

# From Lean Production to Lean Industry: Strategic Choices for the Chinese Automobile Industry

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## I. Introduction

As a strategic choices for China's automobile industry, restructuring the industrial organization and production system is more urgent than setting up joint ventures with auto companies from Japan, the U.S., and Europe. Although the introduction and practice of the lean production system are very necessary, it is more important for China to build a lean industry at this time.<sup>1</sup>

China's automobile industry is too "fat". In 1996 China produced 1.47 million vehicles, becoming the third largest automobile-producing country in Asia after Japan and South Korea. But if we look at the other side of the fact, we will find the problem.

These 1.47 million vehicles are produced by 116 auto makers. Only 2 makers (First Automotive Works and Shanghai-VW) produced over 200,000 units, 3 makers (Tianjin Auto, Dongfeng Motor and Beijing Auto) produced over 100,000 units and enjoy the scaled merit to some extent. 13 auto makers produced over 10,000 units a year. The yearly pruction volume of the remainder 98 auto makers were less than 10,000 units, including 36 makers less than 1,000 units and 18 makers less than 100 units (see Table 1).<sup>2</sup>

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1 For the factors that make up the 'lean production' system, see Womack, Jones and Roos (1990). Roughly speaking, it can be viewed as an idealized Toyota production system.

2 *Chugoku Keizai Shukan* [Chinese Economic Weekly], No. 59, March 27, 1997, p. 13.

**Table 1. Firm Numbers, Total Production Volumes and Market Shares of the Two Main Companies in China's Automobile Industry**

(volume in unit, share in %)

Year	Auto maker numbers	Total production volumes	FAW's		Dongfeng's		Imports	Retainments
			Volume	Share	Volume	Share		
1953	1	0	0				10,884	n.a.
54	1	0	0				16,918	n.a.
55	1	61	61	100			15,199	n.a.
56	1	1,654	1,654	100			11,240	n.a.
57	1	7,904	7,904	100			2,225	120,500
58	8	16,000	14,922	93			30,158	n.a.
59	14	19,601	16,469	84			15,619	n.a.
1960	16	22,574	17,407	77			17,744	223,826
61	16	3,589	1,146	32			1,458	240,007
62	17	9,740	7,602	78			3,178	247,992
63	18	20,579	17,665	86			2,484	261,346
64	19	28,062	24,251	86			3,914	271,603
65	21	40,542	34,155	84			12,151	289,873
66	22	55,861	46,605	83			12,925	322,904
67	22	20,381	15,068	74			8,314	374,446
68	25	25,100	16,673	66			5,946	384,939
69	33	53,100	37,277	70			3,039	436,413
1970	45	87,166	50,336	58			10,976	487,557
71	47	111,022	60,050	54			11,637	542,896
72	49	108,227	58,035	54			14,206	642,792
73	49	116,193	57,857	50			18,863	717,583
74	49	104,771	40,202	38			27,871	825,226
75	52	139,800	60,359	43	n.a.		25,286	946,833
76	53	135,200	56,784	42	n.a.		18,248	1,100,463
77	54	125,400	42,273	34	n.a.		15,993	1,250,827
78	55	149,062	58,227	39	5,123	3	25,367	1,429,229
79	55	185,700	63,002	34	14,541	8	32,226	1,565,678
1980	56	222,288	66,000	30	31,500	14	51,083	1,680,960
81	57	175,645	60,002	34	37,503	21	41,575	1,873,049
82	58	196,304	60,507	31	51,711	26	16,077	2,053,174
83	65	239,886	67,200	28	60,106	25	25,156	2,227,130
84	82	316,367	78,416	25	70,173	22	88,743	2,433,713
85	114	443,377	85,003	19	83,431	19	353,992	2,887,126
86	99	372,753	61,607	17	87,292	23	150,052	3,574,463
87	116	472,538	62,038	13	104,673	22	67,182	4,122,939
88	115	646,951	80,846	12	114,542	18	99,233	4,776,382
89	119	586,936	76,224	13	120,892	21	85,554	5,274,663
1990	117	509,242	69,358	14	107,952	21	65,430	5,835,865
91	120	708,820	83,467	12	122,489	17	98,454	6,114,089
92	124	1,061,721	137,197	13	138,579	13	210,087	6,917,354
93	124	1,296,778	163,621	13	177,351	14	310,461	8,175,835
94	122	1,353,368	178,299	13	182,284	13	283,060	9,419,533
95	122	1,452,697	182,258	13	154,375	11	158,115	10,400,029
96	116	1,474,905	204,743	14	121,450	8	75,863	11,000,764

SOURCE: (1) *Zhongguo qiche gongye nianjian 1996* [The Chinese Automobile Industry Yearbook, 1996] Auto maker numbers: p. 68; total production volumes: p. 83; imports: p. 332; retainments: p. 458.

(2) The production volumes of FAW (from 1978) and Dongfeng: from *Qiche gongye guihua cankao ziliao 1992* [Reference Material of the Automobile Industry Planning 1992], pp. 118-19, 238-9, 214-15.

