Chapter 29
Global Motor Vehicle Assembly: Nationalism, Economics, and Rationale

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29.1 Introduction

In the provision of goods and services that make urban hierarchies regular in the developed world, motor vehicles have become necessary and they require huge amounts of space. Whether the focus is on highway and road networks, parking, or production, the influence of cars, trucks and other wheeled vehicles is everywhere, and their influence in the third world is nearly as prevalent. Much of the world, then, is mega-engineered for vehicular use. The goal of this chapter is to better understand the assembly of motor vehicles throughout the world and the space taken up by factories – as is discussed below, accumulating this information was not a straightforward task.

There are several questions that arise when considering space and design needed for a vehicle plant. How many and what type of vehicle will be produced? What is the general skill level of the workers? How much of the vehicle is to be fabricated at the final plant? Will land be set aside for proving grounds of some type? What is the rationale for plant landscaping? How are the surrounding communities involved in a plant's history and geography? What kinds of government programs dictate form and site? Will the plant make some kind of nationalistic or political statement? Many of these questions are addressed in this chapter.

29.2 Definitions and Finding Factories

For this work, the term "motor vehicle" is defined as automobile, truck, bus or tractor. The project started as only automobile assembly plants, but it was found that plant characteristics were similar for many other vehicles. One or more type of vehicle could have been excluded depending on one's philosophical stance, but in the end I could not rationalize and took a more inclusive route in analyzing vehicle

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assembly. This also included specialty manufacturers of fire engines, recreational vehicles, and heavy duty wheeled or tracked military and construction machinery. I also started with a preconceived notion on the normal size of a plant in the United States (perhaps about 100 acres or 40 ha), but had to alter notions with different economic and political systems and varying land use situations.

There is no good single source for all the world's motor vehicle plants. Books, pamphlets, manufacturers' association websites, brochures, newspaper articles (online and print) sales ads and private and company websites were all used. Yes, Wikipedia was accessed as well. In fact, for some historical information, wisely used and double checked, Wikipedia was invaluable. An example of a normal procedure for identifying plants was to look at a company website (for examples see General Motors Global, Ford Manufacturing or Mitsubishi Motors in literature cited) and find listings for a company's plants. Most corporation websites include this information, often under a section that might be titled "Corporate Information" or "Company". For example, in General Motors' case, a complete listing is then found under "Global Operations". For Mitsubishi the global website was accessed, then "About Us" is clicked, then "Profile" which leads to clicking on more information for various plants. Every company website is different.

If addresses were given on the website, locations were found using Google Maps and then Google Earth and measured with the measuring tool. If the location was in doubt, WikiMapia was searched for labels and company names typed into GoogleEarth or GoogleMaps (say "Volkswagen plant" or "Volkswagen factory") and multiple pop-up business and private "tear-drop" identification tags were used to corroborate the plant location. Such were verified again with newspaper articles and private websites discussing a plant's opening, closing, and special labor or product events. Some factory locations of small producers in Europe were probably missed, but the list is extensive. For example, since small town metal crafters have been so prevalent in Italy, it is certain a few bus coachworks there were missed, though the review of Italian automobile "carrozzeria" is exhaustive.

In searching out plants some were found to be more coy than others. I am more fluent with Romance languages, so interpretation of websites in Spanish, French, Portuguese, and Italian was more complete than with other languages. I had to brush up on Cyrillic to search within the Slavic realm. In China and other parts of Asia more visual searches using GoogleEarth and Wikipedia were resorted to. Chinese companies online present a variety of stances from impressively complete information to being so tight lipped as to make one wonder how they sell their products at all. Auto enthusiast websites eventually discuss where a vehicle was made and sometimes give the specific location. Historic auto advertisements found using Google Image often gave factory addresses at the bottom, particularly for post-war American, British, German or Italian low volume producers. Sometimes Google Panoramio photos identified a factory or gave leads. Online historic photos of factories were also used to locate and identify special cases when addresses could not be found. Historic publications were also used to track locations of different manufacturers (an example is Motor Trend, 1955).

