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6. Changes after the Year 2000:Directions for Future Development

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Changes after the Year 2000

Directions for Future Development

Since 2000, competition in the motorcycle industry in China has changed significantly. As we have already seen, this is indicated by the fact that the profit rate of the industry as a whole has gradually improved since 2002 and that the market share of top firms has risen concurrently. The corresponding decrease of blatantly faulty products, including those violating intellectual property rights, also implies that such a change has taken place.

This chapter explores the transformations of firms that have led these changes during the period. Based on the findings of the second survey conducted during the years 2001–3 and the supplementary survey in 2004, it will clarify the characteristics and changes since the late 1990s of the internal organization of makers and suppliers that undertake product development, and the results of capability accumulation therein. It will then verify how the supplier system has changed in response to, and in support of, such changes within the firms.

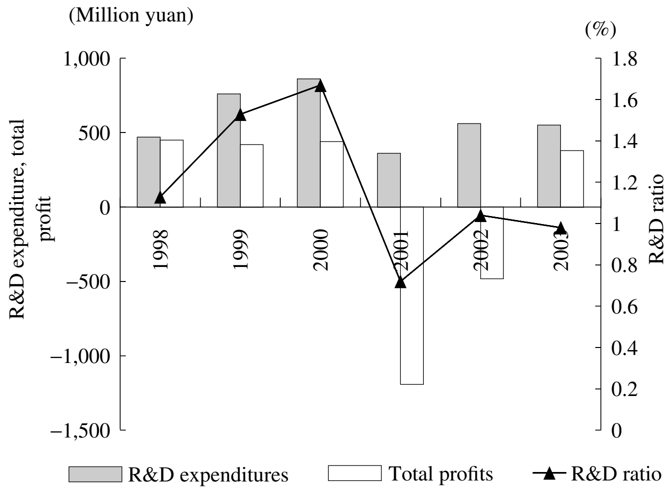
I. Changes in the R&D System of Chinese Makers

This section, which overviews the characteristics of the R&D system of Jialing, Qingqi and Zongshen, compared with that of their Japanese counterparts, will clarify changes since the late 1990s and the direction of future development.

1. Stagnant R&D Spending of the Whole Industry

As shown by the statistical data for the entire industry, the profit rate of Chinese makers fell below zero in 2001 and 2002 and their expenditures for product development have stagnated across the board since 2001 (Figure 6-1). The R&D expenditures[1] of the whole industry (a total of 154 firms) declined, falling to approximately

Fig. 6-1. R&D Expenditures of the Motorcycle Industry



Source: ZQGNB (various years).
Notes: 1. R&D expenditures and total profits are the total of all the registered makers (102 firms in 1998, 154 firms in 2003).
2. R&D ratio = ratio of R&D expenditures to sales of the entire industry.

550 million yuan (U.S.$66 million) in 2003, 35 percent below the level of 2000. The ratio of R&D expenditures to sales also declined to around 1 percent.

A shortage of financial resources may not be the sole reason for the stagnation of R&D expenditures. More fundamentally, it derives from the low profitability of large-scale development projects with their high failure risk in terms of technology and market, as we will see later.

2. Scale of Development

According to the interviews with Jialing and Zongshen in 2002, their annual R&D expenditures were 3–4 percent of sales. In view of their turnover scale, both firms spent about 100 million yuan (approximately U.S.$12 million) per year.[2] In contrast, Japanese makers usually spend 4–5 percent of their sales on R&D, with each firm spending U.S.$200 million or more, approximately sixteen times more than their Chinese counterparts, in 2000.

As for development organization, all three firms have "technology centers," which are divisions specializing in product development. Qingqi had 70 employees[3] assigned to its center (2001), while Jialing had some 300 (in 2003, versus about 100 in 1998) and Zongshen about 300 (in 2002, versus about two dozen in 1998). Both Jialing and Zongshen have made large increases in the number of personnel since the end of the 1990s. Meanwhile, Japanese makers assign 1,300–1,500 personnel to their centers.

3. Number of Development Projects, Lead-Time, and Cost

(1) Type of Development: Major Change and Minor Change

When asked about types of development projects, Chinese makers usually mention two types, namely, those called "brand-new development" (*quanxin kaifa*), and "minor-change development" (*gaizao kaifa*) or "derivative development" (*paisheng kaifa*). The former involves product planning based on a concept that is new to the maker itself, and thus is somewhat equivalent to what is called "full-model change" in Japan. However, the extent to which it actually differs from existing models of other makers and to which parts from existing models are used depends on the firm and on the specific case. The development of various grades is called "brand-new development" including, for example, (i) the development of a new model starting with the development of an original engine; (ii) making reference to existing models of other makers and using reverse engineering to develop a model that is almost identical to another model in terms of body and engine; (iii) the utilization of an existing engine and a mere modification of the body; and (iv) the addition of a relatively large change to the engine. The latter is (v) to add marginal changes to the model the firm already possesses, which is equivalent to so-called minor change in Japan.[4]

Based on the degree of novelty, this study defines (i) as major change (MJC), (ii–iv) as large minor change (LMC), and (v) as small minor change (SMC), and examines whether Chinese firms are going through a technological catch-up process from SMC to LMC, and then to MJC, as assumed by the conventional discussions examined in Chapter 3. By doing so, the author wishes to grasp the overall trend concerning the acquisition and accumulation of product development capability by Chinese makers in recent years.

(2) Number of Development Projects: Increase of SMC

After 1999, when Qingqi was designated as a "technological innovation pilot enterprise," it undertook several projects of full-fledged MJC and LMC for a period of time. In 2001, thirteen new model development projects were underway, of which four or five were joint projects with domestic universities and R&D organizations, and two were outsourced to overseas firms. However, by 2003, most of these projects had been aborted. The small-lot production of an MJC model[5] developed in collaboration with a Japanese R&D consulting firm had begun, but it was not selling well and was considered a failure.

Jialing, which for many years had not been keen on developing original new models, only had one LMC and a few SMCs in 1998 (not including the introduction of models from overseas makers via official technical cooperation). In 2002, however, its LMC increased to three and SMC to thirty-forty. Major change, MJC, seems to have been implemented, but as of 2004, no new models were actually launched onto the market.