(3) FAW's production volume (to 1977): from *Jilin shehui jingji tongji nianjian 1987* [Jilin Statistical Yearbook of Society and Economy 1987], p. 160. The total production volume of Jilin Province was equal to FAW's production volume by 1977.

(4) Others: *Chugoku keizai shukan* [Chinese Economic Weekly], No. 59, March 27, 1997, p. 13.

It is not exaggerative to say whether China can build a lean industry at the beginning of 21 century will determine the course of development of China's automobile industry.

In the past 5 years, the author has conducted field surveys on over 50 car makers and auto parts makers including about 30 Chinese companies and 20 companies in Japan, U. S., Germany, Brazil and South Korea. Base on the field surveys of both domestic and foreign companies, the author attempts to explain the necessary conditions to build a lean industry in China from two aspects – reorganizing auto makers and building a strong auto parts industry.

## II. Why is China's Automobile Industry So "Fat" ?

The reason has largely been attributed to the dispersion of power in local provinces and other system-related factors. Here this issue would be approached from another perspective – three big "fat factors". One is the lack of direct product competition, others are the unique multi-layer division-of-labor structure which was observed in the Chinese automobile industry, and the large-scale entry of foreign auto companies.

### II.1. Fat Factor (I): Lack of Direct Product Competition

Direct product competition refers to a state in which many companies bring similar products to the market. In Japan, the typical example is so-called "CB War", i.e., the competition between Toyota's "Corona" versus Nissan's "Bluebird" since the 1960s. As a result of such fierce direct product competition in the domestic market, the Japanese auto makers gained competitiveness in the international market.<sup>3</sup> In China the similar competition is between two famous models of medium-sized trucks – "Jiefang" of First Automotive Works (FAW) and "Dongfeng" of Dongfeng Motor Corporation (Dongfeng) after the 1980s (see Table 1).<sup>4</sup> As a result of this competition,

3 In Japan direct product competition has caused an increase in R & D expenditures in the late 1980s and early 1990s. The increase was brought by "over-design and over-variation." It was called "lean production but fat design" later. See Fujimoto (1994) and (1996) for details.

4 For the competition between FAW and Dongfeng, see Lee (1996a, 1997a). The former name of Dongfeng Motor Corporation was Second Automotive Works (SAW) which was founded in Shiyang City, Hubei Province in 1969.

the supply of medium-sized truck has been relatively stable, and there have been few new entries in this segment.

This is because direct product competition has brought "product differentiation".<sup>5</sup> In direct product competitions, because the price difference of products is small, competitions in cost and technology become extremely important. Whether a company has volume-production capacity, efficient systems of raw material and parts supply directly influences its manufacturing cost. Whether a company can constantly make improvements on the function and design of products can also influence its performance in the market. Product differentiation, along with scale merit, is the barrier to new entries in the segment of medium-sized trucks.

Direct product competition also drastically reduced the number of medium-sized truck models in the market – from dozens of models before the 1980s to two major models (Jiefang and Dongfeng) after new Jiefang with a full model change was introduced in the mid 1980s. Their market concentration ratio is 90 percent, a typical example of oligopolistic competition.

However, such competition cannot be observed in other segments. In passenger car market, different products coexist in different segments. Even price competition has not occurred. In the small truck market, dozens of auto makers supply different models in different markets.<sup>6</sup> This is same as the market structure of medium-sized trucks before the 1980s. In the markets other than medium-sized truck, no dominant models exist, needless to say the cost or technological competitions. Meanwhile the protective policy of local governments further increased the number of auto makers in China (see Table 1).

## **II.2. Fat Factor (II): Stabilized Multi-layer Division-of-Labor Structure**

The multi-layer division-of-labor structure was formed in the

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5 Product Differentiation: Differentiate one product from another by differentiating its function, design, advertising or sales promotion activities, and customer service to influence customers' behavior.

6 For the industrial organization of small truck market, see Tajima (1996) for details.

1960s to 1970s. By 1958, several medium-sized auto manufacturers appeared after FAW – the first auto maker in China – started its operations in 1956.<sup>7</sup> The leading medium-sized auto manufacturers included Nanjing Auto Co. (the Yuejin 2.5-ton small truck), Jinan Auto Co. (the Yellow River 8-ton large truck), Shanghai Auto Co. (the Shanghai SH760 passenger car), and Beijing Auto Co. (the Beijing 212 off-road vehicle).

Of these new auto makers, Nanjing Auto and Jinan Auto had the same integrated production system as FAW, and were often regarded as mini FAWs. Before the 1980s large and medium-sized auto makers produced basic models in different segments for the national market. Instead of competing with each other, they coexisted because they produced different products (see Figure 1 and Table 2).