Factories needed to be located visually, which requires familiarity of a plant's general shape, size, and layout. Sometimes this could be tricky. Some plants are CKD (knock-down assembly) where a vehicle is partially assembled or disassembled and sent to a third world or other factory to be built up again. CKD plants don't usually require more than 2 acres (1 ha), but a normal auto factory takes up a large amount of space, say 20–400 acres (8 to 160 ha), and perusing a city in GoogleEarth at about 25,000 ft (8,000 m) eye altitude revealed likely candidates for more unfamiliar areas of the world. The modular form of most plants often with stamping, engine assembly, and final assembly portions becomes easy to identify – however not all appear in the same form (Rubenstein, 2001: 114–118). Truck and bus plants are often not as large simply because construction is usually more CKD in form with less total assembly done at the final location.

Large numbers of rowed uniform vehicles parked to one side of a structure is indicative of a plant, but shopping malls from a mile up can be mistaken for plants, especially in the developed world. Though a shopping mall may appear modular, its location adjacent to neighborhoods and the fact that autos will surround a mall on all sides, make it distinguishable from a plant. Conversely, in the developed world and especially in the United States and Canada, the large numbers of autos brought by the commuting workers can make a plant look like a mall. Plants in lesser developed parts of the world have larger stockpiles of new autos and trucks parked in the vicinity while in the U.S., Europe, and Japan, just-in-time delivery keeps stock at the plant to a minimum. Another clue is a proving ground (test track) near the plant, especially in plants of European and Asian automakers. American proving grounds are usually elaborate affairs separate from manufacturing facilities or attached to pre-assembly technical or research centers, and not placed at the assembly plant site itself.

29.3 Calculating Area

Information was collected on plants constructed or making vehicles globally post World War II when a new ethos in industrial mass production was becoming evident. Many formerly devastated economies shared in attempts to industrialize together and recover from war (Flink, 1988: Chapters 13 and 14). For this study, the thousands of small auto factories pre-World War II are not included since most did not make it beyond the depression anyhow, and the full range and suburban impact of production had not yet been manifested (Rae, 1985; Jackson, 1985: Chapters 9 and 10). Factories built before World War II were included, however, if production in those facilities continued post-war. Conversely, factories that have been mothballed or razed were included if their production was post-war.

Auto companies may express the area of a plant in diverse ways. Often, a distinction is made between the sizes of the plant buildings contrasted with the total area for the entire site. In terms of engineering the earth, the totality of site size is more important than mere building size. Facilities for stamping, engine assembly,

component sub-assemblies and testing were included in a factory's area if they were located adjacent to final assembly. However, time permitted only a partial tally of the many stand-alone stamping and engine factories, test tracks, and other parts assembly and storage facilities and such were not included in this research.

The study revealed 1,261 factories ranging from huge complexes of 450 or more acres (about 190 ha) down to craft and design "carrozzeria" of about half an acre (0.2 ha; for the complete 54-page list contact the author). Total area of auto factories worldwide was just over 160,000 acres (65,000 ha) or about 251 miles^2 (649 km^2). If all auto factories in the world were merged into one – it would make a plant about five times the size of the City of San Francisco, or the size of Madrid, Spain proper, or a tad smaller than Nantucket Island. Sixty-two of these were mega-plants greater than 450 acres (186 ha; Table 29.1 is a listing of plants of 700 acres/283 ha or more). The largest factory in total size was the Kamaz/FIAT truck plant in Naberezhnye Chelny, Tatarstan, Russia, with a total production area of 12,000 acres (about 4,850 ha) – a tad smaller than a township in Ohio's Western Reserve. This gigantic plant covers 18.75 mi^2 (45.5 km^2)!

Conversely, a large number were very small European craft shops or small volume sports car producers. An example of the smallest factory is the late 1940s Muntz/Curtis Kraft Glendale, California, garage of about a tenth of an acre (500 m^2). This sets the lower limit of automobile producers accepted for this study. Muntz/Curtis Kraft probably made a total of about 200 cars. Generally, only

Table 29.1 Manufacturing plants >700 acres (283 ha). Plants are automobile production unless noted otherwise. Like numbers are in order of size