On the other hand, Zongshen, according to its top management, only had a dozen SMCs in 1998, but by 2002 it had increased this number to over 100, and LMC of engines to as many as 20. When the author revisited the maker in 2004, the firm said it had increased MJC and LMC, as exemplified by the launch of an engine loaded with an EFI system[6] and was undertaking the new development of a 400 cc engine. However, the maker's MJC and LMC models were not actually generating profits,[7] though they seemed to be contributing to the betterment of the corporate image and, to some extent, to technological accumulation.

Generally speaking, considering that all three firms have increased their SMC development rather than activating MJC, it can be said that the development scale per project has become "smaller" and "lighter" on average.

An unfavorable market response, i.e., high market risks, was presumably an important factor in the background of the stagnation of MJC, in addition to technological difficulties. For example, the failure of MJC and LMC models undertaken by Qingqi and Jialing toward the end of the 1990s was due to technological immaturity and market risks.

The LMC model that Jialing began to develop in 1998 was a minor-change version of an existing model of a Japanese maker, and it took Jialing three long years to complete the development. However, the market release was a failure, having missed the wave, as competitors had already hurriedly developed models of the same style utilizing existing engines and parts from conventional models, and launched them on the market. The MJC that Qingqi began in 2000 cost it a staggering amount, far more than initially projected, and this led to problems with the foreign consultant. Later, Qingqi undertook the development on its own, but the engine performance did not meet the target and the product had little attraction. On the whole, MJC development by Chinese makers around the year 2000 had a longer lead time than market changes, was costly and had poor performance. When asked why this was so, the engineers involved gave the following explanations: (i) Lack of technological capability: Neither maker had adequate experience in development at the time, and unexpected troubles frequently cropped up in various related departments. Furthermore, Qingqi did not have a sufficient understanding of engine technology. (ii) Poor organizational response ability: They failed to smoothly manage internal and external interdepartmental and interfirm cooperation. (iii) Compared to simple new model development that actively exploits existing parts already available in the market, MJC and LMC are difficult per se.

The problems of (i) technological capability and (ii) organizational efficiency can be solved with an accumulation of development experience. However, (iii) deals closely with environmental factors that go beyond the efforts of individual firms. The trend toward "smaller" and "lighter" development as a whole (an increase of the share of SMC) is a result of the fact that the market's demand for minor-changer versions discouraged Chinese makers from taking on the challenge of MJC.

(3) Lead Time and Costs

Lead-time and development costs have changed since 2000 for all three makers. Qingqi shortened its average lead time for SMC from one year in the latter half of the 1990s to about six months in 2002, whereas its lead time for MJC, including fundamental technological research, lengthened to three years, as the content of the development became more complicated and sophisticated. Jialing's lead time for LMC, which was two to three years in 1998, shortened to eighteen-twenty months in 2002. In the case of SMC, it could be as short as two months. Both makers considered that their lead time for the same level of development had shortened during the past few years, as a result of the improvement of trial equipment (e.g., testing and measuring equipment and computer-aided design and manufacturing (CAD/CAM) systems), organizational improvements, and increased cooperation with suppliers. These factors will be examined below.

Zongshen's lead time, according to its top management, has grown longer since 2000 across the board. Compared to the earlier period, when the company practiced the "dismounting and mounting" of existing products with virtually no change, it increased the degree to which it added its own engineering to its products.

The development cost per project of the three makers was in the range of 20 million yuan (U.S.$2.4 million) or more for MJC, several to 10 million yuan (several hundreds of thousands to 1.2 million U.S. dollars) for LMC, and hundreds of thousands to a few million yuan (several tens of thousands to half a million U.S. dollars) for SMC. Compared with 1998, the cost for SMC clearly declined, while that for MJC and LMC apparently increased for Qingqi and Zongshen.

Neither cost nor lead time declined significantly for MJC and LMC, because the contents of the development became increasingly advanced, whereas those for SMC distinctly decreased. This may well be a reflection of the fact that there has been a sufficient accumulation of knowledge and organizational reform suitable to the latter, whereas those suitable to the former have yet to make significant progress.

For a Japanese maker, developing a new 125 cc class model starting with the engine from scratch would cost U.S.$10–20 million in the R&D phase, and dies and jigs for mass production alone would cost approximately U.S.$3 million. These makers routinely release a "full-model change" model every two years and "minor-change" every year, though the lead time varies depending on the case, requiring one to three years to develop a brand new model. By comparison, China's development takes place on a smaller scale and its MJC in fact involves a smaller degree of novelty.

4. Development Teams

The three makers have similar development teams. In addition to a project leader (PL), several engineers[8] are assigned as full-time personnel, and as the need arises, they can be joined by some twenty staff members in total specializing in appearance, electrical system, trial production, testing, and so on. Often, MJC is carried out by a dozen or so core personnel, while LMC is done by five or six, and SMC by two or three. In the case of a Japanese development team, thirty to forty people take part in a "full model change," and two to fifteen in "minor change," depending on the degree of the change.

The reward system for development staff adopted by the Chinese makers differs among the three. As of 2002, the reward for Jialing and Qingqi was primarily a basic salary, whereas in Zongshen's case, a "project contract" was generally practiced. Under the "project contract," the project leader signs a contract for the project, receives a lump-sum budget from the maker, and based on his or her evaluation, distributes the budget among the employees he or she controls and for actual expenditures for trial production and testing. The amount of the reward is highly incentive-oriented, and includes incentives for the achievement of goals regarding schedule, quality, and performance. It is generally linked to the sales results after the product launch. The difference can be huge depending on the results, and in Zongshen, the project leader's monthly reward can vary from 1,000 yuan to hundreds of thousands of yuan.

Though Jialing was once egalitarian, at the end of 1999 it adopted a bonus system linked with sales. For successful models, the bonus of the chief development staff could be equivalent to five to ten months of salary.

At the time of the first survey, Zongshen and the other privately owned makers were headhunting development staff from state-owned makers by offering high salaries. However, in 2004, it was widely acknowledged by managers and engineers in Chongqing that, starting around 2003 and 2004, the gap between the privately owned and state-owned makers narrowed distinctly. This seems to be due to the fact that there was a continuous outflow of experienced personnel from the state-owned makers, and a strengthening of the development personnel of privately owned makers.