During the Cultural Revolution (1966~76), the Chinese government advocated “building one auto plant in each province” under a consideration of national defense. As a result, many small local auto manufacturers came into existence, and began to produce derivative models of Jiefang (FAW), Yuejin (Nanjing Auto), etc. for local markets. They coexisted in different regional markets without competition (see Figure 1). From this period, an extensive reproduction system established through the construction of new plants became the mainstream, determining the decentralized character of the Chinese automobile industry.

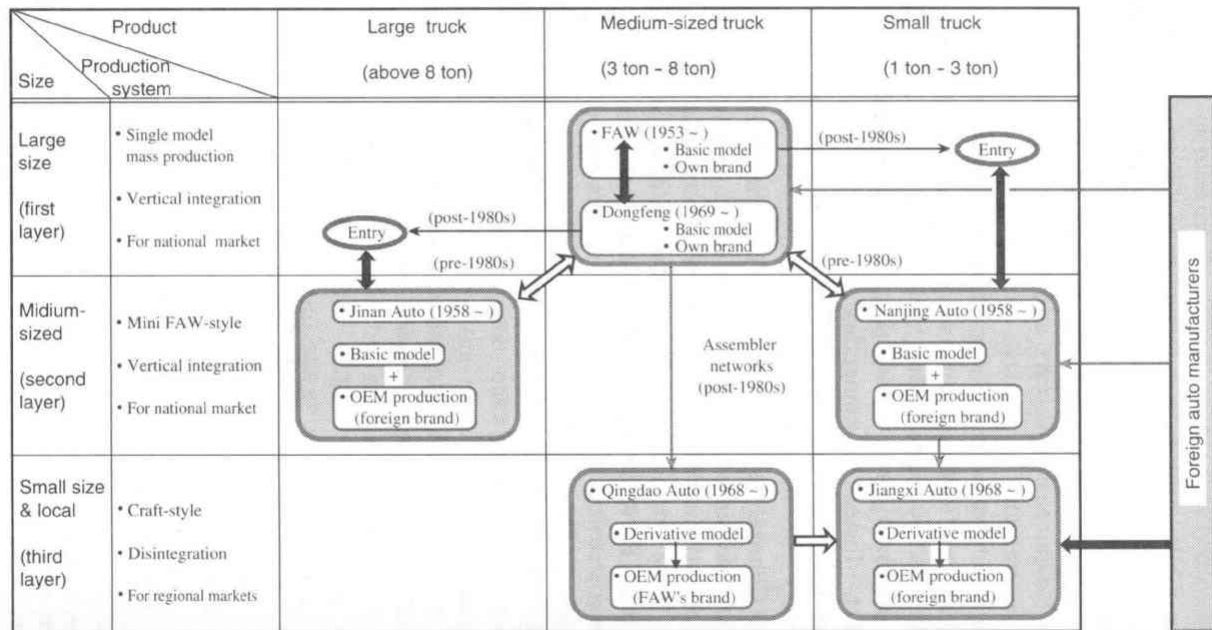
As indicated in Table 1, the number of Chinese auto makers and the total annual production volumes are as following:

1956:	1 company,	1,654 units;
1960:	16 companies,	22,574 units;
1970:	45 companies,	87,166 units;
1980:	56 companies,	222,288 units;
1990:	117 companies,	509,242 units;
1992:	124 companies,	1,061,721 units;
1996:	116 companies,	1,474,905 units. <sup>8</sup>

7 By the way, FAW was founded in 1953.

8 From yearly editions of *Zhongguo qiche gongye nianjian* [The Chinese Automobile Industry Yearbook].

Figure 1. The Multi-layer Division-of-Labor Structure in China's Auto Industry (Commercial Vehicle)



SOURCES:

Based on the yearly editions of *Zhongguo qiche gongye nianjian*  
[The Chinese Automobile Industry Yearbook]

NOTE: Arrows in this figure indicate firm behavior.

FAW : First Automotive Works

Dongfeng:

Dongfeng Motor Corporation (the former Second Automotive Works)

↔ : competition

→ : joint venture

↔ : coexistence based  
on different products

→ : technical tie-up or cooperation

↔ : coexistence in different  
regional markets

→ (circle) : entry into the new market segments

**Table 2 The Multi-layer Division of Labor Structure and Characteristics of Production System in the Chinese Automobile Industry (Commercial Vehicle)**