Location	Manufacturer	Acres/hectares
1. Nabarezhnye, Tatarstan, Russia	Kamaz/OKA/FIAT Truck	11,775/4,765
2. Tolyatti, Russia	Avtovaz/GM	5,020/2,031
3. Marysville, OH, U.S.	Honda (with proving ground)	3,449/1,396
4. Nizhny Novgorod, Russia	GAZ	1,548/626
5. Nabarezhnye, Tatarstan, Russia	Severstal Auto/FIAT	1,540/623
6. Tanjung Malim Town, Malaysia	Proton	1,280/518
7. Ulsan, South Korea	Hyundai	1,225/496
8. Wolfsburg, L. Saxony, Germany	Volkswagen	1,054/426
9. Changchun, Jilin, China	FAW/VW/Audi/Mazda	1,049/424
10. Kaluga, Russia	Volkswagen/Skoda	988/400
11. Gülcük, Turkey	Anadol/Ford/Otosan Kocaeli	976/395
12. Dearborn, MI, U.S.	Ford Rouge	891/361
13. Saltillo, Coahuila, Mexico	Chrysler	846/342
14. Lafayette, IN, U.S.	Subaru/Toyota	820/332
15. Spring Hill, TN, U.S.	GM/Saturn	818/331
16. Greensburg, IN, U.S.	Honda	803/325
17. Smyrna, TN, U.S.	Nissan	797/323
18. Oshawa, ON, Canada	GM	726/294
19. Hwaseong/South Korea	Kia Asan Bay	726/294
20. Georgetown, KY, U.S.	Toyota	726/294
21. Warren, MI, U.S.	Chrysler/Dodge truck	725/293

enterprises making 50 or more cars were counted (like Tucker which made 50 cars in the huge former Dodge engine plant in Chicago). "One-off" craftings, no matter how famous among car aficionados, were also not included.

The layout of factories, their sizes and clustering varies greatly throughout the world. The bulk of global auto production is in the United States, Europe, Japan, and China, but there are significant production from countries generally labeled third world and from some that probably should not be labeled third world any longer (especially in the arena of auto production). The latter would includes Brazil, Mexico, India, Malaysia and South Africa. Even Guatemala, Bangladesh, Kenya, and Ethiopia produce small to moderate numbers of trucks. Then there are examples like Russia and the Czech Republic which under their previous command economies produced incredible amounts of land in auto and truck production, disproportionate to actual numbers of autos produced on the world stage (Laux, 1992: 205–214).

Also notable are regions once producing significant numbers of automobiles with former factory land that is now converted to other uses. Since World War II, California, for example, has had 32 factories with more than 781 acres (316 ha) of past production; today it has only one large plant, the Long Beach Hino truck plant. The influence of the central market location of the Middle-West and Upland South has made California almost insignificant as production there has ended. California is taking a leading role in companies producing alternative fuel vehicles (for example Zap and Tesla), but these plants have yet to take up much space. Both Greece and Chile had significant production in the 1960s and 1970s because of protectionist national policies restricting imports. A renewed global economy in Chile and Greece's joining with the EU shut down their auto industries (Bizarro, 2005). The remainder of this chapter highlights the motor vehicle production in different countries and regions.

29.3.1 The United States

The largest plant in the U.S. is the Marysville, OH, Honda complex which is an immense 3,448 acres (just under 1,400 ha). This total, however, is illusory as the complex includes a fantastic proving ground 3.2 mi (5.1 km) long and 1 mi (1.6 km) wide. For a megaengineering comparison, 11 Indianapolis Motor Speedways could fit inside the whole complex. After this, Ford's River Rouge plant is merely huge at 891 acres (361 ha), but there are ten other plants in the U.S. that are more than 600 acres (243 ha), each larger than the average sized mall: Chrysler – Warren, MI; GM – Oklahoma City, OK; GM – Spring Hill, TN; Honda – Greensburg, IN; Hyundai – Montgomery, AL; Mitsubishi – Normal, IL; Nissan – Smyrna, TN; Subaru/Toyota – Lafayette, IN; Toyota – Georgetown, KY; and Toyota – Princeton, IN). While Malaysia can boast of a single plant larger than any of these (Proton), no country can match the U.S. in the total diversity of large plants spread across the Middle West and Upland South.

With 34,200 acres (13,840 ha) (or 53.4 mi^2 or 138.3 km^2) in motor vehicle plants constructed since World War II, the U.S. represents both the oldest and the newest in factories. In Michigan, the state with the most land in auto production (6,784 acres/2,746 ha a larger total than all the assembly facilities in France), one can still view Ford's old Piquette garage, the Highland Park plant where the assembly line was perfected, the huge and almost paranoid concentration at the River Rouge facility, as well as the new Ford/Mazda Auto-Alliance plant, where the newest of U.S. and Japanese technologies are intertwined (Rubenstein, 2001: Chapters 1 and 6).

