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Manufacturing and supply chain management in China:: A survey of state-, collective-, and privately-owned enterprises

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Abstract

Because of the booming economy, interest in China has soared in recent years. The government has decided to privatize many state-owned enterprises (SOEs), so foreigners can much more easily invest in existing firms than ever before. Is it wise to consider investing in these SOEs? Certainly, many have major problems. How sophisticated are Chinese manufacturing firms? Do they understand modern principles of manufacturing strategy and supply chain management? What is the level of installed technology, from traditional production planning systems, like MRP, to robotics? This paper attempts to answer these questions based on a survey of 100 firms in the Shanghai area. We surveyed state-owned enterprises, collective-owned enterprises and privately held firms, and we discovered some fascinating insights about their differences and their similarities. We discovered that the differences among the ownership types are generally insignificant, suggesting that our results are quite general. We find that these firms are far more advanced using explicit manufacturing strategies than we had expected. However, they are not as advanced in supply chain management as many Western firms. They report significant communication with customers and suppliers – more with customers than suppliers – but the nature of the communication is often limited to one dimension, particularly on the downstream side. Firms that communicate with customers tend to do so with suppliers as well.

Keywords: Supply Chain Management, China, Manufacturing Strategy

1. Introduction

Interest in China has soared in recent years. The Chinese economy has been booming, and multinational firms have been investing in China at a furious pace. Dong & Hu (1995) note that foreign direct investments (FDI) increased in China at an average annual rate of 40.7 percent between 1983 and 1993, reaching a high of 175% in 1993. Managers clearly see the immense opportunity of investing in a country with a population that exceeds 1.3 billion and an economy among the fastest growing in the world. Amway, for instance, invested more than $100 million in China to pursue its strategy of direct, multi-level selling. Amway obtained a license to sell this way in 1995, and by 1997, Amway's sales exceeded $180 million.

However, not all stories have a happy ending, as arrangements are not necessarily stable. For example, Amway faced a remarkable turnabout in 1998 when the government determined that Chinese consumers do not have a "mature and healthy consumption mentality," and that China does not have the necessary legal system to effectively regulate the direct, multilevel marketing business. Therefore, they removed Amway's license. Sales in 1998 fell to $8.4 million after the license was removed. It appears that 1999 will be the first year in two decades that FDI will actually fall, perhaps by more than 20% (--, 1999).

Many companies have made millions in China, but many others have lost millions. Bureaucracy and uncertainty about how to manage in China combine to create huge problems. *The Economist* notes that what is needed is not more investment, but better investment. Some foreign firms have not understood the competition, not only from foreign firms, but from domestic Chinese firms as well. Whirlpool, for instance,

discovered that the Chinese appliance makers, Haier and Guangdong Kelon, had comparable technology, lower prices, and a much better sense of how to design products for the Chinese market (--, 1999).

Having a partner can help smooth the process, and there are many Chinese firms currently available for sale. Because the government has decided to privatize many state-owned enterprises (SOEs), foreigners can invest much more easily in existing firms than ever before. In the fall of 1998, at the Ninth Annual Trade Fair in Harbin, 1078 small and medium-sized state-owned enterprises were offered for sale. The provincial government even tried to give away some of the more distressed firms (Broadman 1999)! A $50 billion program of debt-for-equity swaps likewise is moving very slowly (Eckert 2000). Is it wise to consider investing in these SOEs? Certainly, many have major problems. Steinfeld (1998) notes that SOEs suffer from overstaffing, low (or no) profitability, and low productivity. This is a commonly held position. In fact, we ourselves have argued thus (Pyke 1998a).

This information raises the question of what the real story is. How sophisticated are Chinese manufacturing firms? Do they understand modern principles of manufacturing strategy and supply chain management? What is the level of installed technology, from traditional production planning systems (like MRP) to robotics? This paper attempts to answer these questions based on a survey of 100 firms in the Shanghai area. The study included state-owned enterprises, collective-owned enterprises and privately held firms. We developed a set of summary scales composed of multiple items which are described in Section 3. Each element in each scale was measured on a 7-point scale. The reliability as measured by the Chronbach $\propto$ was above the minimum level of

0.6 for every case but one. The survey employed three self reports of performance which have been shown to be reliable in a wide variety of settings and which produced a reliability measure of 0.81.

In the next section, we present some general material about Chinese firms in the context of reviewing the relevant literature. Then in Section 3, we discuss the methodology we used, and in Sections 4 – 6 present our results on manufacturing strategy and supply chain management, beginning in Section 4 with some general results and comments. We conclude in Section 7.

2. Literature Review

2.1 Organization of Chinese Firms

In China, the state sector includes enterprises that are state-run (State-Owned Enterprise) or collective-owned. "State-run enterprise" is a shorthand term for the Chinese designator "enterprise under the ownership of all the people." These were

- established and maintained with central government investment
- overseen by central government authorities or their local representatives
- included in central government plans that (1) specified allocations of funds and materials that the firm would receive from government sources and (2) set output targets for goods to be delivered to the state.