Company Size	Company	Parts Supply	Assemble (Model)	Marketing	Strategy = pre-1980s		Strategy = post-1980s		Main Cooperators	Division of Labor Structure		
					Production	Technology	Production	Technology		pre-1980s	post-1980s	
Large size (The first layer)	① FAW	Mainly manufacture in-plant	Changchun (Jiefang, mid-size truck)	National market	Single model Mass Production	Complete introduction Selective introduction	Full-line Assembler-networks	Unbundled introduction Self-development	Chrysler Hino (Japan)	Division of labor based on different products ↓ Formation of the national uniform market		
	② Dongfeng Motor	Centralized production	Shiyan (Dongfeng, mid-size truck)						Nissan-diesel Cummings (U.S.)			
	③ Nanjing Auto Co.	Mainly manufacture in-plant	Nanjing (Yuejin, small truck)		Single model small volume production		OEM Production (Iveco)	Technical tie-up	Iveco (Fiat Group)			
Medium-size (The second layer)	④ Jinan Auto Co.	Centralized production	Jinan (Yellow River, large truck)		Mini FAW style	Self development with domestic cooperator	(Steyr)	Technical tie-up	Steyr-Daimler-Puch • Austria	Basic models for national market ↓ Disintegration of strata		
	⑤ Beijing Auto Co.	Purchase in local area	Beijing (Beijing Jeep)		Single model Small volume production		(Cherokee)	Joint-venture (Beijing Jeep)	Chrysler			
Small size & local (The third layer)	⑥ Gold Cup Auto Co.	Purchase engine outside, others from local area	Shenyang (Gold Cup, small truck)	Local market	Single model		(GM, Pick-up)	Joint-venture (Gold Cup-GM)	GM	Division of labor in different areas ↓ Restructuring of automobile industry based on dynamism of competition and coordination		
	⑦ Jiangxi Auto Works	Purchase engine outside, manufacture other parts in-plant	Nanchang (Jinggangshan, small truck)		Single model Small volume production	Imitative production (Nanjing, Yuejin)		(Isuzu, ELF)	Technical tie-up			Isuzu (Japan)
	⑧ Yunnan Auto Plant	Mainly manufacture in-plant	Kunming (Kunming, mid-truck)		Mini FAW Craft production	Imitative production (FAW, Jiefang)	OEM Production (Dongfeng)	Participation in business group (Dongfeng group)				Dongfeng
	⑨ Wuxi Auto Plant (Others)	Purchase chassis outside, manufacture body in-plant	Wuxi (Taihu, bus)		KD style Craft production	KD style	Production of its own brand	Independent				

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SOURCE: Based on the yearly editions of *Zhongguo qiche gongye nianjian* (The Chinese Automobile Industry Yearbook) by the author.

As Sino-Soviet relations deteriorated and the Vietnam War intensified, China adopted the so-called "third front construction policy", building industrial bases in mountain areas. The "third front construction policy" is an economic policy based on military and strategic considerations. The north eastern part of China that is closest to the Soviet Union is the first front; Beijing and the east coastal region is the second front; and the south west and north west interior area is the third front.

The largest project undertaken under this policy was the Second Automotive Works (SAW), now the Dongfeng Motor Corporation. From 1969 to 1975 Dongfeng constructed large plants with highly integrated production logistics in a mountain area in Hubei Province. After Dongfeng started its operation in 1975, China's automobile industry moved toward a multi-layer division-of-labor structure.

As indicated in Figure 1, this structure consists of two large national manufacturers, i.e., FAW and Dongfeng directly under central government control, a few medium-sized makers, and many small local manufacturers in each province under the control of local governments. There was no direct competition between each layer. The large and medium-sized auto makers coexisted by producing different products. Meanwhile, protected by local governments, small local makers were able to survive in each regional market. Lack of competition caused by partition of the domestic market and economic isolation between different regions made this structure come into existence in the first place. The relatively simple technology involved in truck manufacturing helped to maintain this structure. All these factors strengthened and stabilized the multi-layer division-of-labor structure in China's automobile industry.

### **II.3. Fat Factor (III): Large-Scale Entry of Foreign Companies and Restructuring of Automobile Industry**

The multi-layer division-of-labor structure underwent restructuring in the 1980s along with the formation of a national market, the government's "business group policy", and especially the introduction of foreign capital and technology.

In the early 1980s, the Chinese government pursued a business group policy under the influence of Japanese management practice. The purpose of this policy is to consolidate the existing companies



into business groups to solve the problem of dispersion. It aimed to systematize products through restructuring the whole automobile industry. Under the supervision of the China National Automotive Industry Corporation (CNAIC), an administrative organization in charge of the overall Chinese automobile industry, seven large business groups were established, including the nationwide local auto and parts manufacturers.<sup>9</sup> Besides FAW and Dongfeng, the other core auto makers were Nanjing, Jinan, Beijing and Shanghai. These manufacturers engaged in the consignment production of major models for the core companies like FAW and Dongfeng, thus forming the domestic production networks (e.g., the relationship between FAW and Qingdao Auto; see Figure 1).<sup>10</sup>

Under the government's policy of "opening to the outside world", foreign auto makers from Europe, America, and Japan began to enter China and started local production with foreign capital and technology in the early 1980s. From this time China switched the emphasis of automobile production from commercial vehicle to passenger car. The Chinese government put forward the "Big 3, Small 3 and Mini 2" policy, which aimed to consolidate passenger car production among 8 car makers.