Despite modern computer order systems and robotics, many of the factories built just after World War II or during the early 1950s are now ostensibly antiquated because customers stopped buying the trucks and SUVs. And during the current economic downturn, and in the spring of 2009, both GM and Chrysler declared bankruptcy. The survival of plants depends whether the fitter and trimmer American companies can still attract customers. In many cases at least half of the plants in the Midwest have been closed (and most of the plants on the East coast) in the name of efficiency. The result is, and will continue to be, large tracts of unused brownfield space and a continued depopulation of the Rustbelt (Campbell, 2007).

Countering the higher value of the yen and the lessened effect of subsidized tariff relief in Japan, the newest trend has been the foreign company transplant. Starting in the late 1970s, Honda, Toyota, Mitsubishi, Nissan, Mazda, and Subaru all built in the United States. Some of these plants were shared with U.S. companies. German Mercedes Benz, BMW, and Volkswagen have joined in, as well as Hyundai/Kia from South Korea. For these new ventures space was used differently. Plants were now located away from traditional union America, first in the Southern Midland/Upland South and later in the Deep South. Here, lower wage scales and lower rural land values, mixed with excellent transportation connections, attracted new industry and guaranteed that the total size of the new plants would be substantially larger than in the Rustbelt (Rubenstein, 1992). Whereas the older plants averaged about 140 acres (56 ha), the average size for the transplants in the new southern industrial regions is more than four times that (about 560 acres or 228 ha). The new rural locations made nearly household names of several small towns like Spring Hill, Georgetown, and Marysville.

Even General Motors tried to join in the new manufacturing philosophy, building the newfangled Saturn plant on an 817 acre (331 ha) site in Spring Hill, TN, 30 mi (48 km) south of Nashville (Fig. 29.1). Whereas Nissan built a huge "white monolith" in Smyrna, about 20 mi (32 km) away, GM moved 162 million cubic feet (4.6 million m^3) of dirt to make a beautifully landscaped, mounded and partially hidden facility that would supposedly out-do the Japanese, as well as possibly eclipse Lordstown as GMs new small car plant (O'Toole, 1996: 92). Today, however, Spring Hill builds trucks and Saturns are built off of German-made Opel platforms. After an impressive initial investment, observers and fans of Saturn are left wondering what the hoopla was all about. The story of GM's superlative dedication transformed into contemporary apathy is beyond remarkable.

Fig. 29.1 GM's answer to the Japanese – GoogleEarth image of the Spring Hill, Tennessee Saturn plant

29.3.2 Soviet and Modern Russia

The motor vehicle production pattern for today's Russia was established during the time of the U.S.S.R. Production quotas in a system without incentives often led to poor quality and the same product offered for decades (Smith, 1976: Chapter 9). Saying that large factories were the mark of the Soviet system is an understatement. Huge megaengineered complexes were deliberately planned often farther eastward away from possible invasion and ostensibly to be world leaders in all kinds of goods. There were immense motor vehicle factories in central market areas surrounding Moscow, but this was not all. Mainly during the 1960s, entire cities were dedicated to vehicle production. The city of Tolyatti was constructed on the Volga to be the Soviet "Motor City" with auto facilities covering 5,028 acres (2,035 ha) or, for comparison, about one-third of Manhattan Island. As mentioned above, the largest plant in the world – a veritable city – dedicated to vehicle production was the Kamaz/FIAT truck (Fig. 29.2) and auto plant which was nearly 14 times larger than Ford's Rouge. The famed GAZ truck and auto works in Nizhny Novgorod (formerly Gorkii) were over 1,530 acres (622 ha), or twice the size of the Rouge. Even the more modest Ligachev (ZIL) works in Moscow which made trucks and state limousines was 620 acres (251 ha), 69 acres (27.5 ha) larger than the average for the new large foreign transplant factories in the United States.