Collectives are owned by the workers rather than by "all the people." Of the state-run enterprises and collectives, some (such as steel manufacturers) are large and centralized, and others are smaller and are owned by a town, county, or other administrative unit.

Today, many of these enterprises are undergoing major transition. Since 1996 Beijing started implementing a strategy adopted in 1995 under which "the central government focuses its support and supervision on 1,000 of the largest state enterprises while granting local governments greater leeway to pursue ownership reforms in smaller state firms. A substantial proportion of new bank lending in 1996, for example, went to 300 large state enterprises selected as the best performers among the 1,000 'backbone' enterprises." ((--, 1997a), page iv) The plan is to sell off all but 1,000 of the roughly 305,000 SOEs; those that are not sold will be allowed to go bankrupt. The 305,000 SOEs employ 100 million workers, receive 90% of bank loans, and account for 40% of industrial output. Many are plagued by over capacity, running at an estimated average 60% utilization, with perhaps 1/3 too many workers. Half of them lost money in 1996 (--, 1997b).

The reforms mean several things. The owner and the manager will no longer be the same, more autonomy will be given to management, firms will be forced to compete in the marketplace, and firms can change ownership structure.

These reforms were intended to revitalize the SOEs. However, it does not seem to be universally successful. The 100,000 smaller SOEs could easily fail leading to millions of workers being laid off from SOEs (Roberts & Crock 1999). Nevertheless, the process seems to be ongoing. Jefferson (1999) notes that the number of SOEs fell from about 110,000 in 1997 to 64,700 in 1998. Yet, in spite of the government's statement that SOEs would be privatized, only 10-15 percent have been divested to the nonstate sector, and these are almost all small firms.

According to Broadman (1999) SOEs still show the effects of the controlled economy: 78 percent of SOEs indicated in a survey that their largest supplier was another SOE; and 60 percent indicated that their largest customer was another SOE.

What about privately held firms? There are many confusing ownership structures in China, including firms that claim to be village-owned, but in reality are privately-owned, and firms that claim to be privately-owned, but in reality have large government involvement. On August 30, 1999, the government passed a law detailing the legal right to private-property ownership. Even though Chinese President Jiang Zemin officially embraced private enterprise in 1997, owners had been reluctant to publicly acknowledge that they are in fact privately-owned. Many called themselves "collectives" to avoid problems with the government. The number of private enterprises in Shanghai now exceeds 110,000, clearly indicating that fears of calling a business "private" have been declining. The private companies can be large and sophisticated, and they face far fewer restrictions on hiring, firing, and responding to the market than their state-owned counterparts. Roberts, Prasso, & Clifford (1999), for example, describe a private company, with sales of $192 million and 1,200 workers, that makes large air conditioning systems for office buildings.

Recently, Zeng Peiyan, the chairman of the State Development Planning Commission, said that China's economy was relying too heavily on state spending, and that restrictions on privately held firms will be lifted. For instance, private firms will now be granted increased access to bank loans and the capital markets, although they are not treated equally at this time (Browne 2000). Nevertheless, discrimination against private firms and entrepreneurs remains strong (Zhu 2000).

2.2 Manufacturing and Logistics

A number of authors have established frameworks for manufacturing strategy (Wheelwright 1984, Pyke 1997, and Silver, Pyke, & Peterson 1998, Chapter 2, for instance). Most frameworks define four operations, or competitive, objectives – cost, quality, delivery and flexibility – which provide measurable targets for managers to pursue. The next level defines a set of management levers that can be used to achieve these objectives. Examples of management levers include inventory, production planning, supply chain relationships, and facilities location and focus. In developing our questionnaire, we followed the framework from Pyke (1997), which in turn is based on Wheelwright (1984).

In the realm of manufacturing, Yu, Cochran, & Spencer (1998) survey 128 firms regarding total quality management (TQM) practices in China. They note that TQM was mandated in various forms in 1978, 1980, and 1993. For example, the Consumer Rights Protection Law gave customers the right to complain about, and to receive compensation for, inferior quality. The 1993 Product Quality Law made producers responsible for their product quality. Yu, et al discuss the current enthusiasm for ISO 9000 and note that 91% of the firms surveyed have TQM training, 90% have had TQM for more than 2 years, and 95% have a separate quality department. Apparently, 96% have implemented TQM.

Robb & Xie (1998) survey foreign-invested enterprises in the Beijing area. We shall discuss their results below and draw some interesting contrasts and similarities between Shanghai and Beijing. Robb and Xie do not, however, examine supply chain management.