As indicated in Figure 2, the "Big 3" were Shanghai VW Motor Co. (Santana), FAW-VW Auto Co. (Golf/Jetta), and Shenlong Auto Co. (joint venture between Dongfeng and Citroen, ZX car); the "Small 3" were Beijing Jeep Co. (Chrysler, Cherokee), Guangzhou Peugeot Auto Co. (Peugeot 505), and Tianjin Auto Co. (licensed production with Daihatsu, Charade); and the "Mini 2" were Chang'an Suzuki Auto Co. (Chongqing, Alto) and Guizhou Aviation Industry Co. (Fuji Heavy Industries, licensed production, Rex). In addition, Toyota also announced its plan to set up a joint venture with Tianjin Auto to produce the Corolla from 1999.<sup>11</sup> In passenger car production, Chinese auto makers adopted an incremental localization strategy emphasizing participation in the global network (see Figure 3).<sup>12</sup>

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9 CNAIC was first established by the government in 1964 and disbanded in 1966 when the Cultural Revolution began.

10 Concerning the division-of-labor system in business groups, see Lee (1992).

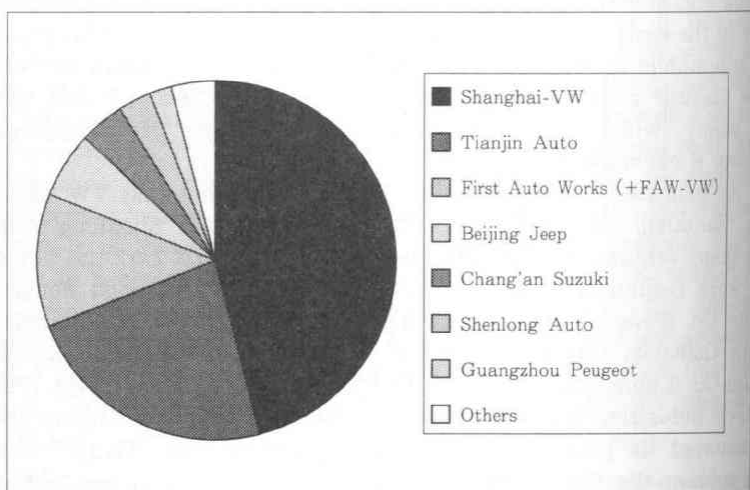
11 From *Chunichi Shimbun* [Middle Japan Journal], 17 August, 1997.

12 For passenger car production in China, see Lee (1994) and (1997a, b).

Figure 2 China's Passenger Car Production and Market Share (1994)

Volume: unit; Share: %

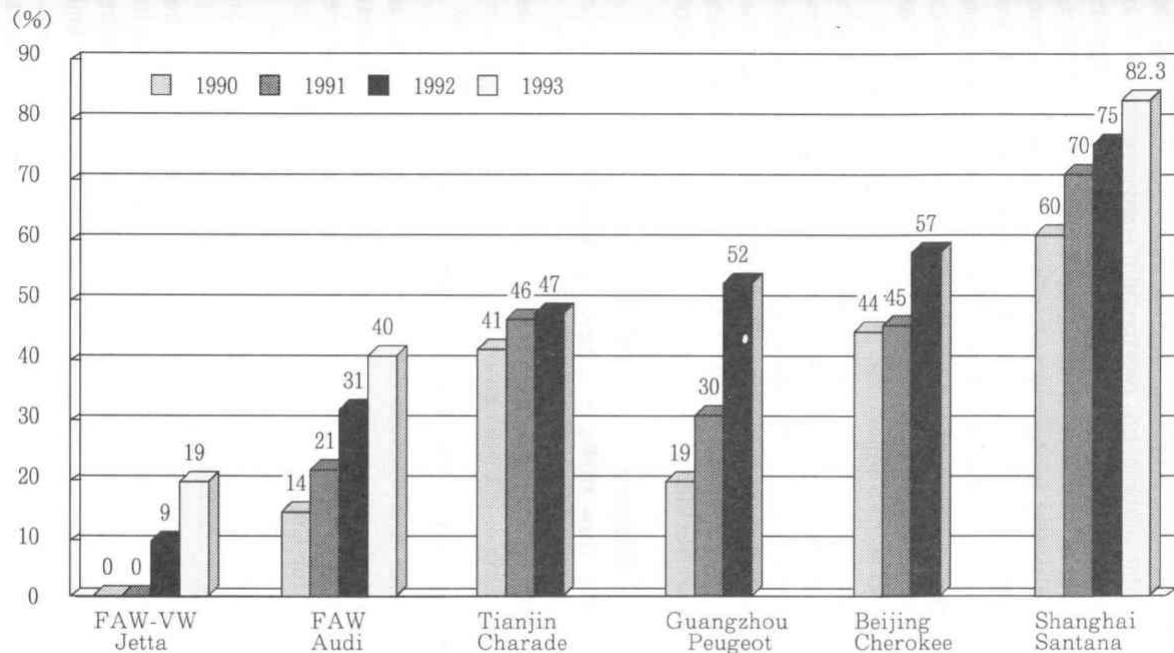
	Car makers	Production volume	Market share
1	Shanghai-VW	115,328	46
2	Tianjin Auto	58,500	23
3	First Auto Works (+ FAW-VW)	30,196	12
4	Beijing Jeep	14,703	6
5	Chang'an Suzuki	10,020	4
6	Shenlong Auto	8,010	3
7	Guangzhou Peugeot	4,485	2
8	Others	9,093	4
	Total	250,333	100



Source: Lee, C., Chen, J. and Fujimoto, T. (1996).