Total plant space in Russia (not including former Soviet Republics) is 26,501 acres (10,724 ha). It is probably no accident that this number is not much different than the total U.S. figure of 34,200 acres (13,840 ha), though most Soviet production

Fig. 29.2 The Kama River, Kamaz Truck and FIAT plant – the largest motor vehicle plant in the world seen in GoogleEarth. Originally, the total plant size was most of the rectangular area seen in this image – about 12 square miles (7,680 acres or just over 3,100 ha), with automotive operations extending to other parts of the city. This is more space than all the motor vehicle plants in France and almost as much as all those in Japan, though there is some boulevard and green space mixed in here

took place at huge factories in single locations. But if you removed the new transplants in the U.S. since 1980, Russia alone would have bested the states by about 4,000 acres (1,620 ha). Add in production from the Ukraine, Belarus and other former republics and the Soviets could proudly boast that they had plenty more space dedicated to auto production than the United States. Of course, total U.S. production vastly overshadowed Russia and the even distribution of plants serving different labor regions in America made the Soviet pattern look lumpy and unwieldy.

Russian factories did not and do not represent paragons of vehicle manufacturing today. They always lagged behind the west technologically and over the last couple of decades have become dilapidated. Areas of modern production are completed in smaller areas of the former factories which produced nearly everything necessary for the vehicle at an earlier time. A truer picture of Russian auto production today is found in the transplants from GM, Volkswagen, and Toyota built within the last fifteen years. Some are large, but are of average size compared to their European and American counterparts.

29.3.3 Italy

Germany, France or Great Britain could be discussed at this juncture, but there are important reasons to look southward first. Though Italy was the last European

country to come to full industrialization after World War II, the cities of Turin and Milan have developed impressive and extensive automotive complexes, chiefly FIAT (Laux, 1992: 198–201). Fiat owns Lancia, Alfa Romeo, Abarth, Ferrari and Maserati – and now bankrupt Chrysler. FIAT is becoming ever more influential on the world automotive stage.

Megaproduction aside, there is still a traditional feel to Italian manufacturing that is distinct from anywhere on earth. This involves a substantially elevated sense of sport, style and craftsmanship that is not seen elsewhere (the word craftsmanship cannot always be interpreted as "quality," however). To a great degree, Italy can be seen as a collection of veteran mechanics and sheet metal workers who pushed their abilities to the level of a fine art that later gained prominence on the world stage (see Ghia Aigle, 2009).

Italy has over 5,521 acres (2,234 ha) of space dedicated to automobile fabrication since World War II. That is roughly one U.S. transplant factory larger than the U.K. and only about one modest sized factory less than France. Large factories like FIAT's Mirafirori in Turin and Alfa Romeo's former Arese works on the western edge of Milan are no surprise, though the Italian incorporation of proving grounds on factory premises in the 1920s are the earliest of any found in the world; they also show the importance to the Italians of the "feel" of the road (Orsini, 1979).

Furthermore, the great number of specialty tractor, sports car, custom car, specialty body designers and engineers that have existed in the country, especially from the 1950s through the 1970s, is notable. At least 25 manufacturers of specialty vehicle "carrozzeria" occupying less than 5 acres (2 ha) each are identified. With names like Vignale, Michelotti, or Savio, many of these shops only produced a few hundred custom FIATs or Alfa Romeos during the 1960s, but their influence among the car-initiated is legend. Besides, the main companies would sometimes recognize the creativeness of the small crafters by accepting a design and building it in large numbers. In addition, some of these specialty manufacturers, after a period of competitive reduction, have today become large scale custom batch producers on their own; the names Peninfarina, Ghia, Zagato, and Giugiaro are well known worldwide.

29.3.4 England

The overwhelming bulk of auto production in the British Isles has taken place in England, with only token production in Scotland and Northern Ireland, and only three small coachworks in Wales. The pattern within England is more surprising than expected with auto makers found in a general northwest to southeast swarm extending from south of London northwest through the auto manufacturing hearth of Coventry/Birmingham, then gradually fading near Preston. Somewhat surprising is the number of small auto and truck makers around and to the southwest of London. This specialty car manufacturing region now includes Rolls-Royce (now made by BMW), AC Cars, and high tech McLaren.