Luk (1998) surveys 1000 “channel members” in fourteen Chinese cities since 1991 to gain insight into the marketing channel implications of distribution reforms in China. This paper provides an historical overview of the changes in the past 20 years and discusses the problems of the old system and the emerging multi-channel competition. It notes that China's distribution system is still inefficient because of “structural factors, such as inter-provincial and inter-ministerial relationships, the level of relatedness between two industries, inefficient administration procedures and overlaps in the roles and functions of different administrative organizations.” (page 65)

Lihong & Goffin (1999) interview managers from six joint ventures in China. They identify four major problem areas: recruiting and training employees, supplier management (especially delivery problems), quality output, and achieving an effective business culture.

Roh & Whybark (1993) survey Chinese and Korean firms, but they address manufacturing practice and tactics, rather than manufacturing strategy; and they focus on apparel and machine tool companies. Other than these papers, we know of no other work that examines the operations strategy and tactics of manufacturing firms. Some case studies have described individual companies (Pyke 1998a, and Robb & Xie 2000), but we have not seen more systematic analysis.

3. Methodology

This section describes questionnaire development, sampling, interviewing, measurement and development of summary scales.

Questionnaire: The basis of our questionnaire was the framework for manufacturing strategy in Wheelwright (1984) and Pyke (1997) and the questionnaire used by Robb & Xie (1998) in a study of foreign-invested enterprises in the Beijing area. This was complemented by questions from other research including Hum & Leow (1996) and by self-report performance measures used in China by Deshpande & Farley (1999a) and McDermott, Greis, & Fischer (1997). The translated new items were added to the draft questionnaire which was back-translated to English by a research assistant familiar with Chinese practices in interview studies and with survey research methodologies in social research. After editing, the resulting questionnaire was pre-tested with senior manufacturing managers from five different firms, who were asked to respond to the questionnaire and to note any questions which posed any sort of problem – lack of clarity, sensitivity of the answers, etc. The handful of problems thus identified were resolved in discussion with the pre-test subjects.

Sampling: The sample of firms was drawn from registers of businesses in Shanghai maintained by the market research firms for their business-to-business projects. Interviewers reported that 92 percent of the original sample was contacted and that 80 percent of these contacts produced useful interviews, yielding 100 firms for our study. The 100 firms interviewed were limited to manufacturers which were State-Owned Enterprises (57 firms), Collectives (27), or Privately-owned (15). Industry representation is given in Table 1. Note that one firm did not fit the categories defined in our questionnaire.

Interviewing: Personal interviews with senior manufacturing executives were conducted by the staff of an international market research firm who specialize in research in business-to-business settings. The interviews were held in the offices of the respondents. Prior appointments were made by telephone for the interviews.

Measurement: All items on the questionnaire were closed-ended. They included three, five and seven-point scales as well as nominal qualitative measures and metric measures, such as number of employees.

Construction of Summary Scales: At the core of the analysis are a set of summary scales composed of multiple items which measure: 1) the importance of the factor as a competitive objective and, 2) recent improvement in the factor. Parallel summary measures in each of these categories cover costs, quality, delivery, flexibility in the new product development process, and flexibility in the production process. The content and reliability of these ten scales are shown in Table 2. Each element in each scale was measured on a 7-point scale. In all but one case the reliability as measured by the Chronbach $\propto$ is above the minimum level of 0.6 (Nunally 1967). The three elements of the self reports of performance, shown to be reliable in a wide variety of settings (Deshpande and Farley 1999b), produced a reliability measure of 0.81. Cost objectives and cost performance were measured with single 7-point items.

4. Some General Results

The average size of the state-owned enterprises (SOEs) is 688 workers/operators, but there is considerable variation as reflected in the standard deviation of 1582. The total number of employees for SOEs is 1106 (standard deviation = 2288), and the total number of employees five years ago was 1677 (standard deviation = 3075). For collective-owned enterprises (COEs) the number of workers/operators is 594 (1041), with 931 (1524) total employees, and 1135 (1952) total employees five years. Privately-owned enterprises (POEs) are slightly smaller at 449 (404) workers/operators, 772 (549) total employees, and 880 (756) total employees five years ago. SOEs have downsized by 34% (on average), COEs by 18%, and those POEs that existed five years earlier by 12%. Note that there is a potential survivorship bias in all of the downsizing figures. The relative sizes of the SOEs, COEs and POEs are consistent with our observations from our visits to numerous Chinese firms. However, it is clear from our survey that some privately-owned manufacturing enterprises are quite large and have achieved a remarkable status in a socialist, centrally planned economy.

We examined the differences among the three ownership types for every question. Perhaps the most remarkable result from this analysis is the *lack* of significant difference among them. For the vast majority of questions, there is no significant difference, which implies that our conclusions are quite general in their application to all three types of Chinese organization. One exception is the implementation of advanced manufacturing technologies, on which SOEs are clearly behind and POEs are clearly ahead. We plan to discuss the results on advanced manufacturing technologies in more detail in a subsequent paper.