In comparison with the extremely egalitarian reward system in Japan, the Chinese system is highly incentive-oriented. Though such a system is effective in the context of competition for development speed using standardized technology, engineers are unlikely to choose a technology that involves high novelty and a high risk of failure. It is regarded as an organization suitable to minor-change development.

5. Reform of the Development Process

In the interviews with the author, Jialing and Qingqi emphasized that their development processes had matured significantly since 2000. Earlier, they had pursued new technologies without careful consideration, often leading to market failures.[9] However, starting around 2000, they became increasingly sensitive to market results and profitability, and began to conduct careful research concerning markets and technology in the planning phase, introducing stringent evaluation and approval at each phase of the development process. Further, it has become general practice for various related departments, including not only the design department, but also the departments doing modeling, dies and molds, and trials, to participate in the development team.

In the interview in 2002, Zuo, the top manager of Zongshen, said that the key to improving the development process of his company was to make sure that design information was shared among development personnel and to build a data-sharing system to this end. It is because by nature, the "project contract" system mentioned earlier does not facilitate mutual information sharing among in-house designers unless such intentional countermeasures are devised.

Although the development process seems to be improving, this does not necessarily mean that the makers' technologies are sufficiently sophisticated. According to the suppliers doing business with each of the three makers, design changes after the start of mass production, though decreasing as a trend, remains frequent.[10] This is particularly prominent with parts the makers do not understand technologically.

6. Increased Cooperation with Suppliers

In Jialing and Qingqi, suppliers have clearly become increasingly involved in the development phase. In the background of this lie two changes in the makers' policies. The first is the outsourcing of parts development. Since 2000, as suppliers have upgraded their design capabilities, they have come to simply receive base drawings or specifications for a growing number of parts, based on which they develop detailed designs. The upgrading of the design capability of suppliers will be examined in the following section II. The second is the increase in the number of development projects, especially SMC development.

For example, starting in 2002, Jialing implemented an organizational reform to involve suppliers more heavily in product development. This derived from a change in its development policy to actively utilize the existing parts of the "base models." The chief development engineer of Jialing, in 2003, stated, "Enormous systematized resources are available in society. They can be called standardized platforms. We, too, exploit them." This demonstrates that Jialing also took part seriously in minor-change competition. Its organization was changed accordingly. Until that time, the firm's suppliers were dealt with by several organizations—the purchase department, finance department for payments, and quality control department for the evaluation of products—and because of this, it was difficult for Jialing to maintain close communications with them.[11] Starting in 2002, the supplier contact was unified into a "department of parts procurement."[12]

Meanwhile, Zongshen, which had relied almost completely on suppliers for parts development since its establishment, expanded the scope in which the maker itself developed detailed drawings for important parts, in particular engines, and had suppliers produce parts based on them. By headhunting front-line engineers from state-owned makers, it rapidly upgraded its design capability. The firm is moving against the trend of Jialing and Qingqi, indicating that the three firms are converging in the same direction.

7. Development Policy of the Three Firms for the Near Future

Zongshen has a clear development policy for the future. Zuo, in 2002, said that unless there was a change in the current quality of the demand, it would be sufficient for products to be practical. He stated, "technology is not the main source of competitive advantage,"[13] and that "sharing resources with suppliers is vital," adding that the key to competition was to accelerate the development speed by actively utilizing common parts based on a standard "platform."[14] Lifan seems to share the same line of thinking. An executive there in charge of technological matters said, with regard to engines intended for sale to other makers, "we are capable of conducting audacious new product development, but we develop what users demand, i.e., products that are standardized." In fact, since 2002, both Lifan and Zongshen have released several unique engines and models to enhance their lineups, demonstrating that their technological capability has reached a certain level.[15]

On the other hand, in comparison with Zongshen, the policies of Jialing and Qingqi seem comprehensive but lack clear-cut characteristics. Jialing mentioned, as its major emphases, firstly that it would attach importance to quality, secondly that it would utilize new technologies, and thirdly that it would accelerate development speed. As for new technologies, the firm, being unable to expect more than what it received in the past from Japanese makers, is seeking partners in Europe, Taiwan, and Korea, indicating that it has not grown out of its dependency upon foreign firms.

8. Summary

In general, the Chinese makers, compared with the highly established Japanese makers, are in the phase of learning in terms of development scale, quality and novelty. However, compared with the latter half of the 1990s, their capabilities have been clearly upgraded since 2000.

Looking at the future direction or emphasis of the upgrading, it seems that it differs from the past experience of their Japanese counterparts. SMC development has distinctly increased and there has been little major-change development. This is not solely because they lack the technological capability, but also because they do not have ample opportunities to accumulate the technologies needed for MJC, as the products they developed using MJC for novelty have not been appreciated by the market. Instead, all three makers seem to be moving in the direction of accumulating technology and reforming their organizations in a way that is more suitable to minor-change type development.

Judging from the above, we can conclude that as far as the first several years past 2000 is concerned, Chinese makers have not made smooth progress from SMC to LMC and LMC to MJC, as we assumed earlier, indicating that they are experiencing “homogenization pressure” as was examined in Chapter 3.

II. Changes in the Suppliers’ R&D Systems

This section examines the strengthening of suppliers’ internal organizations and capability upgrading for product development after 2000. The rapid growth of China’s motorcycle industry in the 1990s was characterized above all by the development of suppliers that, beyond the control of makers, accumulated independent strength and worked to survive in an isolated manner. This situation basically remained unchanged after 2000, but their capability upgrading in recent years has brought about a change in the outsourcing strategies of the makers, thus forming the foundation for the development of more disciplined and cooperative transaction relationships between the two. This section is primarily based on the findings of the interviews in the second and supplementary surveys, in which the author asked the suppliers what changes they had made concerning product development since 1998. Table 6-1 briefly summarizes the findings.

