, we discuss the features, problems, and solutions for CCTIT from the supplier's viewpoint. We ask: How does it differ from the traditional partnerships transaction, and how do suppliers respond to them? Let us discuss these questions using the results of the case study of the LCD panel industry.

Features and the critical problem of CCTIT

At first, we stressed that there were several types of transactions in the LCD panel industry, and that not all of them were CCTIT. However, we found that technically or strategically important parts, such as protecting film and color filter materials, were often transacted at the risk of the counterpart engaging in opportunistic conduct.

CCTIT in the LCD panel industry has several distinct features, including component transaction that starts at the time of the panel maker's new product development program. Because of the technical leaks in the past, both makers and suppliers hid technically important information about their transactions from each other. Panel makers hid information about the product concept and detailed design and gave suppliers only specification requests for parts. Parts suppliers hid information about the core technology of their parts and gave makers only sample products. Although certain technically important parts are necessary to be highly integrated into a panel's design, both suppliers and makers feel that it was difficult to integrate each other's product technology.

Considering this, it becomes obvious that the scarce information flow from a customer is a critical problem for suppliers. Moreover, because customers do not provide technical information about their products, suppliers have trouble customizing their components.

Potential solutions: An evolution of the relational skills

From our case study, LCD component suppliers adapted to CCTIT by reconstructing their capability for customization, i.e., their relational skills. As mentioned previously, both trust and relational skills can enhance the flow of information from a producer to its supplier. Therefore, suppliers have to rebuild their relational skills to respond to the lack of trust. In fact, suppliers reformed their routines for customization by 1) acquiring customer technology by themselves, 2) using information sources other than customers, and 3) improving the flow of information from customers by using veteran sales engineers. From the viewpoint of the flow of information, all of them are the improvement of information gathering and processing capabilities to cover the limited flow of information from their customers. As a whole, in CCTIT, suppliers' relational skills evolved from a traditional partnership-based, customer dependent mode to a more independent one.

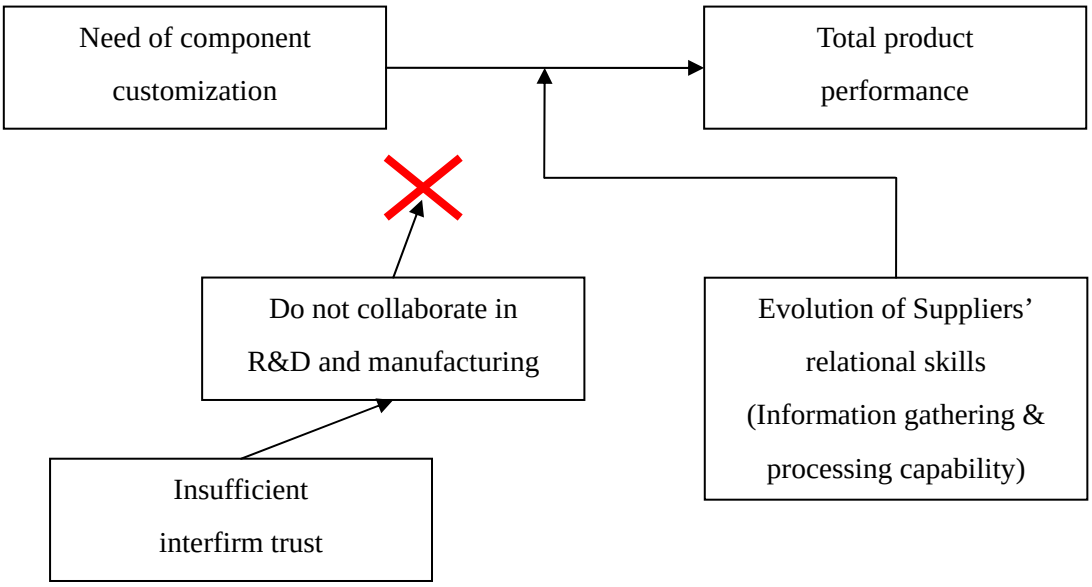


Figure 3 Structure of CCTIT

Possession of customer technology

In CCTIT, customers had not given suppliers their product's detailed design. Fujifilm

and Company A overcame this problem by possessing customer technology independently. Fujifilm acquired customer technology through the tapered integration of small polarizer maker, Sanritz. Company A acquired it through its own R&D. From our research, one-third LCD component suppliers, in general, made trial products for customers, and over 70% of them stated that they understood a certain amount of their customer's product technology. Such knowledge about the customer's product became the basis for the supplier's relational skills, which are used in integrating its component technology with the customer's product design (Prencipe, 2003). In CCTIT, in particular, when suppliers cannot obtain product information from their customers, the supplier's own knowledge acquisition becomes more important than having a trustful transaction. In this sense, possession of customer technology is the core component of relational skills for CCTIT.

Using information sources other than customers

In CCTIT, sources of information other than the customer are important because the customer does not give enough information to suppliers. In the LCD industry, suppliers supplement the quality and quantity of the flow of information from makers by obtaining it from other sources.

Using veteran sales engineers

From the case study, we also uncovered the importance of veteran sales engineers. These engineers have mastered customer product technology and used that knowledge to customize their company's components. They are gatekeepers who gather external information, interpret it, and share it with the development team (Allen, 1977). In this sense, using veteran sales engineers is an effective way to gather information directly from the customer.

Conclusion

The trustless transactions seen in the LCD panel industry might not be an unusual situation. Traditional long-term trustful relationships cannot always be established in the global supply chain, because players in the global supply chain have different perspectives, rules of competition, commercial institutions, and strategies. Makers and

suppliers transact with each other despite having the feeling of the risks that customers or supplier will engage in unexpected conduct. Although the experiences in the LCD business teach us what CCTIT is about, additional research will give us more understanding about it specific attributes and foster future research about CCTIT.

Acknowledgement

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