It is interesting to note that SOEs report less planning to reduce workforce size than COEs or POEs (though, again, not significantly). Nevertheless, SOEs *are* significantly lower on a question that dealt with plans to increase production capacity. In other words, they are planning to reduce, or not increase, capacity, but they are not planning reducing the workforce size as much as COEs and POEs. To date, SOEs have been constrained in layoffs, so this latter result is consistent with observations of current practice. However, it highlights the problem faced by SOEs. They must improve, but they have few options to pursue; and perhaps they lack the management talent to pursue them. It is probable that early layoffs in SOEs had little effect on productivity because the organizations were so bloated. It is also likely that production capacity increases are not sought by SOEs because they often produce products for which there is excess industry manufacturing capacity.

In this light, it is interesting to note that the sign of the Pearson correlation coefficients of the three items (number of workers/operators, total employees, and total employees five years ago) with the firm performance index are all negative (although not significantly). The correlations are –0.103, –0.126 and –0.195, respectively. In other words, firms with more employees apparently achieve worse performance. In fact, firms that were larger five years ago have an even stronger negative association with current firm performance. Perhaps these firms are shedding employees, but the effect has not been as positive as one would hope.

We end this section with some brief comments about the face validity of the results. We shall see below that these firms are more advanced than we had expected. One could argue that they simply reported higher values on each question, leading to a

false impression. It seems, however, that this is not so because a number of questions received extremely low scores. For instance, one question asked whether "Manufacturing can run small batches at virtually the same cost as larger batches." The mean response on a 1 – 7 scale was 2.13, much lower than most other questions. This score is clearly consistent with the lack of flexible manufacturing technology in China. In a similar vein, we asked a set of questions about the current status of implementation of advanced manufacturing technologies, while another set asked for future plans for the same technologies. One of these questions addressed automation in production and the mean scores were 1.84 for current status (1 = Not implemented, 2 =In progress, 3 = Fully implemented) and 2.14 for future plans (1 = No plan for future investment, 2 = Considering to add future investment, 3 = Decided to add future investment). In other words, many firms are in progress, and even more expect to implement in the future. Again, this is consistent with our observations. Finally, one of these questions addressed robotics. The scores for both current status and future plans were extremely low: (means of 1.01 and 1.22, respectively). This data is consistent with our observations of Chinese firms. They are working or planning to work with computer aided design (means of 1.71 and 2.21, respectively), and with MRP (means of 1.64 and 2.34, respectively), but they are not working or planning to work with more expensive and high tech equipment such as robotics.

5. Manufacturing Strategy Results

Two sets of questions relate to the four operations objectives – cost, quality, delivery and flexibility. One set asks for the degree of emphasis the company placed on the objectives

during the past year; for instance, "Reducing product cost," "Reducing time to introduce new products," and so on. The mean responses on a 7-point scale are given in Table 3, where 1 = "No emphasis" and 7 = "Extreme emphasis." A second set asks for the degree of improvement in the past year on the identical dimensions (1 = "Much worse and 7 = "Much better"). The means for these questions are given in Table 3 as well. For comparison purposes, we have included the results from Robb & Xie (1998). Note that these are broken out between foreign invested enterprises (FIEs, or joint ventures) and wholly Chinese owned enterprises (WCOEs). Thirteen of the 46 plants surveyed in Robb & Xie (1998) were WCOEs.

It is evident that flexibility is emphasized less than cost, quality or delivery. We define flexibility on three dimensions – new product introduction, product mix and volume flexibility (questions 4, 11 &12; question 2; and question 1, respectively). All of these have low scores relative to the other objectives. The three delivery questions (5, 6 and 7) score very high, as do the quality questions (8 –10, 13), with the exception of improving product durability. Reducing product cost (question 3) scores relatively high as well. We might argue that low product cost is almost a given in China. Cost is emphasized, improvements are difficult to achieve, but the current emphasis is on delivery and quality.

Note too that the Shanghai firms score higher on *every* question, with the exception of improvements in product cost, than FIEs and WCOEs. This is not surprising given the vibrant nature of business in Shanghai. Observers suggest that large amounts of foreign investment and technology have been pouring into Shanghai and Guangzhou,

thereby creating a more modern, competitive environment. What might be surprising, however, is that these firms seem to be intentional about their manufacturing strategy.

We have argued elsewhere (Pyke 1997) that cost reduction was the major emphasis of Western firms during the 1950s and 1960s. When Japanese automotive and consumer electronics made significant inroads in the U.S. in the 1970s and 1980s, quality became the dominant concern. Then, in the late 1980s and early 1990s, flexibility and delivery – or time-based competition – came to the fore. (The late 1990s have been dominated by supply chain management, a topic we will address in the next section.) It seems that Beijing firms, especially WCOEs, have not yet made the transition to competing on the basis of time. In fact, *the* major difference between the two surveys is that "time" is much more important to the Shanghai firms than the Beijing firms. Note that the current research came 18 months later than the Robb and Xie results. Things are changing rapidly in China, and it is possible that the strategic direction of these firms would change significantly in such a short time.