1. Product Development Performance: Quantity, Lead Time, and Cost

In the several years after 1998, the number of new products developed by each

Table 6-1

SUPPLIERS' R&D: CURRENT STATUS AND CHANGES FROM 1998

a. Number of new product development projects (per year):		b. Degree of increase of the number of new product development projects:	
Increased	14	Three times or more	5
Unchanged	3	Two times or more	7
Decreased	2	Less than two times	2
N	19	*N*	14
c. Change of lead time:		d. Change of development cost:	
Became shorter	11	Decreased	8
Unchanged	4	Unchanged	5
Became longer	2	Increased	4
N	17	*N*	17
e. Change of development risk (failure rate[a]):		f. Change of development staff (number of personnel):	
Decreased	12	Increased	12
Unchanged	3	Unchanged	7
Increased	2	Decreased	0
N	17	*N*	19
g. New introduction of trial and testing equipment:		h. Availability of the following equipment[b]:	
Introduced	9	CAD	14
Not introduced	6	Machining center	5
N	15	Chassis test equipment	3
		N	15

Source: Survey by the author.
Note: Questions were asked regarding the status at the time of the interview and the change from 1998.
[a] The rate of products for which the order was canceled or discontinued before the depreciation of the development cost was completed.
[b] Multiple answers allowed.

supplier every year increased (Table 6-1-a). Those with fewer development projects were unfavorable performers[16] suffering from decreased orders from Jialing and Qingqi. Many suppliers more than doubled their development projects (Table 6-1-b).

The overall increase in the number of new products was primarily due to an increase in the number of developments projects per maker, particularly in the area of SMC development. In some cases, this happened because suppliers did business with an increased number of makers, and this tendency was prominent with blue-chip suppliers (see the next section III).

Table 6-1-c shows responses to the question about their overall perception of development lead time, including for SMC, LMC, and MJC. Respondents predominantly said that lead time was growing shorter. This is consistent with the trend among the makers, and as a whole, it is due to factors such as the increased share of SMC, strengthened development organizations resulting from organizational reform, enhanced personnel and equipment, and accumulation of know-how through experience. This is also true for the decreased cost (Table 6-1-d).

Two suppliers that answered that the overall development lead time had lengthened were examples in which the contents of their major development activities had become more sophisticated (firms *s* and *w*). For costs, too, some answered that average expenditures per development project had increased because they had increased their number of personnel and introduced test equipment required for the increasingly sophisticated development (firms *n*, *p*, *q*, and *s*).

2. Decrease of Development Risk

To suppliers, development risks are more important than development costs. If the product is highly likely to succeed in the market, they will take part in product development even if the costs are somewhat high.

Suppliers recognize that the failure rate of development[17] has largely declined from 1998 (Table 6-1-e).[18] The major reasons for this include improved development capability on the part of makers and less frequent "risk shifting" behaviors (see the next section). Another important factor is improved development capabilities on the part of suppliers.

Suppliers are more cautious than they were in the latter half of the 1990s and therefore refrain from "blindly" participating in development projects. Qingqi's suppliers were particularly emphatic on this point. For example, firm *p* now conducts lengthy market research before embarking upon development. Supplier *n* said that it would not begin any work before receiving payments for dies and molds in advance if the order was from a maker other than credible partners with whom it had continuous business transactions.

Further, as we shall see in the following section III, the fact that some blue-chip suppliers, having been so identified in the market, received concentrated orders and, as such, enhanced their bargaining power against makers, also seems to be one of the reasons for the overall decrease of development risk.[19]

3. Sophistication of Development: Increase of the "Drawings Approved" Method

A major factor contributing to decreasing the lead time, cost, and potential risk of product development is the growing technological sophistication of product development. The enhanced design capability of suppliers has enabled them to increase their participation in joint development with more technologically important roles.

An example of this is the increase in the "drawings approved" method (see Note 17 of Chapter 3). For instance, in the case of supplier *n*, a piston manufacturer, in the past, (i) processing based on detailed drawings provided by makers accounted for 70 percent of its work, while the remaining 30 involved (ii) producing exactly the same products as samples given (without drawings), which then went through some mutual coordination with makers.[20] The latter was used with second-class makers that required less precision, or for the aftermarket. However, as of 2003, job category (i) accounted for 70 percent, while category (ii) dropped to 10 percent, with the remaining 20 percent involving (iii) the development of detailed drawings by itself, based on basic specifications from the makers and to be approved by the maker. This is close to the "drawings approved" method in the true sense. There are many other cases of suppliers for whom the share of jobs using this kind of "drawings approved" method increased.[21]

On the other hand, firm *t* presents an opposite example, as its major work changed from "drawings approved" development to "drawings supplied" jobs, when the maker (Zongshen) gained the ability to develop detailed drawings by itself.

Some suppliers are basically only engaged in SMC development as a result of the progressing standardization of parts. The most capable among them have significantly increased their share of work in other areas such as automobiles and general-purpose engines, and decreased their motorcycle-related work (firms *e*, *h*, and *j*).

4. Standardization and Differentiation of Parts, Jigs, and Tools

The full-fledged implementation of minor-change type development facilitates the sharing of common parts, jigs, and tools on the level of suppliers as well. This has led to an acceleration of the development speed and to falling cost.

For instance, firm *m*, a harness supplier, uses plastic terminals in its connector parts. In the harness unit for a new model made by maker *J*, a Japanese-affiliated firm that produces Suzuki brand motorcycles, only two or three of the ten connectors are common with those of existing products. Meanwhile, 80 percent of the connectors for Qingqi's harness, though based on the same base model, are common and new dies are only made for one or two of them. With a view to reducing costs and development time, supplier *m* is promoting the sharing of common parts and dies. Similarly, supplier *i*, which produces drum brakes, consisting of eight parts, for Jialing, developed nearly twenty types of new products in 2002, but only developed new dies for two sets. The firm says that the key to design is to utilize existing dies and molds, to respond to differing requests from one product to another by differentiating at the processing phase, and to increase the number of product types by sharing common parts whenever possible. This is also Jialing's request.

On the other hand, however, makers are trying to differentiate themselves partially beginning from the parts phase. What is particularly bothersome to suppliers is what they call "disguised differentiation" in response to the government's reinforcement of the protection of intellectual property rights. For example, firm *t*'s gear shifting unit for the CG125 is made up of thirteen gears but the unit itself is "common" to almost all the other CG125-based models. However, some makers, out of fear of running into problems with intellectual property rights, began to designate one or two gears of the thirteen to be replaced by specially designed gears. However, the completed unit is still compatible and whichever is used makes no difference in the performance of the engine (see the case observed at the repair shop in Inner Mongolia in Chapter 2). Awareness of intellectual property rights grew rapidly around 2001 when China became a member of the WTO, leading to an increase of such cases. This contributed to increasing the burden on the shoulders of suppliers.