In commercial vehicle production, two different patterns of technology transfer could be observed. As indicated in Table 2, Large auto makers like FAW and Dongfeng that possessed developing capability mainly produce their own models, engaged in the inde-

Figure 3. Local Content Rate of the Main Car Models in China



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Source: Yearly editions of *Zhongguo qiche gongye nianjian* (The Chinese Automobile Industry Yearbook).

pendent development of products, and introduce foreign technology selectively. On the other hand, the medium-sized auto makers and some small local manufacturers introduce foreign technology through setting up joint ventures or tying up technically with foreign auto companies. Backed up by the technology transfer, they started to produce foreign vehicles in order to compete with large auto makers. In response to this challenge, FAW and Dongfeng adopted a full-line strategy and entered the markets of small and large trucks respectively, intensifying competition with the medium-sized and small auto makers (e.g., Nanjing and Jinan Auto, see Figure 1).<sup>13</sup>

The original multi-layer division-of-labor structure was thus restructured into two groups: the large and some small manufacturers group stressing production of domestic vehicles; and the medium-sized and some small manufacturers group emphasizing consignment production of foreign brands. As a result, the entry of foreign makers accelerated further dispersion of auto makers in local areas and an increase in the number of firms (see Table 1).

### **III. How to Build a Lean Industry ?**

This issue will be analyzed from two aspects – reorganizing auto makers and building a efficient auto parts industry.

#### **III. 1. How to Reorganize the Existing Auto Makers ?**

The author will first introduce the experiences of the U.S. and Japan in reorganizing the auto makers in the course of developing their automobile industries. Then we will discuss which experience is more suitable for China.

##### **(1) The American Experience: Natural Growth and Natural Elimination**

In the first two decades of 20 century, there were 181 auto makers in America. However, from 1903 to 1926, 137 of the 181 auto companies disappeared because by that time the "Big Three" had established a mass production system.<sup>14</sup> Medium-sized and small

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13 For the adoption of the full-line strategy in FAW and Dongfeng, see Lee (1995) and (1997a).

14 Shiomi, *et al.*, (1986) p. 205.

auto makers were either merged into the "Big Three" or eliminated in the competition. The Great Depression in 1929 further accelerated in the industrial restructuring. From 1933 to 1935 the market share of "Big Three" nearly reached 90 percent. What the American automobile industry experienced was a history of natural growth and natural elimination. The author would analogize as surgical operation of the Western medicine.

## (2) The Japanese Experience: Assembler Networks

Japan embarked on a different road to restructure its automobile industry after World War II. There are 11 auto companies in Japan today – well above the average number in other developed countries.

Besides the 11 companies that obtain their own brands and sales networks like Toyota, Nissan and Isuzu, there are about 20 body assemblers in Japan that engage in consigned assembly for these auto companies. These body assemblers were originally auto makers. Some of them were defeated in the competition and forced to become body assemblers. Others are assemblers specializing in producing bodies from the very beginning.

According to Shiomi (1995), Toyota produced 3.66 million vehicles in 1985, but 1.84 million vehicles were produced by body assemblers, including Toyota Automatic Loom Works, Toyota Auto Body, Kanto Auto Works, Wind Motors, Central Motor, Araco, Gifu Auto Body, and so on. These body assemblers are companies independent of Toyota. Consignment production is not limited to body assemblers, but extends to some auto makers. For example, Toyota also consigned production both to the above body assemblers and Hino and Daihatsu.

There are 4 patterns of consignment production between Toyota and the body assemblers in the Toyota Group:

- (a) Contracting out of commercial versions (van, wagon, and pickup);
- (b) Contracting out of standard (sedan) versions (e.g., Crown by Kanto Auto Works, Corolla by Daihatsu);
- (c) Contracting out of low-volume models (e.g., Publica by Hino);
- (d) Complete contraction out (e.g., the first-generation Corona by Kanto Auto Works).<sup>15</sup>

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15. Shiomi (1995), pp. 30–34.

In this way Toyota built a lean production system by contracting out of both parts production and assembly. Until recently Toyota's consignment production has not fully caught people's attention.

Japan has a different history of reorganizing the auto makers from the U.S.. In Japan big auto makers did not merge or absorb medium-sized and small auto makers. Instead of constructing new plants, big auto makers consigned assembly to the existing medium-sized and small auto makers to save equipment investment and hedge risk in the period of business fluctuation. By forming an "assembler network" composed of big auto makers (at the core) and body assemblers, Japan not only alleviated the pain of restructuring its automobile industry, but also rationalized production. This could be analogized to oriental medical treatment stressing internal body adjustment.