The Pearson correlation coefficients between the competitive objectives emphasized and the recent improvements are significant. This indicates that firms are actually improving in the areas they currently emphasize. In addition, four of the five of the competitive objective indices, and all of the recent improvement indices, are significantly correlated with the firm performance index (Table 4). The highest correlation is with the recent quality improvement (0.503), followed by the recent factory flexibility improvement (0.382). The lowest is with the cost objective (0.192), which is nearly significant ($p = 0.056$). It appears that both high emphasis and recent improvement on any of the operations objectives correlates with improvement in firm

performance. Note too, however, that for any objective (cost, quality, and so on), recent improvement has higher correlation with the firm performance index than does recent emphasis on the objective. This adds to the face validity of the results.

In 1985, Wheelwright and Hayes identified four stages of competitiveness of manufacturing companies (Wheelwright & Hayes 1985). Stage I companies, for instance, look outside for help in solving manufacturing problems and have low skill workers and managers. Stage II firms typically pursue a follower approach to implementing new technologies and try to achieve operational parity with competitors. Stage III firms formulate a manufacturing strategy and screen their manufacturing decisions for consistency with marketing and business strategies. Finally, Stage IV firms anticipate new manufacturing practices and attempt to pursue a manufacturing based competitive advantage. They consider both structural (bricks and mortar capacity expansion, for instance) and infrastructural (workforce training, for instance) decisions as important to strategy. We asked a set of questions designed to discover the stage of manufacturing competitiveness of these firms. A subset of the results is in Table 5.

In Table 5, the firms in our sample seem to be in Stage III. The mean scores for questions 1 and 2, which correspond to Stages I and II, are quite low compared to questions 3 to 5. The firms are screening manufacturing decisions for consistency with marketing and business strategy, and many are looking to manufacturing for competitive advantage. However, the mean on question 4 (Stage IV) is lower than the mean on question 3 (Stage III). Likewise, the score on training given to workers is quite low, implying that perhaps they place greater emphasis on structural decisions than on infrastructural issues.

In general, these results are somewhat surprising, given the negative press about Chinese firms. One would have expected, perhaps, that they would be mired in Stages I or II. It appears, however, that these firms are more sophisticated than we might have expected. Investors should be encouraged to know that there are many Stage III firms that at least attempt to formulate and utilize a manufacturing strategy. Note too that the correlations with the firm performance index seem consistent with expectations. High scores on Stage I and II questions are consistently negatively correlated with firm performance, whereas high scores on Stage III and IV questions are positively correlated. Some of these are significant at the 0.001 level, as noted in the table.

6. Supply Chain Management Results

Supply chain management (SCM) is the term used to describe the management of materials, money and information across the entire supply chain, from suppliers to component producers to final assemblers to distribution (warehouses and retailers), and ultimately to the consumer. We asked a number of questions aimed at discovering the status of SCM in China. Their means and correlations with the firm performance index are listed in Table 6.

Only one item, "Relationship with our customers," is significantly correlated with the firm performance index. This is somewhat surprising given the enthusiastic pursuit of SCM among U.S. and European firms. Perhaps more surprising is the sign of the correlations in some cases. For example, consulting suppliers about new product development (Item 8 in Table 6) is associated with poorer performance. Western automotive and high tech firms are representative of many who place significant

emphasis on working with suppliers in developing new products. The benefits for time-to-market, product cost and manufacturability are enormous. At first glance, it would appear that Chinese firms have not yet realized the same benefits, or perhaps they are not yet at a stage in which they can benefit from closer relationships with their supply chain partners.

6.1 Stages of Supply Chain Integration

Lee outlines a series of four stages of supply chain integration (Lee 1999). Stage 1 is sharing information (about demand or production schedules, for instance); stage 2 is exchanging decision rights (such as allowing a vendor to make inventory stocking decisions); stage 3 is exchanging work (such as allowing a distributor to perform some final assembly and configuration); and stage 4 is an explicit scheme for sharing risks and benefits. We test the first three stages with specific questions (Items 1 – 3 in Table 6). We hypothesize that to achieve stage 3, a firm must already share information and decision rights. This would imply that the means of the three items would be in descending order (mean of Item 1 > mean of Item 2 > mean of Item 3). In fact, the mean of Item 1 is greater than the other two, but the mean of Item 2 is not greater than that of Item 3. In other words, firms share information more than they share decision rights and work, but firms share work more than decision rights.