This problem can be seen with various kinds of parts. Suppliers *e* and *p*, as board member firms of a national-level business association for automotive parts,[22] have even suggested that motorcycle makers completely "standardize" if they are going to do standardization at all, but their advice has been ignored.

5. Measures to Strengthen Internal Development Capabilities

As shown by Table 6-1-f, the various firms have increased the personnel of their development divisions. Privately owned firms, which generally poached engineers and technical staff from state-owned firms in the past, are increasingly hiring new graduates.[23] This indicates that they are moving toward improving their own in-house technological capabilities.

As for organizational reform, there was once inadequate cooperation among design, testing, and the production floor, but those related departments began taking part in the development team from the design phase, and this cooperation has been effective in many cases. For example, firm *p* halved its lead time from the level of 1998, and the key to this was the organization of a "development team" led by a manager of the manufacturing line with the participation of designers and representatives from related departments, enabling problems to be solved more quickly and quality to be stabilized (firms *b*, *k*, *l*, *s*, and *v* share the same experience).

Table 6-1-g shows that an increasing number of firms have newly introduced measurement and testing equipment in recent years. Those answering that they "did not introduce" such equipment were either state-owned or foreign JV firms, who had introduced such equipment earlier. Suppliers, too, have already reached the stage where they are equipped with basic equipment for trial and quality control such as 3D measuring machines, componential analyzers, surface analyzers, and bench-test facilities.

For example, supplier *y*, a manufacture of shock absorbers, established a water resistance test room in 2003 in addition to vibration measurement equipment that it already possessed. This has enabled it to conduct use environment tests on the whole motorcycle. Departing from a concentrated focus on the performance of the shock absorbers alone, the firm has now embarked upon product development with an additional focus on the combination of the product with the whole body and user's driving environment.[24]

Of companies that had introduced test and measurement equipment, some said that they had been required to do so when they began transactions with Honda's JV makers (firms *k*, *p*, *s*, *v*, and *w*). Honda became serious about purchasing parts from local Chinese suppliers and began nurturing them in 2000. The suppliers interviewed by the author received Honda's guidance favorably, expressing great expectations toward the maker.

Table 6-1-h shows that drawings are already exchanged on a CAD basis. The introduction of CAD was often mentioned as a reason to explain the shortened lead time. Machining centers (MC) were also introduced with the aim to achieve stable quality for mass production, but they were also used for trial production. In most cases they were introduced by suppliers of engine parts, including die-casting and steel parts.

Finally, the share of specialized production equipment has grown. This has been a response to the increasing requirement for high stability in quality and processing precision. As for machining, processes that were traditionally handled by massive manpower using many general-purpose machine tools are being moved to computer numerical control (CNC) machine processing, at least for key parts, by newly purchasing or converting existing machine.[25] Firm *x*, for example, becoming aware of the need to invest in equipment for quality improvement, began toward the end of 2003 to implement shaft-hole machining using a single CNC machine. In the past, the machining had been done by four general-purpose machines for primary processing and two for final processing. This change was triggered by an increase of exports and the initiation of transactions with makers affiliated with Honda.

6. Summary

We have seen that within a period of several years after the late 1990s, the overall R&D organizations of Chinese suppliers significantly changed and their capabilities were upgraded considerably. On the surface, as shown by the increase of SMC development, they appear to be doing nothing but conventional marginal "configuration imitation," but in reality, steady efforts are being made to increase development efficiency by undertaking organizational reform and expanding and strengthening personnel and equipment. It is true that the purchase of equipment and organizational changes alone do not necessarily lead to an upgrading of the quality of development and production, but the fact that they are consciously making necessary investments for improvement is important.

III. Restoring Order: More Disciplined Transaction Relationships

This section examines changes in the transaction relationship between makers and suppliers during the several years following the end of the 1990s, when both sides were trying to enhance their capability for product development and quality management.

The author's conclusion is that there was a considerable decrease in the earlier blatant "risk shifting" activities, and makers are moving toward the direction of restoring orderly transaction relationships, in an attempt to obtain a stable commitment from suppliers. It has been revealed that the undisciplined isolated-type supplier system observed in the latter half of the 1990s is moving toward a more disciplined system with an increased degree of cooperativeness, though the isolated nature still retains on the whole.

1. Concentration of Transactions on Major Suppliers: Multisourcing

The three makers have shown a tendency to narrow down the number of suppliers they dealt with. Qingqi, whose production plunged, concentrated its work on fewer suppliers, and gave them quite large orders. Jialing's total number of suppliers increased to as many as nearly 400, but in fact it narrowed down the number of suppliers of customized parts into approximately 200 firms, and increased the number of suppliers of standard parts purchased on the market. Zongshen also increased its number of suppliers to nearly 600 to meet increased production, but the number of customized parts suppliers per model was cut to approximately 100–120.

All three companies implemented multisourcing, but basically had a "one main, one supplementary" (*yizhu-yifu*) system. In reality, however, the "one main, two supplementary" case was more frequent, particularly with Zongshen.

With regard to the necessity for multisourcing, Zuo mentioned that the aim was to create pressure for quality control. He said, "A supplier in a monopoly position cannot be controlled. To create pressure, we must place orders with at least two suppliers." According to Jialing, in the mid-1990s, when the mass production of single models was pursued, the maker had to order parts of the same kind from many suppliers, as the scale of suppliers was still small, whereas today this is no longer required because order quantity per kind has decreased and also because blue-chip suppliers have grown in size.

When asked how many suppliers received orders from the maker on average for identical parts (the author asked the question concerning the supplies' main product), two suppliers answered that the maker ordered to one supplier, two suppliers said to two suppliers and eighteen suppliers said to three or more suppliers (N = 22) in the first survey (Table 4-3), while in the second survey, two suppliers said to one supplier, seven suppliers said to two, and eight suppliers said to three or more suppliers (N = 17). The result underpins the argument that makers are narrowing down their suppliers. Generally speaking, transactions are moving in the direction of being more stable and where it is easier to acquire suppliers' commitment.

2. Suppliers' Business Partners Are Becoming Polycentric

Suppliers' business partners seem to be becoming polycentric. Table 6-2 indicates that in the first survey, the number of business partners per supplier of Qingqi (5 firms were surveyed) was 15 on average, Jialing's (7 firms) 11, and Zongshen's (5 firms) 18, whereas in the second survey, the numbers had increased to 20 for Qingqi (5 firms), 10 for Jialing (7 firms), and 21 for Zongshen (7 firms).