### **(3) What Should China Learn from the American and Japanese Experiences ?**

Japan's "assembler network" is a more suitable method to restructure China's automobile industry. The American-style surgical operation - the natural growth and natural elimination - requires too much time, and will cause more social and economic losses. If the government takes compulsory measures to restrict entry, it can prevent entry to some extent, but can never reorganize the existing auto makers. Even these measures are difficult to implement in China where local governments have great political and ever-increasing economic power. Therefore, if China is to reorganize the auto makers on the basis of their actual manufacturing capacities, it is more realistic to choose the milder medical treatment method - forming the assembler networks.

In the 1990s big companies switched from forming business groups to M & A to enlarge their scales.<sup>16</sup> This is similar to what GM did in the 1920s - a big progress in the history of business organization in the Chinese companies. But these companies should make sure they do not enlarge their organizations too fast and maintain an efficient management system. Otherwise they are likely to slip into chaos like GM before Alfred Sloan took charge. In that

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16 For business groups in China, refer to Lee (1992).

situation, smooth communications between divisions, plants, and departments become difficult. It is difficult to bring them under control.<sup>17</sup> Productivity will also probably go down along with the increase of employee.

On the other hand, Toyota took productivity and rationalization of production into consideration from the very beginning. It controlled the number of new recruits. Instead of engaging in large-scale M & A, it formed an assembler network by consigning production to independent body assemblers.

Among the so-called "auto makers" in China today, some correspond to the body assemblers in Japan. It is necessary to reclassify all auto makers according to certain standard - e.g., availability of original brands and sales networks - and form a nationwide assembler network composed of auto makers and body assemblers. It is estimated that after the reclassification, the existing 116 auto makers in 1996 will decrease to half or more.

The Toyota-style assembler networks could help the Chinese auto companies establish a flexible lean production system and restructure the automobile industry on the basis of the actual manufacturing capacity of each auto maker.

### III. 2. How to Build an Efficient Auto Parts Industry ?

China's auto parts industry is characterized by a self-integrated manufacturing system in each province. There is no complementation of parts manufacturing between provinces and companies. Meanwhile the lack of standardization of parts and confusion of industrial standards further hindered the development of a contemporary auto parts industry. Self-integrated manufacturing system and lack of standardization have become two bottlenecks for developing China's automobile industry.

#### (1) The System-related Factor: Weak Complementation between Provinces and Companies

Auto parts industry is generally capital-intensive, demands high level of manufacturing technology and large-volume production.

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17 For GM's M & A and management organization in its early period, see Chandler (1963), Chap. 3.

Therefore, in the developing countries that have scarce management resources and small domestic market, small-volume parts production will increase the manufacturing cost and weaken the competitiveness of finished car. As a result, the increase of the local content rate of parts is not beneficial to domestic automobile production. To put it simply, when the local content rate of parts increases, the price of finished car in the international market will increase. This is the result of Baranson's study on the automobile industry in Latin American and Asian countries, and known as the "Baranson Curve".<sup>18</sup>

China's auto parts industry is in the dilemma of small-volume production. As mentioned in the introduction of this paper, the top five auto makers could produce over 100,000 units a year and enjoy the scaled merit to some extent, but the yearly production volumes of about 100 small auto makers were less than 10,000 units a year except that about 10 medium-sized auto makers produced over 10,000 units in 1996 (see Table 1).<sup>19</sup> The optimal scale of parts production is larger than auto manufacturing. Because parts makers in China mainly supply parts for a limited number of auto makers in the same region, further contributing to the small-volume production.

There are 46 carburetor manufacturers in China now. This number very well reveals the problem of dispersion and small-volume production in China's auto parts industry. These manufacturers can exist because of the self-integrated division-of-labor system in each province. One could not help asking: "What will happen to these carburetor manufacturers when technological change occurs, especially when China is actively introducing EFI (electronically-controlled fuel injection) to replace carburetor?"

Things are not better in joint-ventures. Japan's Isuzu has two joint ventures (Chongqing Isuzu and Jiangxi Isuzu) and two technical tie-ups (Xinan Small Truck and Beijing Small Truck) with China. All companies produce the "ELF" small truck. But as far as the

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18 See Baranson (1969), pp. 28-32. For details discussion on this issue and China's supplier system, see Lee (1994).

19 *Chugoku Keizai Shukan* [Chinese Economic Weekly], No. 59, March 27, 1997, p. 13.



author knows, there is no parts complementation between these four companies.

The "Brand to Brand Complementation" (BBC) scheme in ASEAN countries may provide some hints for China. Toyota's concentrated and specialized production of functional parts in the five countries of ASEAN is an important part of the scheme. Toyota has built joint ventures to produce diesel engines in Thailand, transmissions in Philippines, steering gears in Malaysia, and gasoline engines in Indonesia. It has also set up a 100 percent subsidiary in Singapore to oversee the transactions between each country and business operations in each country. These parts makers supply parts and components both to the ASEAN countries and to Japan. Toyota has thus established an inter-supplying, inter-dependent division-of-labor system in ASEAN nations.<sup>20</sup>

In this way Toyota has been able to avoid small-volume production of auto parts in each country and enjoy the greatest scale merit as possible.