It is possible that there is a translation issue here. "Sharing work" might imply outsourcing, which is pursued by many firms regardless of recent supply chain initiatives. Note that all of the correlations between these three items and the firm performance index are in significant. Finally, the proportion of work subcontracted to outside firms (Item 4)

is negatively correlated with the firm performance index (–0.185), which is consistent with the result about sharing work. Once again, it seems that supply chain advances are less developed in China.

6.2 Relationships with Suppliers and Customers

The firms surveyed communicate more with customers than with suppliers. Item 5 in Table 6 ("Customers are consulted in deciding the production schedule") and Item 6 ("Suppliers are consulted…") have means of 5.28 and 4.38, respectively, and both have negative but insignificant correlations with the firm performance index. Likewise, Item 7 ("Customers are consulted in deciding which new products to develop") and Item 8 ("Suppliers are consulted…"), have means of 6.10 and 4.57, respectively, again with insignificant correlations with the firm performance index. The latter is not too surprising: it is much more common to ask customers about new products; consulting suppliers in new product development is fairly sophisticated supply chain management. However, certain industries rely on suppliers for these decisions. Personal computer manufacturers, for instance, require knowledge of the latest generation of integrated circuits. It is likely that the technical sophistication of many of these products is not at the level that would require frequent supplier consultation.

Further results confirm the conclusion that downstream relationships are closer than upstream relationships. Item 9 in Table 6 ("The relationship between our firm and the majority of our suppliers") has a mean of 5.63, while Item 10 ("The relationship with the majority of our customers") has a mean of 5.99. Likewise, Item 11 ("We communicate with our suppliers – never … often") has a mean of 5.72, while Item 12 ("We communicate with our customers…") has a mean of 6.31. Respective correlations

with the firm performance index are 0.182, 0.314 (significant at the 0.01 level), 0.103, and 0.141. All of the means are well above the value at the middle of the scale (4.00). *t*-tests on the parallel measures of supplier – customer (Item 6 – Item 5, Item 8 – Item 7, Item 9 – Item 10, and Item 11 – Item 12) indicate that the customer mean is significantly larger than the supplier mean at the 0.001 level.

We also asked a series of questions about recent improvement actions (1 = Not implemented, 2 = Implementation in progress, 3 = Fully Implemented), and about future plans (1 = No plan for future investment, 2 = Considering to add future investment, 3 = Decided to add future investment). Recent improvement in relationships with suppliers has a mean of 2.39, while recent improvement in relationships with customers has a mean of 2.42. The plans for the future for the same two actions have means 2.82 and 2.89, respectively. Neither difference is significant.

Now let us examine whether firms that communicate with customers, also communicate with suppliers. For instance, Items 11 and 12 in Table 6 ("We communicate with our suppliers" and "We communicate with our customers") are correlated at 0.422, which is highly significant. Items 9 and 10 ("The relationship with our suppliers…" and "The relationship with our customers…") are correlated at 0.509, again highly significant. The same is true of deciding production schedules with suppliers and customers (Items 5 and 6, correlation = 0.387), and deciding which new products to develop (Items 7 and 8, correlation = 0.318). It appears that firms that communicate do so with both suppliers and customers on at least one dimension. This suggests that some firms are perhaps significantly more advanced in SCM than others.

Interestingly, it is not necessarily true that firms that communicate with customers, say, do so on many dimensions. Item 5 ("Customers are consulted in deciding the production schedule") and Item 7 ("Customers are consulted in deciding which new products to develop") are not correlated, and neither are Items 5 and 12 ("We communicate with our customers…"). How do we interpret this? Is it true that there is little relationship between discussing production schedules and overall communication? Two points are in order. First, some firms may need to communicate about production schedules but not about new product development. For instance, if the firm is delivering a stable product, such as packaged food, production schedule information could be very useful to the customer, but there may be little new product development to discuss. Therefore, a low correlation between Items 5 and 12 is not necessarily surprising. Second, it may be that communication in the more general question, Item 12, might be interpreted as demanding, one-way communication ("You will do what I tell you to."), whereas consulting customers about production schedules implies asking them for their preference. The response to Item 12 is *very* high across the board (high mean, and low standard deviation). It could be that nearly all firms score high on Item 12 because of the varieties of communication that fit within the question. This does not imply that the same firms are asking customers for feedback on production schedules.

Now, let us investigate communication with suppliers. Item 6 ("Suppliers are consulted in deciding the production schedule") and Item 8 ("Suppliers are consulted in deciding which new products to develop") are correlated 0.342, which is highly significant. Likewise, Items 6 and 9 ("The relationship with our suppliers is close") have correlation of 0.250 (significant at the 0.012 level) and Items 6 and 11 ("We

communicate with our suppliers") have correlation of 0.255 (significant at the 0.011 level). Compared with customer relationships, it appears that, if there is a relationship on one dimension with suppliers, there is a stronger relationship across multiple dimensions. Note that Item 8 is significantly correlated with Item 11, but not with Item 9 (correlations are 0.239 – significant at the 0.05 level – and 0.085, respectively). Items 9 and 11 have correlation 0.598, which is highly significant, and is expected. In general, a close relationship with suppliers is correlated with communication between the firm and its suppliers, and with consultation about production schedules, but not with consultation about new products. It would appear that, as on the customer side, communication involves several, but not all, dimensions.