TABLE 6-2

MULTIPOLARIZATION OF TRANSACTION PARTNERS BY SUPPLIERS

Suppliers of	No. of Suppliers Surveyed[a]		No. of Transaction Partners per One Supplier[b]		Share of the Major Maker[c] (%)	
	1st Survey	2nd Survey	1st Survey	2nd Survey	1st Survey	2nd Survey
Qingqi	5	5	15	20	32	8
Jialing	7	7	11	10	45	20
Zongshen	5	7	18	21	38	25

Source: Survey by the author.
Note: First survey: 1998–99, second survey: 2001–3.
[a] The firm is not necessarily the same between the two surveys in the cases of Jialing and Zongshen (see Introduction).
[b] Average number of makers that a supplier transacts with concurrently at the time of the interview. Makers with whom suppliers' transactions are only minor in volume are excluded.
[c] Average share of Qingqi, Jialing, or Zongshen in the total sales of the respective suppliers.

Many suppliers of Qingqi and Jialing increased the number of their business partners as they were no longer able to rely solely upon the two makers, whose growth was stagnating. The share of the two makers in their suppliers' main products also declined significantly, and in many cases they were no longer the most important business partners of the supplier. This was particularly prominent with Qingqi's suppliers. During this period, Zongshen's suppliers also increased the number of their business partners in a similar manner despite the growth of the maker's production. As far as the three makers were concerned, the general trend toward the concentration of suppliers' business partners could not be confirmed. In other words, a situation close to a "multipolar dispersed type," as we saw in Chapter 4, remained unchanged.

Of the seven suppliers of Zongshen surveyed by 2003, there were three firms (*t*, *v*, and *w*) that had grown into large national-level suppliers and two firms (*r* and *s*) whose degree of dependence upon Zongshen had increased. The former three firms have grown to possess such gigantic production scales that they can produce three million engine gear units per year, in one case, and are trying to fill their capacity by increasing their number of clients.

Meanwhile, in Chongqing, firms *r* and *s*, both engine-parts makers, are seen as suppliers that maintain strong ties with Zongshen, since they have particularly large transaction volumes with the maker. Lifan, Zongshen's rival maker, uses suppliers other than *r* and *s* as its main suppliers of the same parts. Zongshen has conveyed to them its intention to build a close relationship with suppliers of important parts and to work for technological differentiation in cooperation with them.[26]

Despite this, however, firms *r* and *s* do not intend to totally depend upon Zongshen when it comes to the business opportunities outside Chongqing. For example, firm *s*, which is attracted to transactions with Honda and Grand River, said that its most important challenge at present was to meet their quality requirements. It said that Honda and Grand River have higher technological levels and that it would be able to learn more by trading with them than with Zongshen.

Zongshen, starting in the beginning of 2004, developed the land adjacent to its headquarters and established a new industrial park on the site that could accommodate about a dozen suppliers. Zongshen hoped to accommodate suppliers that would function as factories under the control of the maker, but no supplier had actually moved into the park as of the summer in 2004. The author asked the suppliers surveyed in 2004 about the likelihood that they would move into the park, and none stated an intention to do so because Zongshen, they feared, might restrict their transactions with other makers.

In general, makers tend to concentrate their orders on blue-chip suppliers, whereas major suppliers tend to multi-polarize their business partners. In some cases, small and medium-sized suppliers build specifically close relationships with major makers, and yet even such suppliers are not necessarily showing such a strong commitment that they intend to share the future with Zongshen. The overall transaction relationship continues to retain isolated-type characteristics when compared to those of Japanese counterparts.

3. Development Risk: Toward Mutual Sharing

The sharing of development risk will be examined here in terms of the sharing of the costs of dies and molds as discussed in Chapter 4. In the first survey, 17 of the 22 suppliers received nothing at all from makers for the costs of dies and molds, with the remaining 5 receiving part of the expenses. Meanwhile, in the second survey, suppliers who answered that the cost was often shared jointly by makers and suppliers accounted for 9 out of 18 interviewees. If confined to MJC and LMC development involving a high degree of novelty, 13 firms said that makers shared part of the cost.

The change seems to have been brought about partly by the improved bargaining position of suppliers as described above. For instance, suppliers no longer entered into transactions with Qingqi unless they received advance payment. The drastic decrease of Qingqi's production volume was partly caused in part by the fact that unlike in the past, the maker can no longer use parts without making payments.[27] It seems that Qingqi, whose opportunism is no longer accepted, has changed its attitude with a view to acquiring suppliers' commitment.

According to suppliers, the sharing of development cost has become a general practice in the industry since around 2002. For example, supplier *k* introduced development-cost sharing, with 60 percent borne by the maker and 40 percent by firm *k*, when trading with continuous business partners, vis-à-vis 100 percent by the maker when dealing with a totally new maker.

The payment of the development cost by the maker is predominantly done by the method of depreciation, with the cost added to the price of the parts, although advance payments are sometimes used when carrying out transactions with less credible makers and totally new makers. This method of payment is problematic when the order is discontinued before the depreciation is completed, and none except for firm *w* among the firms surveyed said that the balance that had yet to be depreciated was paid by the makers using other methods of ex post compensation. For example, suppliers may have an agreement with makers that a transaction will not be discontinued before it reaches, say, 10,000 units (or a period of six months) after the beginning of mass production, and that no reduction will be demanded of the price agreed upon at the outset. However, the situation was actually unchanged from the time of the first survey, in that the undepreciated balance was not paid in the event of the discontinuation of the order. And yet, suppliers considered that risk sharing with makers had become common because of the higher success rate of development, which in turn reduced the degree of seriousness of depreciation failure.

Further, no new serious instances of nonpayments to suppliers were revealed in the second survey, though some delayed payments were reported.

Serious nonpayments, which were once prevalent throughout the industry, might be considered a unique phenomenon that was observed in that particular period of the latter half of the 1990s. Until the middle of the 1990s, everything that the industry made sold well in the market. In particular, the situation around 1993 or 1994 was apparently such that trucks lined up in front of factories, trying to get ahead of the others to buy motorcycles and parts in cash—a typical example of a time that people still talk about in the industry. During this period of the "economy of shortage" or "seller's market," the lack of systems for ensuring market transactions in the transition economy period did not come to the surface. However, in the second half of the 1990s, when the "buyer's market" emerged, mainly state-owned makers, who were suffering from excess inventory, implemented "risk shifting" to weaker firms in an opportunistic manner, by capitalizing on the above deficiency. Nonpayments seemed to be a symbol of such behavior.