To some degree, England's experience is similar to that of Italy as the British made an incredible array of small sports and minicars in a market forcibly flooded

Table 29.2 Selected countries and total land in vehicle fabrication specifically comparing to Great Britain (excluding Northern Ireland)

United States	34,200 acres (13,840 ha)
Russia	26,501 (10,724)
China	13,496 (5,462)
Germany	9,211 (3,728)
Japan	8,136 (3,293)
France	6,105 (2,470)
Italy	5,521 (2,234)
England	4,728 (1,913)
Brazil	4,379 (1,772
South Korea	4,354 (1,762)
Canada	4,282 (1,733)
Mexico	4,147 (1,678)
India	3,889 (1,574)
Spain	3,858 (1,561)
Malaysia	2,678 (1,084)

with transport possibilities. Out of England's 158 total plants, 94 (59%) were small producers taking up less than 5 acres (2 ha) of space. The emphasis was on sporting cars, an ideal shared with Italy, though the Brits somehow lacked the elevated sense of "carrozzeria" and frequently turned to the Italians for design, anyhow.

England was mass producing many more different types of autos right out of World War II up through the 1960s compared with Germany, Italy, or France. As has been pointed out many times (for example, Wilson, 1993), the British industry attempted to flood the world in a somewhat colonial way with medium quality cars that were fun to drive but lacked the necessary backing to find export success. Labor divisiveness, weak service and parts supply networks, and too many models at too high a price doomed the mass produced British auto. Though there are a couple of mega-factories like Ford's Dagenham plant (just under 650 acres or 260 ha), the broad diversity of manufacturers is reflected in many modest sized facilities. Producers such as Singer, Alvis, Standard and Jowett rarely had facilities of over 18 acres (7 ha) and 22 of England's factories measured between 4 and 18 acres (2 and 7 ha). Facilities in the U.S. were commonly 5 to 10 times that size.

Today there are no British owned automobile companies mass producing cars. The Mini, though still made at Oxford, is made by German BMW. Jaguar and Land Rover are owned by Tata Motors of India. Chinese SAIC owns Rover and MG which aren't producing much anyhow and new Rover designs are made in Shanghai and Nanjing, not the venerable Longbridge plant southwest of Birmingham. While there are plenty of Hondas and Toyotas and GM Vauxhalls and Fords and overall production is significant, a comparison of land in plants in England since World War II to other countries shows the British loss in industrial footing (Table 29.2). It should be remembered that though Great Britain has more space dedicated to motor vehicle factories, South Korea and even Spain regularly out-produced it.

29.3.5 Japan and South Korea

In some ways it is appropriate to compare Great Britain to Japan. Both are island nations about the same size with significant industry. The similarities end there,

however. Where Britain has used up most of its resources of coal and iron ore, Japan preserves hers and receives resources from Russia, China, Indonesia and Australia. The British built up their foreign market at the same time as or ahead of their own domestic one. Japan built up its own market first and then exported. British ports are not up to modern global shipping standards, but Japan's deep water piers are world class.

One feature that Japan does not possess is large amounts of flat lowland space to expand. Industrial development generally occurs in densely populated port areas. For its legend motor vehicle industry, it is surprising that the country's average plant size is a rather modest 172 acres (70 ha). Over 90% of the area of the Japanese motor vehicle industry is found from Nagoya to Tokyo, the most concentrated area of large production on earth. Most notable are Toyota City, just east of Nagoya with at least 900 acres (364 ha) dedicated to the automobile industry. Mazda's main Ujina district plants in Hiroshima (an example outside of the Nagoya – Tokyo concentration) is a good-sized 496 acres (201 ha; Fig. 29.3). This does not seem grandiose compared to many of the gigantic Japanese installations in America, until one considers that it is mostly constructed on harbor landfill.

South Korea's assembly plant sizes are even more impressive than those of Japan. Outside of the Soviet experience (with an average plant size of 716 acres or 290 ha), South Korea is next with an average of 363 acres (147 ha). Next is the United States at 170 acres (69 ha), Japan and Malaysia are tied at 158 (64), Spain at 154 (62), Brazil at 152 (61), then France at 149 (60), and Germany at 133 (54). Automobile companies like Daewoo and Hyundai/Kia are smaller divisions of immense industrial conglomerates which follow the chaibol business model of close ties to government planning – closer even than the Japanese model which pioneered