Finally, note that the more general questions ("The relationship between our firm and the majority of our suppliers/customers" and "We communicate with our suppliers/customers") all have high means: 5.63, 5.99, 5.72, and 6.31. However, the more specific questions have lower means, with one exception. The items, "We consult our customers/suppliers on production schedule and new products," have means 5.28, 4.38, 6.10, and 4.57. The sole exception pertains to consulting customers about which new products to develop.

In summary, there is more communication with customers than with suppliers, across the sample. Firms that communicate with customers tend to do so with suppliers as well. Communication with customers does not necessarily cover multiple dimensions, but communication with suppliers more often does.

Of course, communication with supply chain partners is not the only supply chain initiative that can have value for these Chinese firms. However, going forward, they

might do well to learn some lessons from Western firms' JIT implementation experience. Many firms pursued pieces of the JIT tool kit and philosophy without understanding which tools applied well to their situation. Implementing Kanban, for instance, in a job shop can result in excessively long lead times and extremely low throughput. One might view the results of our survey as a mandate for Chinese firms to pursue closer relationships with suppliers and customers. However, we would recommend that the nature of the relationship be considered with care. If there is little new product development, or if new products do not depend on a particular supplier's components, there is little need for discussion on that topic. However, if delivery times are important, and we have seen above that they increasingly are, communication about production schedules and delivery performance might be extremely valuable. Elsewhere, we have argued that managers should form supply chain relationships that fit the complexity and uncertainty inherent in the situation (Pyke 1998b). It seems appropriate to highlight that point here. These firms are not at world class stages of supply chain management. However, it will be important for them to think carefully about the initiatives, and related relationship styles, they choose to pursue.

7. Conclusion

The Chinese economy has been booming with private investment, joint ventures, contract manufacturing, and even the sale of state-owned enterprises. How should Western firms proceed with their China strategy? Are state-owned enterprises a good investment? What is the status of manufacturing strategy and supply chain management in Chinese firms? This paper has attempted to give some insight into these questions by reporting

the results of a survey of 100 state-owned, collective-owned, and privately-owned enterprises in the Shanghai region. We discovered that the differences among these three ownership types are generally insignificant. We also learned that these firms are more advanced with explicit manufacturing strategies than we had expected, but they are not as advanced in supply chain management as many Western firms. For example, they report significant communication with customers and suppliers – more with customers than suppliers – but the nature of the communication is often limited to one dimension, particularly on the downstream side.

There are other results in our survey that we plan to report later. This includes more in-depth analysis of the supply chain itself. We are also surveying a number of joint venture firms and wholly-owned foreign subsidiaries, using the identical instrument, to see if we can further understand differences between wholly owned Chinese firms and firms with some foreign ownership interest. One useful avenue for further research would also be case studies that give readers deep insight into the operations, management and challenges of these various types of firms in China.

Product Line/Industry	Number of Firms in the Sample
Consumer goods	
Durable consumer goods	13
Non-durable consumer goods	38
Goods for industrial / commercial / government uses	
Manufacturing equipment (capital goods)	15
Raw materials or half-finished products	6
Parts / components for assembling	15
Supplies and other consumption goods	12

Table 1: Industry representation

Table **Description of Scales**

Scale	Number of Items	Scale Content	Reliability (Cronbach ∝)
Competitive Quality Objectives	3	Emphasis on improving product reliability, improving quality consistency, good after-sale service	0.66
Improvement in Quality Performance	4	Improved product reliability, improving quality consistency, good after-sale service, increasing product durability	0.75
Competitive Delivery Objectives	3	Emphasis on time for completion, delivery and meeting due dates	0.69
Improvement in Delivery	3	Improved time for completion, delivery and meeting due dates	0.86
Competitive New Product Flexibility Objectives	3	Emphasis on reducing time to introduction, adding functions, introducing more products	0.68
Improvement in New Product Flexibility	3	Improvement in time to introduction, adding functions and new product introductions	0.69
Competitive Factory Flexibility Objectives	2	Emphasis on ability to change product volume and product mix	0.33
Improvement in Factory Flexibility	2	Improvement in ability to change product volume and product mix	0.61
Improvement in Performance	3	Improved market share, profitability and return on sales	0.83