In view of the findings of this study, this opportunism seems to have lost its viability, because suppliers can no longer accept the practice physically, and also because the relative position of suppliers, who survived an intense process of corporate selection, strengthened. In addition, such factors as increasing demand for quality and development to suppliers, which increased the need to acquire supplier commitment, and the fact that suppliers became increasingly capable of selecting their business partners, contributed to this change.

In general, both makers and suppliers recognized that the transaction order of the industry had recovered for several years from the latter half of the 1990s.

4. Increased Communication: Heightened Awareness of Quality

(1) Makers' Failure to Grasp Technological Information on Suppliers

The premise of the value analysis and value engineering carried out in Japan is that makers have detailed information on the technology of their suppliers. By sharing information, they are able to establish cost reduction targets and evaluate the results while ensuring a certain profit for suppliers. Meanwhile, the results of the second survey give no indication that information is being shared to such an extent in China.

In the procedure of pricing, each maker analyzes costs together with its suppliers by breaking down the costs into various items. However, the implementation of the procedure has not yet been standardized and has often changed arbitrarily. In addition, it is not necessarily sufficiently well organized to ensure the continuous accumulation of information on certain parts between makers and suppliers.

For example, when firm *p* began receiving direct orders from the purchase department of Honda's home office in Japan, it was also doing business with Sundiro Honda at the same time. From the viewpoint of firm *p*, the concept and the format of value analysis of the two companies was the same, though differences appeared in the implementation. In the transaction with Honda, the price was determined by analyzing the costs for dies and mold, jigs, materials, process costs, profits, and so on. Special imported steel was used, and the product price could change to reflect fluctuations in the price of the steel. On the other hand, the purchase department of Sundiro Honda, though adopting the same pricing method on the surface, had a poor understanding of firm *p*'s technologies and lacked clear-cut rules, leading it to demand price cuts soon after transaction began or to change its policy when a new person was put in charge of the orders.

(2) Opportunism Overrides Information-Sharing Efforts

Inadequate efforts for organizational information sharing are considered to have a serious impact on the provision of continuous quality assurance of motorcycles, which require the accumulation of incremental technological innovation.

For example, makers are emphasizing the "returns, repairs, and replacement free of charge" (*sanbao*) of defective products and other after-service. However, the practice examined in Chapter 4 still remains today where, when a complaint of a defective product is received, the maker disassembles the product into parts and returns them unilaterally to the suppliers. According to firm *c*, a carburetor maker, nothing was actually wrong with 80 percent of the parts returned to it as defective in 2002, while cylinder-head supplier *v* said that 60 percent of the problematic parts returned in 2003 were due to the reasons unrelated to it.[28] Both of the suppliers said that the situation was the same with Jialing and Zongshen.

This indicates that, as in the late 1990s, cooperative organizational efforts for quality improvement between makers and suppliers have yet to become full-fledged. This is primarily due to opportunism on the part of makers. What is described above occurs not only with such parts as carburetors and shock absorbers, which makers have no technological grip on, but also with engine parts, for which makers prepare detailed design drawings, indicating that a lack of analysis ability is not the sole reason.

Poor analytical ability among suppliers was one of the reasons for the spread of this practice. For example, following its introduction of basic measurement equipment in 2002, firm *v* determined that the majority of the defects of the returned parts were caused not by itself but by external factors. Until that time, it had had no option but to accept the returned parts as told.

(3) Enhanced Awareness of Quality and the Beginning of Cooperative Analysis

However, from around 2002, cooperative efforts toward quality improvement began in part. Firm *y*, a shock absorber supplier and firm *z*, a clutch supplier, said that taking part in a "national after-service circuit" sponsored by Zongshen in cooperation with a dozen representative suppliers in 2003, and directly listening to the voices of consumers and repair shops in various areas of the country, greatly helped them to improve the quality of their products thereafter. For example, oil leaks from shock absorbers can be caused by various factors including, in addition to defective manufacturing: (i) quality of the oil sealing parts, (ii) penetration of sand and dust and resulting friction, (iii) poor assembly by the maker, and (iv) incorrect usage and excess loading. The majority of the products of firm *y*, which is located in Chongqing, a city in a mountainous area, are actually used outside that area. The firm's chief development engineer, who had no idea of the strength of the wind and dust storms in the northern plain regions where the products were actually used, came to an acute realization of the need to strengthen countermeasures against sand and dust in the design phase by gaining a physical understanding of the driving environment of the area. Firm *z* came to an acute realization of the need for quality improvement when it increased its exports after 2001 with Zongshen, and thereby began to understand the high level of demand in overseas markets. From 2003, it began its own market research and problem-solving activities upon user complaints in the Southeast Asian market.

Furthermore, firm *y* said that in 2003, it began visiting the oil sealing parts factory together with Zongshen engineers to conduct technological consultations. This reveals that makers have launched joint efforts in cooperation with their first-tier suppliers to promote technological and quality improvements among second- and lower-tier suppliers.

As such, both makers and suppliers, in response to the growing quality demand at home and abroad, are consciously beginning to work, at present chiefly as ad hoc projects, in a more cooperative manner than before. And yet, unilateral opportunistic behaviors also continue, and the system for conducting full-fledged joint analysis and knowledge accumulation as a routine has yet to be consolidated.

5. Support from Makers

It seems that suppliers do not have high expectations of support from Chinese makers, while the makers are wavering with regard to how they should support suppliers.

In Chapter 5, the author introduced Zongshen's endeavor, starting in 1998, to develop quality management standards and operation standards jointly with its suppliers and to dispatch instructors to give guidance to them ("quality assurance system"). This endeavor, however, stalled as early as in 2000.[29] For Zongshen, upgrading the general-purpose quality management capability of suppliers may benefit its rivals.[30] In addition, as it suffered from a shortage of experienced personnel, it lacked the ability to provide satisfactory guidance.