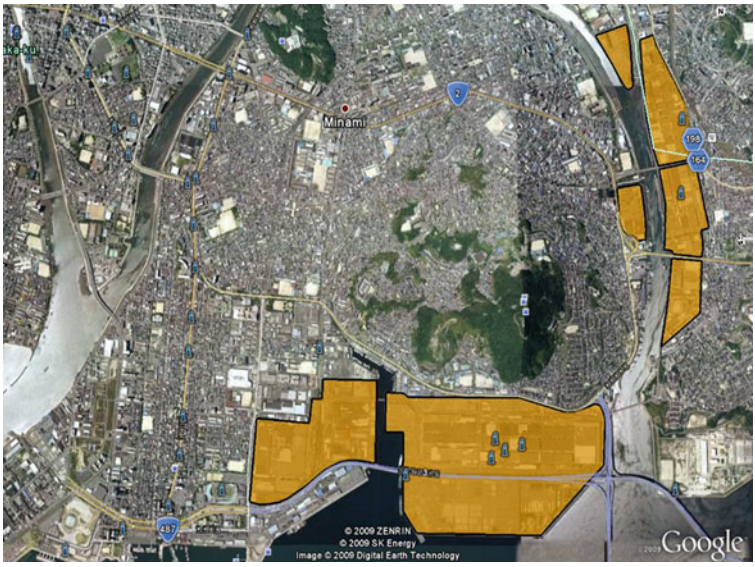

Fig. 29.3 GoogleEarth image of the Hiroshima Ujina complex (Mazda Manufacturing, 2009)

government-industrial cooperation and planning post World War II (Richie, 2002: 140–142). Automobile plants in South Korea are huge, singular, and, therefore, distributed more sparsely throughout the peninsula.

29.3.6 China

General Motors sold 1,000,000 vehicles in China in 2008, most of them Buicks, probably a main reason the company has decided to kill the Pontiac name in the United States (Andolong 2009). China has 13,496 acres (5,462 ha) of factory space, taking third in rank after the U.S. and Russia. Whereas the U.S. total reflects past production, with plants well known in the 1950s but closed since the 1980s, nearly all of the Chinese plants identified and recorded for this study are currently producing. China surpassed the United States in total auto production in 2008 by 600,000 units with 9.3 million total motor vehicles produced (EMS Now, 2009). So much has changed that one well written academic article on Chinese automobile culture from 2002 seems woefully out-of-date seven years on (Barmé, 2002). At the beginning of 2009 China was not feeling the global economic downturn nearly as much as other parts of the world.

Motor vehicles in China are assembled in a variety of ways reflecting both communist past and the global interconnections of the present. A large number of factories continue to make buses and trucks in the old communist system style, piecemeal in old run-down warehouses without so much as a brick produced from modern technology. Many of these factories are small and are widely diffused throughout China. Nationally, these contrast with the most modern of facilities constructed over the last decade.

Foreign auto companies such as Volkswagen, Toyota, and General Motors by Chinese law cannot operate alone and must joint venture with Chinese industrial giants, like First Auto Works (FAW), Shanghai Auto Industry of China (SAIC) or Beijing Automobile Industry (BAIC). Some of these factories are in the megafactory range (450 acres or 186 ha) and are unique because the same company will make Nissans, Volkswagens, and Fords all within a kilometer of each other in a single complex. One good example is the FAW complex in Chanchun, Jilin province just north of Shenyang (Fig. 29.4). Here, Mazdas, Volkswagens, and Audis are made with FAW trucks in a manufacturing area measuring 1.7 miles long by 1 mile wide (2.7 km by 1.6 km) and taking up 1,049 acres (425 ha). This is just six acres smaller than Volkswagen's huge Wolfsburg, Germany plant (see Table 2.1).

In one way, the Chinese share a problem similar to the British in the late 1940s through the 1950s, viz., a lack of industrial rationalization (Flink, 1988: 300). There are about eight major manufacturers in China with about ten smaller ones trying to flood the voracious Chinese market with their vehicles and the feast of one maker gobbling up another is just getting started. This is a market of over 1.2 billion people and though England's lack of rationalization led the decimation of its mass production, China's vehicular future is ripe with possibilities. The great mix of new and old assembly types is also the main reason that China's average factory size is so

Fig. 29.4 GoogleEarth image of the FAW Chanchun, Jilin works. Over 6,000 vehicles are parked to the southeast – a testament to an undeveloped just-in-time system? The FAW Toyota works are just over a kilometer to the southeast

modest – only 115 acres (46 ha), whereas the U.S. average is not quite twice this amount and South Korea's average triples it.