Table 2: Scales and reliabilities

	Shanghai[1]		Beijing			
	Degree of Emphasis	Improvement	FIE[2] Degree of Emphasis	WCOE Degree of Emphasis	FIE Improvement	WCOE Improvement
Description	Mean	Mean	Mean	Mean	Mean	Mean
1. Ability to vary production volume at any time	5.79	5.68	5.0	4.5	5.3	5.3
2. Ability to product a different mix of products	5.70	5.67	5.0	5.3	5.4	5.3
3. Reducing product cost	6.12	4.73	5.5	5.3	5.2	4.8
4. Reducing time to introduce new products	5.21	5.01	5.0	4.8	5.0	4.9
5. Reducing time from customer order to completion	6.28	6.05	5.7	4.9	5.3	4.9
6. Rapid delivery to customer (after production)	6.10	6.17	5.8	4.5	5.3	4.8
7. Meeting customer due dates	6.47	6.17	6.4	4.8	5.4	4.6
8. Improving product reliability	6.29	5.92	5.8	5.5	5.5	4.9
9. Improving product durability	5.15	5.52	4.8	4.9	5.0	4.8
10. Improving consistency in product quality	6.23	5.55	5.1	5.8	5.1	5.2
11. Adding new functions to existing products	4.82	4.87	3.9	4.0	4.8	4.7
12.Introducing more new products	5.48	5.20	5.3	4.8	5.1	4.9
13. Providing good after sale service	6.31	5.90	5.8	5.3	5.2	4.9

Table 3: Mean scores for operations objectives – degree of emphasis in the past year and improvement in the past year

[1] There were 100 firms in the Shanghai sample, and 33 FIEs and 13 WCOEs in the Beijing sample.
[2] FIE = foreign invested enterprise, and WCOE = wholly Chinese owned enterprise.

Index	Correlation with Firm Performance Index (*p*-value 2-tailed)
Competitive objective	
Cost	0.19 (0.06)
Quality	0.28 (0.01)
Delivery	0.20 (0.04)
New Product Flexibility	0.30 (0.00)
Factory Flexibility	0.21 (0.04)
Recent Improvement	
Cost	0.23 (0.02)
Quality	0.50 (0.00)
Delivery	0.23 (0.03)
New Product Flexibility	0.33 (0.00)
Factory Flexibility	0.38 (0.00)

Table 4: Correlation between competitive objective and recent improvement indices with the firm performance index

Description	Mean	Correlation with Firm Performance Index
1. We always obtain assistance from external experts to solve manufacturing issues	3.93	–0.08
2. We only consider implementing new manufacturing practices or technologies if they have been adopted successfully by our competitors	3.34	–0.09
3. Manufacturing decisions are screened for consistency with marketing and business strategies	6.44	0.33***
4. Competitive advantage is sought by having manufacturing participate in making marketing, engineering and business strategy decisions	5.99	0.15
5. Our factory is able to pursue multiple competitive objectives simultaneously	5.39	0.33***
6. Level of training given to workers	4.38	0.34***

Table 5: Mean scores for stages of manufacturing competitiveness and correlation with firm performance index (* significant at the 0.001 level)**

Question	Mean	Correlation with Firm Performance Index (*p*-value 2-tailed)
1. Competitive advantage is sought by sharing information with our suppliers or customers (1 = "Strongly disagree", 7 = "Strongly agree")	6.55	0.03 (0.74)
2. Competitive advantage is sought by making production or inventory decisions for our suppliers or our customers, or by having them making decisions for us. (1 = "Strongly disagree", 7 = "Strongly agree")	5.15	0.01 (0.94)
3. Competitive advantage is sought by performing some of our suppliers or customers work for them, or by having them perform some of our work. (1 = "Strongly disagree", 7 = "Strongly agree")	5.34	–0.08 (0.41)
4. Proportion of overall production process subcontracted to outside firms. (1 = "Strongly disagree", 7 = "Strongly agree")	3.02	–0.19 (0.07)
5. Our customers are consulted in deciding the production schedule (1 = "Strongly disagree", 7 = "Strongly agree")	5.28	–0.03 (0.74)
6. Our suppliers are consulted in deciding the production schedule (1 = "Strongly disagree", 7 = "Strongly agree")	4.38	–0.06 (0.56)
7. Our customers are consulted in deciding which new products to develop (1 = "Strongly disagree", 7 = "Strongly agree")	6.10	0.00 (0.98)
8. Our suppliers are consulted in deciding which new products to develop (1 = "Strongly disagree", 7 = "Strongly agree")	4.57	–0.09 (0.39)
9. The relationship between our firm and the majority of our suppliers is: (1 = "Very weak", 7 = "Very strong")	5.63	0.18 (0.07)
10. The relationship between our firm and the majority of our customers is: (1 = "Very weak", 7 = "Very strong")	5.99	0.31 (0.00)
11. We communicate with our suppliers (1= "Never", 7 = "Often")	5.72	0.10 (0.31)
12. We communicate with our customers (1= "Never", 7 = "Often")	6.31	0.14 (0.16)

Table 6: Supply chain management questions and correlations with the firm performance index

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