Toyota is not alone in participating in the scheme. Honda and Mitsubishi are also actively promoting the scheme. However, because the auto markets in the ASEAN countries are very limited, Japanese companies aim to establish a large-scale division-of-labor system that links the ASEAN areas with mainland China to form an "Asia Network".

The multi-national corporations have established an in-company division-of-labor system on a global scale. On the other hand the Chinese companies still continue the inefficient small-volume, multi-model parts production in separate regions. This kind of division-of-labor system is apparently unsuitable for the automobile industry, a typical volume-production industry that pursues scale merit. Therefore to strengthen the complementation in parts manufacturing between local regions and companies is an important task in the future development of China's automobile industry.

## (2) Standardization: Prerequisite for Mass Production

Standardization is an important paradigm of the mass production

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20 Toyota Motor Company, *The Automobile Market in Asia and ASEAN*, 1990, pp. 14-15.

system, which was established by Herry Ford in the American automobile industry. Standardized parts were assembled onto standardized models, and for the first time there was interchangeability of parts between models. In a country where demand far exceeds supply, it is natural to first build a mass production system to produce a few models. But in China, things go the opposite direction. Over 100 auto makers still engage in small-volume production of multiple models. There is hardly any interchangeability between each models.<sup>21</sup>

This is mainly caused by the confusion and inadequacy of industrial standards. There are three kinds of industrial standards in China today: state standard, ministry standard (determined by each ministry of the government), and company standard (determined by each province and employed in companies under its control). The state standard for the automobile industry corresponds to SAE (Society of Automobile Engineering) of the U.S., JIS (Japan Industry Standard) of Japan, and DIN (Deutsche Industrie Normen) of Germany.

In 1983, there were 5,496 items of state standard, 13,000 items of ministry standard, and 89,000 items of company standard.<sup>22</sup> In 1978, there were 5,324 items of state standards in China. In the same year, there were 9,092 in the U.S., 7,220 in Japan, 7,800 in Britain, 18,000 in West Germany, and 22,120 in the former Soviet Union. In 1984 there were 18,763 items of state standard in China and 7,413 in South Korea.<sup>23</sup>

The number of items of the ministry and company standards is overwhelmingly higher than that of state standard. It once again indicates that China's economic structure is characterized by dispersion of power in local areas. The state standard was first stipulated in 1958, less than 10 years after the People's Republic of China was founded. But the Chinese do not have the tradition of abiding by the industrial standard.

In agricultural machinery, there are 53 series, 250 models of

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21 For adoption and evolution of mass production system in China, see Lee (1995).

22 From Maruyama (1988), pp. 32-35.

23 *op. cit.*, p. 32.

medium and small sized diesel engines, 34 models of tractors nationwide. Since there is no interchangeability between these models, repair is extremely difficult.<sup>24</sup> Some companies even ignore standards when they engage in production. Until the late 1970s, the state standard was replica of the Soviet standard, which was made in the 1950s and 1960s. Many items can no longer be applied in real situations. In 1984, of the 18,763 items of state standard, only 28 percent met the international standard.<sup>25</sup>

After the 1990s, China began to make new industrial standard for the automobile industry on the basis of ECE (Economic Commission for Europe) standard. As indicated in the released industrial policy for the automobile industry by the State Council in 1994, the Chinese government will also strengthen the system of type approval. In the author's opinion, unification of industrial standards and thorough implementation of these standards are especially important when auto manufacturers from Japan, the U.S. and Europe are entering China on an unprecedented scale. Furthermore, China should take the opportunity of being affiliated with WTO to restructure its division-of-labor system and reengineer its technological system.

#### IV. Tentative Conclusion

In order to build a lean industry, China should first rationalize the division-of-labor system by moving from the extensive reproduction method to intensive reproduction method. The author introduced the concepts of "direct product competition" and "assembler networks" on competition and coordination between companies. On parts production, we discussed the Brand to Brand Complementation scheme in ASEAN countries.

The author introduced these foreign experiences to provide China – also the people who takes interest in the Chinese automobile industry – with actual examples on how to rationalize its industrial organization and production system, and accumulate capability to digest the technology transferred from developed countries more effectively.

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24 *op. cit.*, p. 35.

25 *op. cit.*, pp. 33–35.

Japan and South Korea developed their automobile industries not merely by relying on foreign technology. They have their own clear visions and never lose identities. After selectively introducing production systems that adapted to their real situations, both countries made lots of improvements and even recreations on the systems. They accumulated the capability to apply the production technology and management know-how, and finally to catch up with the developed countries.

Having gone through all the twists and turns and reflected on the past experiences, the Chinese government put forward the new industrial policy for the automobile industry in 1994. The policy provides a vision for the further development of the industry. How well the Chinese automobile industry will perform in the future largely depends on whether China can simultaneously establish a lean industry and a lean production system.

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