A perennial problem of Chinese manufacturers as perceived by the west and Japan has been copyright/trademark infringement. Many Chinese cars are simply copies of Nissans, Mitsubishis or Hyundais offered to an anxious home market that does not fathom or care where the designs come from. Some of the Chinese companies argue that their products are indeed unique, to the dismay of global auto makers, but change is in the air as unique designs and engineering are coming about (see discussions on the informative China Car Forums website). Brilliance Auto began producing its unique and attractive BC3 sport coupe in 2008. BYD Auto, based in the Guanzhou (Canton) urban region has dedicated itself to energy efficient hybrids. Geely has announced its intention to export to the U.S. The Chinese realize the foreign market potential, particularly of the U.S., and are shaping themselves to function there.

The efficiency of distribution of goods and services in any economy can be measured by how well a company or organization can diffuse its products all through an urban service system from the largest city down to the smallest. China has done an impressive job of locating motor vehicle facilities throughout the country with companies (usually still owned by the government – Geely is the only major private operator) developed in the regions of Shanghai, Beijing, Guangzou, Fuzhou, Chongqing, Changchun, Shenyang, Qingdao and many others. There is no primate city structure here.

29.4 Global Perspectives

The variety of auto manufacturing, and thus, auto plant philosophies across the world is surprising. The U.S., the juggernaut of auto production historically, now seems vulnerable. Central and South American production, not discussed much here, is surprising, with significant production histories in Mexico, Brazil, and Argentina. Brazil is always up-and-coming and ranks ninth in total space allotted to assembly. Sometimes Argentine ads are known for their nationalistic rhetoric for example displaying an IKA Kaiser as the "Grand Coche Argentino" (the Great Argentine Car), Autoar (for "AUTO ARgentina") truck ads showing great trucks of the "patria," or the "Justicialista" during Peronist years of the early 1950s (Aguerre, 2009; Autohistoria, 2003).

Europe, ostensibly unified, shows a remarkable variety of different auto production philosophies matching a country's raison d'être and general cultural milieu. Germany's average plant size is not the largest in the world, South Korea, the U.S., Japan, France and even Spain and Malaysia plants are all larger. Yet German plants on average are larger than England or Italy mentioned above. France's factories, though on the whole 16 acres (6.47 ha) larger, are distributed in a pattern more reflective of a primate urban system mainly based on Paris. Farther southward, Lyon, Bordeaux, Marseilles and Toulouse are lacking automobile production (not ignoring Toulouse's aircraft production, however). Germany's pattern is a testament to a wider geographic diffusion of facilities throughout a more diverse and even urban network. So bigger is not always better.

Elsewhere in Europe, Sweden's unique history with previously independent Volvo and Saab, is now in doubt as their new owners, Ford and GM, respectively, have sold them off. Spain is a country where FASA Renault and SEAT of the 1960s Franco era have given way to completely modernized motor vehicle production. SEAT is now owned by Volkswagen and the country now rivals the United Kingdom in space for manufacturing. In average factory size, Spain ranks fifth, and in 2007 it out-produced the U.K. by over 660,000 vehicles (OICA, 2008). In fact, Spain outproduced the U.K., Italy, Brazil, Canada, and Russia. Portugal has seven new and advanced plants. Eastern Europe since the Velvet Revolution has opened new markets with new factories from Poland to Romania and every country in-between. Poland is already approaching Italy in total vehicle production (OICA, 2008).

Japan remains dominant on the world stage, its marvel being how such densely populated coasts have developed a huge yet compact industrial pattern along congested rivers, subsidized agricultural areas, and on landfill. South Korea takes the Japanese pattern to an extreme with the largest newer factories in the world. Other Asian countries are on the rise. India, with 3,889 acres (1,574 ha) in factories, is quickly raising its standards for mass production, particularly for export. Malaysia also has significant space dedicated to vehicle production (2,678 acres or 1,084 ha).

Perhaps it is not surprising now, but China is probably set to become the principal global auto maker and distributor. It has passed the U.S. and Germany in total auto production (OICA, 2008). It has the most space in productive auto assembly after the U.S. and has the widest variety of types of vehicles produced of any country. Is it

ultimately a ruse? A mask? Will China really be the next automotive superpower? China has not yet mastered the desires of the American and European markets. The answer probably lies in a series of complex population and environmental issues that range far beyond motor vehicle assembly, but China's rise to the top of the motor vehicle industry seems inevitable.

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