With regard to support from makers, great expectations were placed by suppliers upon Japanese makers starting around 2001. Honda has a global development system, and sends a large number of specialists from its Japanese R&D base to overseas subsidiaries in the event of a problem. According to firm *p*, in 2002, during a period of about six months, Honda specialists visited it eight times, staying two to seven days each and providing instructions. Firm *v* received more than a dozen visits, with a total of 100 specialists in 2003, to conduct evaluations. Compared with local makers, Honda's support system seems formidable.

However, in 2004, some suppliers expressed disappointment, saying that Honda's support was not living up to their initial expectations. They said this was not because of its level of technology, but because its commitment was confined to cost reduction on obsolete products, and it did not provide further technologically advanced orders (firm *t* and *w*).

IV. Summary

The important changes that have been the focus of this study are the sophistication of the methods and organization for product development and the concurrent intensification of discipline in transaction systems, which have enabled the three makers and their major suppliers to undertake joint-product development more systematically. Opportunistic risk-shifting activities between firms have decreased prominently, and cooperative efforts are frequently observed.

The results of these changes are reflected in the greatly increased release of minor-change new products, but major-change-type development has yet to become common, for the reason that it does "not sell," coupled by technological reasons.

As a whole, makers seem to be moving toward the direction of accumulating capabilities suitable to minor-change type development with an emphasis on quality upgrading, but not full-fledged novelty. Their supplier system is still characterized by a limited degree of cooperativeness, and thus should be identified as an isolated-type system, as distinguished from the highly united-type one of Japanese counterparts.

For now, it cannot be said that the Chinese firms in the motorcycle industry are following their Japanese counterparts in their development paths, and it seems that they will likely develop in a direction of their own in the near future.

Notes

1 R&D expenditures are mainly personnel expenses for development staff, costs for purchasing R&D-related assets such as equipment, and operational costs including trial costs (trial parts, dies and molds, tests implementation, and so on). Among R&D (research and development) expenditures, the costs for "research" are presumably not large in China.

2 According to ZQGNB (various years), the R&D expenditure rate of eleven makers classified as large firms was 3 percent in the peak year of 2000, with annual R&D expenditures per firm of approximately 50 million yuan (U.S.$6 million) in the same year.

3 The Qingqi Group's Research Center is an independent firm that conducts large-scale development for the Group. Minor changes are undertaken in each of its subsidiary factories and their staff are not included in this number.

4 In Japan, too, the difference between full-model change and minor change is a "matter of degree" from the viewpoint of "cost development." Japanese makers, using the ratio of new parts of the entire cost, make the following classification: assuming that A is 60% or more; B is 40–60%; C is 10–40%; and D is 10% or less, A and B are called full model change, while C and D are called minor change.

5 It seems that for this new model, an original four-stroke engine was developed based on the conventional two-stroke engine.

6 The EFI engine management system was purchased from a U.S. firm.

7 In the interview, Zongshen said that new products were sold to the degree that enabled the depreciation of 90 percent of the development cost. However, according to firms *t*, *v*, *w*, *x*, *y*, and *z*, surveyed in 2004, which participated in the development of Zongshen's MJC models (e.g., the 250 cc) and LMC models (e.g., the EFI engine), none sold well and were profitable. The profitable development models were all SMC types, based on such models as the CG125 and C100.

8 In general, one design staff member is assigned for each of five or six units such as engine, driving, frame, shock absorber, and brakes.

9 For example, Jialing, in the latter half of the 1990s, developed an American-style 150 cc model and a motorcycle loaded with a 250 cc twin-cylinder engine (LMC), but they were too advanced to be favorably accepted by the market at that time.

10 Interview with firm *c*, a Japanese-affiliated carburetor maker.

11 One of the functions of this organization is to prevent collusive relationships and corruption between Jialing's front-line contact person and suppliers.
12 The above is based on the interview at Jialing's technical institute. According to the suppliers, this move allegedly led to a problem of corruption.
13 He went on to say, "Japanese firms are unable to maximize the value of technology. Their thinking is backward."
14 According to Zuo, the firm's policy is to develop a few dozens models by one platform by making half of the engine parts to be used commonly.
15 Lifan converted the air-cooled transverse-mounted JH100 engine to a water-cooled vertical-mounted one, which had a good appearance, and also developed an EFI engine. The new water-cooled engine was successful in the market.
16 Firms *h* and *o*.
17 The ratio of the new products for which the development cost could not be recovered, divided by all the newly developed products of the firm.
18 Those that increased in Table 6-1-e are the ones that, until then, had stable transactions with a few particular makers, but that newly expanded their business partners.
19 This point was emphasized in the interview with Lifan.
20 Form-wise, it uses the "drawings approved" method. But it differs in nature from what Asanuma (1989) intends to point out using this concept; i.e., the enhancement of supplier's capability to develop basic designs. In this case, both suppliers and makers lack the capability to develop basic designs themselves. In this sense, this case is close to what Asanuma defined as suppliers of "quasi drawings approved" parts who complete detailed design based on rough drawings, not basic specifications, provided by the maker (Asanuma 1989, pp. 15–16)
21 This happens frequently with the engine-related parts of firms *k*, *l*, *p*, *s*, *v*, *w*, *x*, and *z*. Meanwhile, such parts as carburetors, shock absorbers, electric parts, and others for which makers lack a technological grip, have consistently been "drawings approved" since the 1990s.
22 They are board member firms of the valve chapter and crank shaft chapter, respectively, of the China Internal Combustion Engine Industry Association.
23 Of the thirteen privately owned suppliers, nine had hired development staff fresh from college.
24 Earlier, only major makers had such equipment, and testing could not be done elsewhere. Suppliers can shorten their lead time by obtaining such equipment.
25 As of 2004, of the eleven privately owned firms that has many processes using metal processing works, seven had introduced special NC machines.
26 Interview with firm *r* and *s*. Lifan's executive director in charge of development also pointed out in the interview the importance of enclosing major suppliers.
27 Interview with Qingqi.
28 Similar problems were mentioned by all the firms interviewed in 2004 (firm *t*, *v*, *w*, *x*, *y*, and *z*)
29 Of the suppliers surveyed, only firm *w* had accepted Zongshen quality control staff for a long period of time in 2003.
30 An engineer from Zongshen handling quality control at that time said that opposition existed within Zongshen to nurturing non-transaction-specific general-purpose capability.